

ETHNOMYCOLOGICAL KNOWLEDGE OF SOME WILD MUSHROOMS OF NORTHERN DISTRICTS OF JAMMU AND KASHMIR, INDIA

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ABSTRACT

Objective: Mushrooms are known for their nutritional and medicinal importance from ancient times throughout the world. The use of mushrooms as valuable tonic, food, and ethnomedicines has also been reported from India. However, information on the ethnomedicinal use of mushrooms is not available from the surveyed area of Kashmir valley. Therefore, the objective of this work is to study the ethnomedicinal use of wild mushrooms from the Northern districts of Jammu and Kashmir.

Materials and Methods: Different remote areas of Northern districts, Baramulla and Kupwara of Kashmir Valley were surveyed to document the indigenous use of various mushrooms growing in the area by local tribal people and local herbalists. Mushroom hunters, local Hakims, herbalists and aged people from tribal communities and nomads were consulted, interviewed and taken as guides to collect various mushroom species.

Results: The mushroom samples collected from the study area were used as a source of food and medicines for different ailments. The specimens collected were photographed by Sony cyber shot 12.1 megapixel camera in their natural habitats and were identified on the basis of macro and microscopic characters, expert mushroom taxonomists, field guides and standard related literature. The study revealed that 33 mushroom species belonging to Ascomycetes and Basidiomycetes were used for their nutritional and medicinal values. These mushrooms were used by the local hakims against various ailments ranging from respiratory, blood and heart ailments, arthritis, nervous and urogenital diseases either alone or in combination with some herbs.

Conclusions: It was concluded from this study that all the mushrooms used by the local tribal people and local herbalists for different ailments can be further evaluated for medicinal value and for bioactive constituents.

Keywords: Wild mushrooms, Ethnomycological studies, Food and medicinal values, Mushroom hunters, Kashmir valley.

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INTRODUCTION

The collection and use of wild mushrooms by human beings is an age old practice. The consumption of wild fungi by Chinese has been reliably noted several 100 years before the Christ's birth, and now they are being commercially exploited world over with an average value of about 2 billion US dollars in 2004 [1]. Of this nonconventional forest wealth, about 3000 species belonging to 31 genera are edible, among which 100 species are now economically cultivated and 60 are grown commercially, and out of which 10 have been raised to industrial scale. Mushrooms have been used as a valuable source of food and medicine all over the world. The active constituents found in mushroom are: Polysaccharides, dietary fibers, selenium oligosaccharides, triterpenoids, peptides, proteins, alcohol, phenols, amino acids, and mineral elements. They show anticancerous, antidiabetic, antiviral activity and also ameliorate toxic effects of chemo, and radiotherapy [2-6]. In addition to these, mushrooms contain a wide variety of bioactive molecules such as terpenoids, steroids, phenols, nucleotides and their derivatives, glycoproteins, and polysaccharides. Mushroom proteins contain all the essential amino acids and are especially rich in lysine and leucine. The low total fat content and high proportion of polyunsaturated fatty acids relative to the total fatty acids of mushrooms are considered significant contributors to the health value of mushrooms [7,8]. Mushrooms have also been used as a source of folklore medicines [9-11]. The Himalayan mountain range of Indian subcontinent contributes a major portion of this forest wealth, where their ethnomycological use has been reported by many mycologists [12,13]. However, there is a limited knowledge of ethnomycological use of macrofungi in Jammu and Kashmir state of Indian subcontinent, and Northern Kashmir Himalaya stands virgin and hitherto unexplored with none of the reports in the literature.

Therefore, rationale of our study was to carry out ethnomycological survey in district Kupwara and Baramulla of Kashmir Valley, to document the diversity and use of different mushroom species as ethnomedicines and to gather the knowledge related to the occurrence, and distribution of the wild mushrooms in the study area.

