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Nutritional Composition of Rare Himalayan Herbs Constituting the World's First Health Food

B.D. Sharma, Lal Singh and Maninder Jeet Kaur

Himalayan Research Group (HRG)
Core Group, Department of Science and Technology (Govt. of India)
Umesh Bhavan, Chhota Shimla, Shimla-171002 India
E-mail: bdsharma.iias@gmail.com

ABSTRACT

Indian Ashtavarga herbs is a group of 8 miraculous plant species mentioned in the Nighantus (Indian Materia Medica) with a reputation of constituting the world's first rejuvenation functional food, named after its user, Rshi Chayavan. Out of these, three plant species, *Polygonatum cirrhifolium* (Mahameda), *Polygonatum verticillatum* (Meda) and *Lilium polyphyllum* (Kshirakakoli) were assessed for nutritional composition of their underground rhizomes and bulbs both for major food constituents (protein, carbohydrates, fat, crude fibre, ash and moisture) and macro- and micro-mineral contents. The study revealed the presence of a high level of all the constituents for all the species except phosphorus was non-detectable in Liliumpolyphyllum. The study validates the traditional claims of wide ranging medicinal benefits as well as their nutritive value for use as functional food popularly known as Chayavanprash.

Introduction

The first ever nutraceutical or health food, Chayavanprsh, constituted of eight rare Himalayan herbs full of vital energy, high in antioxidants, and boosting immunity and as an effective cure for tuberculosis, was discovered by the Vedic period physicians, Ashwani Kumar brothers nearly 5000 years ago. The formulation of these eight herbs is named after the first user, Rshi Chayavan to restore his wasting, frail and emaciated body. These eight herbs were named as Ashtavarga group and included Rdhi (*Habenaria intermedia*), Vrdhi (*Habenaria edgeworthii*), Jeevak (*Malaxis acuminata*), Rshabhaka (*Malaxis muscifera*), Kakoli (*Roscoea procera*), Kshirakakoli (*Lilium polyphyllum)*, Meda (*Polygonatum verticillatum*), and Mahameda (*Polygonatum cirrhifolium*). The Chayavanprash of Ashtavarga is

tasty, nutritive, cooling, aphrodisiac and nourishes body. It is beneficial in seminal weakness, increases fat in the body, heals bone fracture, and cures vata, pitta and rakta doshas (blood disorders), abnormal thirst, burning sensation in the body, consumption, fever, and diabetic condition (Sharma and Balkrishan, 2005). Recent reports point out that these target species were found to be a good source of major food constituents and contain good amounts of minerals and important microelements and have high antioxidant potential (Bhatta *et al.*, 2013). The Ashtavarga Chayavanprash is also reported to have various phyto-constituents such as alkaloids, carbohydrates, fixed oils and fats, flavonoids, glycosides, saponins, tannins and phenolic compounds, ferric compounds and free amino acids (Kumar, Kaur and Rinwa, 2012). The three species (*Polygonatum* and *Lilium*) are also reported to be good sources of compounds such as phenolics, steroids, tritepenes,saponins, glycosides, carbohydrates, fatty acids (e.g. gamma-linolenic acid), and alkaloids, and also possess aphrodisiac, antiherpetic, antimalarial and free scavenging, antimicrobial, antipyretic and anticonvulsuant, antinophoric, antineoplastic, antinociceptive, and cytotoxic, and antirespiratory disorders activities (Singh *et al.*, 2013). Moreover, the three species are also reported to be used as vegetable and are eaten roasted in China and India (Wujisguleng, Liu and Long, 2012).These herbs are also attributed to possess adaptogenic, immuno-modulatory, and also antimicrobial, antimalarial activities(Singh *et al.*, 2013). However, their contribution towards human nutrition still had remained unknown. Out of eight herbs, only three had been included in the present study. Nutritional analysis of these herbs will play a crucial role in highlighting their significance in related various health effects.

MATERIALS AND METHODS

Plant collection: Table 1 presents the details of medicinal herbs collected as sample for the proximate analysis. These herbs are found growing in the temperate regions of the north-west Himalayas between elevations of 1500 m and 3000 m.