MATERIALS AND METHODS

For this study field trips were conducted at regular intervals between March 2013 and March 2015 in remote areas of Kupwara and Baramulla districts of North Kashmir Himalayas. The surveyed area include Qaziabad, Mawar, Ramhal and Rajwar in Bungus Valley, Chowkibal, Gushi and Kupwara main, Chandigam, Devar and Kalaroos in Lolab Valley, and forest areas of Rafiabad, Baramulla and Wagoora Tehsils of Kashmir Valley. Samples of mushrooms were collected in separate paper bags [14]. During the field survey help of mushroom hunters, local herbal healers (Hakims) and local tribal people were sought to reveal the necessary information regarding the vernacular names, occurrence, edibility, and ethnomedicinal use of mushrooms (Fig. 1a and b). Ethnomycological knowledge was procured from the local informants, old and experienced persons using questionnaire and recording interviews. Field notes were prepared with respect to soil type, forest type, mycorrhizal association, date of collection, and the specimen were photographed using Sony cyber shot 12.1 megapixel (DSC-W310) camera in their natural habitats and some of the morphological characters, viz., shape, color, size, color change on bruising, and taste and odor were noted (Fig. 2). The samples were taken to the laboratory for further examination. Spore shape, color, and size were studied after taking the spore prints on a paper [15,16].

The samples were identified on the basis of macro and microscopic observations, mushroom herbaria, by consulting field mushroom guides and other standard related available literature [17-19]. Expert mushroom taxonomists were also consulted for final identification of mushrooms. The specimens were preserved after shade drying [20,21]. The fungal specimens were also preserved in formaldehyde acetic acid, and formalin for herbarium purposes and preserved in fungal collection section of KASH herbarium of Plant Taxonomy, Section of Mycology and Plant Pathology, Division of Botany, the University of Kashmir, India.

RESULTS

This study documented the ethnomycological use of 33 species of medicinal and edible mushrooms belonging to 23 genera and 17

families. The mushroom species collected from the surveyed areas, in a diverse range of habitats such as coniferous forests, deciduous forests, and alpine and subalpine pastures, with their scientific name, local name, family, habit and habitat, site of collection, seasonal occurrence, ethnomedicinal uses, and other medicinal uses are listed in Table 1. It was observed from the study that besides being consumed as food, local people, hakims and tribal people inhabiting the surveyed areas use different modes of preparation of mushrooms for the treatment of a number of body ailments such as dermatitis, respiratory diseases, kidney disorders, cardiac problems, jaundice, diabetes, gastrointestinal problems, and tumors. It was revealed from this study that mushrooms, *Bovista plumbea*, *Coprinus comatus*, *Disciotis venosa*, *Lentinus tigrinus*, *Helvella crispa*, and *Geopora sumneriana* were used as ethnomedicines against chest ailments and anticold in the surveyed areas by local herbalists. Similarly, *Ganoderma* species, *Flammulina velutipes*, *Fomes fomentarius*, *Helvella acetabulum*, and *Lycoperdon perlatum* are used as immunomodulators and ethnomedicines for the treatment of skin ailments. Ethnomedicinal use of *Boletus edulis* and *Cantharellus cibarius* for bone ailments and *Lactarius deliciosus* for curing gastric irritations was also recorded in the area under study. Many species such as *Morchella*, *L. deliciosus*, *G. sumneriana*, *Sparassis* sp., and *Rhizopogon* species are used as functional foods whereas *Agaricus* sp., *Neolentinus lepideus*, *Phallus impudicus*, and *Pleurotus ostreatus* are widely used as food either fresh or in the dried form (Fig. 1c and d).

Some of the mushroom species such as *Geopora*, *Helvella*, *Pleurotus*, *Coprinus*, and *Morchella* are sold in the local markets and is a good source of income for the inhabitants of the area. This study also revealed that many mushrooms were used as a source of food in the study area, however, mode of consumption and edibility status of these mushrooms varied from area to area. Species such as *Agaricus campestris*, *A. bisporus*, *B. edulis*, *L. tigrinus*, *Lactarius deliciosus*,



Fig. 1: (a) Mushroom hunters during collection, (b) local guides with the author, (c) mushrooms on grocery shop, (d) dried mushrooms for use in winter



Fig. 2: Wild mushrooms of the surveyed area: (a) *Ganoderma lucidum*, (b) *Boletus edulis*, (c) *Rameria stricta*, (d) *Geopora sumneriana*, (e) *Rhizopogon villosulus*, (f) *Morchella esculanta*, (g) *Helvella crispa*, (h) *Lactarius deliciosus*, (i) *Sparassis crispa*, (j) *Rhizopogon roseolus*, (k) *Pleurotus ostreatus*, and l) *Fomis fomentarius*

Table 1: Ethnomedicinal use of mushrooms of two Northern Districts of Kashmir Himalaya

S. No.	Scientific name	Local name	Ethnomedicinal uses and mode of consumption	Reported medicinal uses	Month of collection
1	<i>Agaricus augustus</i> Fries	Haend	Widely used as food and general tonic. Prescribed as a supplementary diet to patients suffering from asthma, stroke, heart ailments, and diabetes	Antioxidant	Jul-September
2	<i>Agaricus bisporus</i> (Lange) Imbach	Haend	Widely used as food and general tonic	Antioxidant	July-October
3	<i>Agaricus campestris</i> L.: Fr.	Haend	General tonic Immunomodulators. Prescribed to diabetic patients	Antihyperglycemic, insulin releasing	July-October
4	<i>Boletus edulis</i> Bull.	Rate	Believed to be iron rich, prescribed to women after deliveries either alone or with dandelion As expectorant, antidepressant, treating lumbago, leg pains, numbness in limbs and tendon discomfort. However not recommended for patients with kidney stones	Antioxidant, extracts used in treating sarcoma 180 in mice	May-June, October-November
5	<i>Bovista plumbea</i> Pers.	Badul	Cooked in milk with some preliminary treatment given against respiratory tract infections after boiling in milk and concentrated to powder form is used against frost bites	Treatment of tonsillitis, sore throats, curing of skin ulcers. To stop bleeding	May-October
6	<i>Cantharellus cibarius</i> Fr.	Pueh Heand	Believed to cure wounds when used in powdered form because of its color resemblance with turmeric. Besides, it is believed to be a natural tonic. Used against bone ailments and general weakness. Dried forms used as vegetable in the off season	Contains 8 essential amino acids and vitamin A. Frequent consumption may be effective for night blindness, dry skin, infections of respiratory tract, inflammation of eye and sarcoma	July-August
7	<i>Coprinus comatus</i> (O.F.Mull.: Fr.) Pers.	Harda guech	Decoction of young mushrooms or the stipe only is used against respiratory ailments and against diabetes	Regulation of glucose concentration in blood, antitumor, antibacterial and immunomodulator, antiandrogenic modulator	October-November
8	<i>Disciotis venosa</i> (Pers.) Arnould	Kana Guech	Widely used as food. However some communities use against common cold as culinary preparations with chili and eggs	No reports	March-April
9	<i>Flammulina velutipes</i> (Curt.) Singer	Heand	Given as a tonic and immunomodulator	May prevent, as well as cure, liver disease, and gastro enteric ulcers	November-December
10	<i>Fomes fomentarius</i> (L.) Fr.	Heand	Its ash mixed with oil is used against skin ailments. Small slices are prescribed in vegetables for hypertensive patients	Diuretic, antimicrobial, wound healing	Round the year
11	<i>Ganoderma applanatum</i> (Pers.) Pat.	Heand	Decoction given to patients with weak immune systems. Local herbalists use it along with honey and Kaloongi against cough and common cold	Has immune-stimulating properties, fights cancers, stops pain, eliminates indigestion, reduces phlegm, antibiotic, antiviral	May-August
12	<i>Ganoderma lucidum</i> (Leysser) Karsten	Heand	As tea against multiple ailments, mostly given to the patients recovering from prolonged illness	In treating hepatitis, chronic bronchitis; coronary heart disease, allergies, and altitude sickness. For aging-related conditions, anticancer and as an immunomodulator	May-August

(Contd...)