Plant species	Place of collection	Period of collection	Habitat characteristics	Altitude range
Polygonatum cirrhifolium	Garh Ka Chhol, Mandi, Himachal Pradesh	Sept, 2010	Forest shrubberies Open slopes	1500-3700 m
Polygonatum verticillatum	Murhala, Mandi Himachal Pradesh	Sept., 2010	Forest open and rocky places	2700-4000 m
Lilium polyphyllum	Khanora, Mandi Himachal Pradesh	August, 2010	Rocky, shady, semi-shady places	3000-3500 m

Sample Preparation: The rhizomes and bulbs were thoroughly washed under the running water and dried. The rhizomes were cut into thin slices and fleshy scales of lily were then dried at 40^0C in the oven. The dried samples were ground to a fine powder for carrying out further chemical analysis.

Proximate Nutritional Composition Analysis

The recommended methods of the Association of the Official Analytical chemists (AOAC, 2003) were used for the determination of moisture, protein, fat, carbohydrates, crude fibre, ash and nitrogen (Seal, 2011). The nitrogen content was determined by Kjeldahl method and then nitrogen content was multiplied by a factor 6.25 to give the protein value. Protein estimation was also done by using two other methods, Lowry and modified Lowry.

Macro -and micro-nutrient analysis

Test sample (1g) was taken in conical flask and 10 ml of concentrated HNO_3 (67%) was added and kept overnight at room temperature followed by 4 ml of $HCIO_4$ (67%). The resulting solution was concentrated on hotplate at 60^0C until a clear solution of approximately 1 ml was left. After cooling, the solution was supplemented with deionized double distilled water, filtered through Whatman (#42) filter paper. Then final volume (100 ml) was made with deionized water served as stock solution (Saeed *et al.*, 2010). The sample then was in quadruplicate by ECIL atomic absorption spectrophotometer (AAS 4141 A ECI Ltd.) and flame photometer (Systronic-128). The chemical materials of all the reference metals were obtained from Merck (Darmstadt, Germany). All chemicals used in the study were of analytical reagent grade. Calibration standard of each metal was prepared by appropriate dilution of the stock solutions.

Statistical analysis: Results obtained from the experiments (n=3) are expressed as mean values ± SD and percent coefficient of variation.

Results

The results on the proximate analysis of rhizomes and bulbs of three species are presented in table 2. It is observed that *Polygonatum cirrhifolium* possesses higher values among others for protein content and energy value, while *Polygonatum verticillatum* had a higher content of fibre and moisture. *Lilium polyphyllum* showed higher values of fat, carbohydrates and ash contents. Some of this variation in the major nutritional constituents may also be attributed to variation in moisture contents of the samples of the three species. Uniformly higher values for ash content were shown for all the species under study. It was also observed that moisture, protein, fibre values were low in respect of *Lilium polyphyllum* but had higher values for fat, carbohydrates and ash contents. This could mean that this species may have higher contents of those minerals which were not assessed in this study.

Results on the estimation of macro and micro- nutrients such as calcium, phosphorus, potassium, iron, sodium, magnesium, copper and manganese using atomic absorption spectrophotometer are presented in table 3. It was interesting to observe that one of the three species, *Lilium polyphyllum* did not show the presence of phosphorus in its bulbs. The contents of Ca, K, Fe and Cu were higher in the rhizomes of *P. cirrhifolium,* while contents of Na and Mg were higher in rhizomes of *P. verticillatum.* Lilium polyphyllum gave highest value for Mn only. Fairly good amounts of minerals are found in all the species, especially that of Fe, Cu, Mg, Mn and Ca which are essentially required to maintain a healthy human body.

Table 2. Major nutritional constituents(g/100g) of three Ashtavarga plant species by different methods .

Plant species	Moisture	Protein by three methods			Fat	Fibre	Carbohydrates	Ash	Energy Value Kcal/100g
		NX6.54	Lowry	Modified Lowry					
Polygonatum cirrhifolium	81.56 ±5.43	17.5 ±0.0	17.5 ±0.0	20.27 ±2.04	1.23 ±0.12	8.33 ±0.58	16.08 ±0.0	8.00 ±0.24	121.70 ±2.10
CV%	6.65	0.0	0.0	2.04	10.06	6.93	0.0	8.70	1.73
Polygonatum verticillatum	84.53 ±4.69	16.20 ±1.62	15.0 ±0.0	16.20 ±1.61	0.46 ±0.06	12.33 ±0.57	17.07 ±0.0	7.45 ±0.79	108.23 ±9.73
CV%	5.55	10.0	0.0	9.94	12.55	4.62	0.0	10.63	8.99
Lilium polyphyllum	75.51 ±0.28	8,18 ±0.82	7.50 ±0.0	8.61 ±0.79	1.70 ±0.10	2.00 ±0.0	22.00 ±0.0	8.44 ±0.60	119.49 ±2.73
CV%	0.37	10,02	0.0	9.18	5.86	0.0	0.0	7.11	2.28

Table 3. Micronutrients status (mg/100g) of three Ashtavarga plant species by different methods.