Table 1: (Continued)

S. No.	Scientific name	Local name	Ethnomedicinal uses and mode of consumption	Reported medicinal uses	Month of collection
13	<i>Geopora summeriana</i> (Cooke) M. Torre	Shage Kan	Widely used as food and cooked with milk. Stimulant and tonic anticold. Its powder when taken along with milk and sugar before sleep is fruitful against constipation and acts as immunomodulator	No record	March-April
14	<i>Helvella acetabulum</i> (L.) Quel	Heand	Chronic cough	No record	April-May
15	<i>Helvella crispa</i> Bull	Batta Heand	For treatment of asthma, cough. Powdered form when taken with milk releases intestinal inflammation and mouth ulceration	Antioxidant, anti-allergic	May-August
16	<i>Hericium coralloides</i> (Scop.) Pers.	Kukur Panj	Anticold, brain tonic, suggested food for diabetic patients	Used against dementia, and other brain disorders, ulcers helpful remedy for pancreatitis, Crohn's disease, hemorrhoids	June-December
17	<i>Lactarius deliciosus</i> (L.: Fr.) Gray	Heand	Sex stimulants. Gastric irritation and heart burns Used along with herbal medicines (Sharbat bazoori motadil or Saikanjabeen lee moon). However not advisable to aged persons in this formulation	Anti-tumor, antioxidant and immunostimulant	July-August
18	<i>Lentinus tigrinus</i> (Bull.) Fr.	Veeri Heand	Widely used as food, brain tonic and against anger. Powder taken in hot water removes dry cough and asthma, when taken raw is fruitful for wet cough. Raw slices along with lemon juice enhance digestion	Antibacterial, hypoglycemic and antioxidant	May-October
19	<i>Lycoperdon perlatum</i> Pers.	Shale saes	Healing of wounds and frost bites	Antimicrobial and antioxidant	June-August
20	<i>Lycoperdon pyriforme</i> Schaeff.	Do	Healing of wounds and frost bites	Anticoagulant	June-August
21	<i>Morchella conica</i> (Pers.) Fr.	Zande guech	Heart ailments brain tonic arthritis general weakness and sex stimulant. If taken along with dimagheen (herbal medicine), pomegranate and honey, its efficacy enhances in the above mentioned ailments	Vitamin D supplement, antioxidant and antimicrobial, immunostimulant	March-May
22	<i>Morchella esculenta</i> Fr.	Batta Guchi	Heart ailments general weakness brain tonic arthritis	Vitamin D supplement, antioxidant, immunostimulant Nephroprotective against drug-induced kidney damages	May-June
23	<i>Morchella hybrid</i> (Fr.) Cetto	Saaz guech	Do	Do	March-May
24	<i>Morchella vulgaris</i> (Pers.) Boud.	Kreuhn guech/ Dumguch	Do	Do	March-April
25	<i>Neolentinus lepideus</i> (Fr.) Redhead	Kaire Heand	Widely used as food, fresh as well as in dried form	Antibacterial. Inhibitory effect on free radicals, antioxidant activity	June-October
26	<i>Phallus impudicus</i> L.	Paane laet	Used as food, for healing of wounds	Immunomodulator, anti-inflammatory, anti-stress, anti-tumor, wound healing and anticancer	May-August
27	<i>Pleurotus ostreatus</i> (Jacq.: Fr.) P. Kumm.	Kuel Heand	Widely consumed as food and used as tonic against weakness as a result of prolonged illness	Effective in the treatment of lumbago, numbed limbs, and tendon and blood vessel discomfort and reduces cholesterol	June-November

(Contd...)

Table 1: (Continued)

S. No.	Scientific name	Local name	Ethnomedicinal uses and mode of consumption	Reported medicinal uses	Month of collection
28	<i>Ramaria stricta</i> (Pers.) Quel.	Rai Saad	Asthma and other respiratory ailments. After boiling its filtrate is used for stimulation of nervous system. Its powder along with herbal medicines Stumble tayeb and Shahtara is used as blood purifier and enhancing skin color. Used for eye ailments along with pepper. In winters its powder along with pepper and clove reduces lung inflammation	No reports	June-October
29	<i>Rhizopogon villosulus</i> Zeller	Deodar Mungrae	Used raw or as vegetable Its powder along with herbal extract of Aaloo Baloo and Sang i sarmahi is used against kidney stones and urinary tract infections. When powdered form is used along with Zoofa an ayurvedic medicine cures fatty liver and asthma	Squirrel diet	March-May
30	<i>Rhizopogon roseolus</i> Corda	Madaan Mungrae	Treatment of urinary tract infections	Antioxidant, antimicrobial	March-November
31	<i>Sparassis crispa</i> Wulfen	Kawa khour	General tonic, blood purifier and anticold. Local hakims use its powder along with Aaloo Baloo (herbal medicine) in the ratio of 1:5 against memory loss, depression, anger and chest pains Powdered Mushroom along with adiantum powder and Kaloongi is used to cure asthma	Enhances hemoglobin level and anti-tumor properties	June-October
32	<i>Sparassis spathulata</i> (Schwein.) Fr.	Raisaad/ Kawkhour	Mainly used as food and General tonic and anticold, blood purifier when cooked along with milk	Not reported	June-October
33	<i>Trametes versicolor</i> (L.) Lloyd.	Heand	Effective against skin diseases such as rashes, itching, dryness, and healing of wounds when used with butter or oil	Secondary prevention strategy as immune therapy against breast cancer	Round the year

Table 2: Knowledge of tribal and local people with regard to mushrooms

District	Tehsil	Knowledge of mushroom utilization		
		Food	Ethnomedicine	No information
Kupwara	Handwara	16.67±2.89*	1.67±1.53	3.33±2.89
	Kupwara	16.67±5.77	1.33±0.58	3.33±5.77
Baramulla	Baramulla	11.67±10.40	2.67±2.52	6.67±11.55
	Wagoora	2.33±2.52	0.33±0.58	10.66±9.45
	Rafiabad	20.00±0.00	1.67±0.57	0.00±0.00

*Mean±SD of three sample sites with a sample size of 20 each. SD: Standard deviation

Morchella spp., *P. ostreatus*, *Rhizopogon* sp., *G. sumneriana*, *Cantharellus cibarius*, *Sparassis crispa*, *S. spathulata*, and *Hericium coralloides* are considered highly delicious, while *H. crispa*, *Ramaria stricta*, and *Disciotis venosa* have good acceptability for consumption. *Ramaria* species were used as medicine and cooked in the Ramhal area of Kupwara district but not from other areas, likewise, *C. cibarius* and *B. plumbea* are consumed as food and medicine in some areas of Bungus valley and not in others. *Morchella* spp., *Sparassis* sp., *Geopora*, *L. deliciosus*, *P. ostreatus*, *Agaricus* sp., *Hericium coralloides*, and *B. edulis* are almost consumed as food in all the areas and for the treatment of several diseases in many areas. *Rhizopogon* sp. are utilized as raw as well as in cooked forms as vegetable and for the medicinal purpose. The ethnomycolological survey related to edibility status of mushrooms was undertaken in the study area, and it was observed that as many as 24 mushroom spp. were preferentially consumed by the native populations of the area and a few species were marketed as source

of income. Species of *Geopora*, *Cantharellus*, *Pleurotus*, and *Lentinus* were found in the local markets, while as *Morchella* species fetched a handsome income through contractors who used to go door to door in the tribal areas for their purchases. Nine species of mushrooms were used as folklore medicines. During the survey on an average 20 respondents belonging to different age groups from three different sites of the study area were interviewed and information regarding the edibility status, medicinal uses and general information was recorded (Table 2). It was observed that people from Rafiabad, Handwara and Kupwara have a good knowledge of mushroom utilization with reference to food and ethnomedicinal uses as compared to Wagoora and Baramulla. Moreover, it was also observed that people within the age group of 50–80 years had a good knowledge of mushrooms as compared to the youngsters and below 30 years of age, the people had less information or not familiar with regard to mushrooms, their edibility and ethnomedicinal value.