Plant Speceis	P	K	Na	Ca	Mg	Fe	Cu	Mn
Polygonatum cirrhifolium	100±0	20.75 ±0.53	1 4.42 ±0.70	1365.3 ±3.35	75.4 ±4.23	35.06 ±2.17	0.90 ±0.01	28.84 ±0.43
CV%	0	0.25	2.53	4.84	5.62	6.20	0.99	1.48
Polygonatum verticillatum	100±0	13.33 ±0.39	37.82 ±2.19	1338.3 ±3.83	90.1 ±0.80	23.64 ±0.88	0.21 ±0.01	28.64 ±0.37
CV%	0	2.90	5,79	0,29	0.89	3.74	5.61	1.30
Lilium polyphyllum	0±0	15.74 ±0.26	34.06 ±2,24	1074.7 ±3.20	74.2 ±3.72	18.56 ±1.04	0.20 ±0.01	29.10 ±0.75
CV%	0	1.65	6.57	0,30	5.02	5.58	4.08	2.56

Discussion

The three species included in the study were ingredients of the original Ashtavarga Chayavanpras. Their medicinal properties have been given in Ayurvedic Nighantus (Materia Medica), but they were not evaluated for their nutritional composition which certainly will add value to the product and will provide a complete picture of their action as health food or functional food (Sharma and Balkrishan, 2005). This may also serve as guidelines for the use of this product to exclude adverse interactions of certain mineral contents with modern medicines, if administered, during its consumption. According to a FAO/WHO report, there is need for food diversification in order to meet the needs of minerals and vitamins for ensuring optimal nutrition including micronutrient adequacy for most population groups, essentially so when they largely subsist on refined cereal grains or a narrow food base (FAO/WHO report, 2001). This assigns much significance to such species for the larger well-being of human all over the world. The three species, as shown in tables 2 and 3, in general, contain fairly high levels of main food constituents and mineral micronutrients

adequately justifying their role in human nutrition. Such other studies on *Polygonatum cirrhifolium* (Singh, 1995) from Sikkim Himalaya and *P. verticillatum* from Pakistan (Khan *et al.*, 2012) have been reported, but they are at variance with the results of the present study.

Prominent contents (17% and 16%) of proteins in two *Polygonatum* species but low protein (8%) in lily is worth to note from nutritional view point with approximately similar energy value because of their use as ingredients of Chayavanprash. All the species showed low contents of fat signifying their value as cardio-tonic. Carbohydrates content of all the species is nearly similar to the potato tuber but with much higher protein content, which show their significance in the human nutrition combined with high crude fibre except in *Lilium* (Lister & Mumo, 2000). The high amounts of ash content in these species indicate towards their being rich natural sources of mineral contents (Khan *et al.*, 2012), which easily takes care of mineral deficiency problems in human nutrition. Micronutrients such as phosphorus, potash, sodium, calcium, magnesium, iron, copper and manganese were assessed in this study, were present fairly high amounts in the three species, however, the high ash content points out the presence of other micronutrients in them as reported by Saeed *et al.*, (2010) that the aerial parts could be a significant source of micro- and macro-nutrients and thus require further investigation. Rich contents of calcium in rhizomes and bulb materials support their use as healer of bone fractures. These results however, do not show any similarity with results reported by Singh (1995) and Khan *et al.*,(2012). This could be due to variation in the plant material sources growing in two entirely different ecological zones of Sikkim and Swat in Pakistan. High iron content also justifies their use in tonics for health rejuvenation due to anemia.

Nutritionally rich foods strengthen human body and enhance disease resistance as well as prevent the incidence of deficiency diseases. Thus rhizomes and bulbs of the three species show the high contents of protein, carbohydrates and micronutrients could be used as a potential natural source of essential nutrients needed for health and energizing human body along with other ingredients of Chayavanprash, a well known functional food.

CONCLUSION

On the basis of results, It can be concluded that the rhizomes of two *Polygonatum* species and bulbs of *Lilium* Sp. are an excellent natural source of major and micronutrients such as protein, carbohydrates, calcium, magnesium, iron etc. By using modern technologies, this study has validated the age-old use of rhizomes and bulbs of three species in various Ayurvedic formulations including Chayavanprash.

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