DISCUSSION

Wild edible mushrooms have been utilized for food and medicines since thousands of years ago. They are important sources of food for tribal communities who mostly live in the forest and depend on natural resources for their livelihood. It was revealed from this study that out of 100 species of mushrooms collected from the surveyed area, 33 species were used by the local inhabitants and herbalists (Hakims) as a source of ethnomedicines, functional food or purely as food. The ethnomedicinal mushrooms included *Ganoderma* species, *C. cibarius*, *Flammulina velutipes*, *B. edulis*, *Morchella* species, and *Fomes fomentarius*. *B. plumbea*, *L. tigrinus*, *Rhizopogon* species, and *P. ostreatus* have been used as functional foods whereas *Agaricus* species, *G. sumneriana*, *N. lepideus*, *P. Impudicus*, and *L. deliciosus* are widely consumed as food. *Morchella* species, *Cantharellus cibarius*, *G. sumneriana*, *Helvella*, and *Coprinus* species are sold in the local markets to earn some income. The documentation of ethnomedicinal value of mushrooms has been carried out for the first time in the study area. Edibility status of most of the mushrooms documented in the surveyed areas was confirmed from the literature and has been found widely consumed in Northern Himalayas, north eastern states of India [22-26]. However, precautions were made by the tribal people to utilize only the easily identifiable mushrooms both for domestic and commercial purposes. The ethnomedicinal value reported in this study has also been found by earlier workers [9-11,27] which have been further substantiated by many workers for their antioxidant value and presence of essential mineral elements and secondary metabolites [4,28-32]. Studies on the antioxidant activity of *Pleurotus florida*, *Calocybe indica*, and *Volvariella volvacea* has revealed that these mushrooms could serve natural rich oxidant foods and thereby enhance immune system against oxidative damage [33,34]. Oral herbal dosage form of *Agaricus bisporus* powder in the form of tablets have been reported to have antidiabetic properties [35] thereby confirms the practice of using mushroom powder by many herbalists as ethnomedicines as reported in this study. Mushroom is being treated as the potential source of new generation of antioxidants [36] such as nutrition and antioxidants of plant products against oxidative stress and for prevention and treatment of a large number of diseases [37]. Therefore, the ethnomedicinal studies of mushrooms to explore their therapeutic potential become important.

It is important to mention here that the herbalists and hakims used some of the species for medicinal purposes either through food supplements or in combination with some other herbal plants or modified forms giving some preliminary treatments. However, much information was not sought about the preliminary treatments given to the mushroom products. Only a few hakims, herbalists and mushroom hunters revealed the complete knowledge they had, while others could not do so without citing the reasons. Any extract of mushrooms to be taken as such is prohibited because of toxic nature of some of the mushrooms as the herbalists give some preliminary treatments to the mushrooms before their use and the authors do not take any responsibility for any untoward for mushroom consumption before their proper identification.

CONCLUSIONS

It is concluded from the above study that ethnomedicinal knowledge is restricted to the elder people. Therefore, it becomes imperative to document the information on wild edible and medicinal mushrooms to pass on this knowledge to future generations. It is also emphasized that to avoid the ignorance of the edibility and medicinal value local inhabitants need to be trained to collect and conserve this natural wealth on scientific pattern without overexploitation and local inhabitants and the tribal communities should be sensitized about the ethnomedicinal value of mushrooms. Moreover, this study will form the base line for researchers and the mushrooms used by local inhabitants can be further evaluated for medicinal value and bioactive compounds.

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