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Review Article

CLASSICAL, ETHNOBOTANICAL, PHYTOCHEMICAL AND PHARMACOLOGICAL OVERVIEW OF KODRAVA (*Paspalum scrobiculatum* L.)

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Abstract

Indeed, the plants have been a great source of medicine since the day when a disease troubled a human being. Many people in different parts of the world depend on the plants to heal and cure the diseases. Plants are used as medicines by traditional healers, practitioners of Ayurveda, herbalists and ethno botanists. Even the grandmother recipe and folklore medicine contain plants as the main ingredients. There are number of instances, where the lead molecules are obtained from the plants and utilised to develop a modern medicine. Interestingly, a concept of providing medicinal properties through food grains has also a part of treatment strategy in Ayurveda. Hence, they included certain grains in the therapeutics and dietetics as well. Kodrava (*Paspalum scrobiculatum* L.) procured as a grain that benefitted the consumer as a nutrient and a medicine since ages. But, unfortunately, its utility as a nutri-cereal and medicine is only limited to certain tribes in different parts of the world in present times. This review will help to understand Kodrava (*Paspalum scrobiculatum* L.) through different angles and lays a foundation to develop new drug.

Key words: Kudhanya; *Paspalum scrobiculatum* L.; Compestrol; Nutricereal; Hydrocele.

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INTRODUCTION

According to the glossary of statistical terms, coarse grains are generally refer to the cereal grains, other than wheat and rice in the OECD countries, those used primarily for animal feed or brewing.[1] But, interestingly, the age old system of Indian medicine has considered many coarse grains fit for human consumption owing to their medicinal and nutritional value. The treatises of Ayurveda have categorically explained their effects on various doshas. All the coarse grains are described under a class called Kudhanya varga or Trinadhanya varga in most of the lexicons written on plants at different times. The term Kudhanya varga literally means a class of inferior grains. However, the grains falling under this group, are packed with many useful phytochemicals and nutrients. Their importance in diet, is well appreciated in treating a disease by many ancient sages.

Ironically, the modern life style has replaced many such grains that were once considered as nutri cereals. On the other hand, the ethno botanists, traditional healers, folklore practitioners and tribes of different parts of the world, irrespective of their literacy, banked on many plants for their healthy living. Many therapeutic uses they practice, are left unnoticed. They use many coarse grains as food without even knowing how much nutrient they would be.

Kodrava is also one among such grains that lost its importance over a course of time in the more civilized modern life, but stilla medicine and a food in some tribes. Integrating the ancient knowledge and ethno botanical knowledge with the present existing knowledge of health care system will, obviously, help in understanding the missing link of long healthy life

Kodrava in classics of Ayurveda

Brihattrayi provides pretty useful information on the plant. Kodrava finds its place in different contexts of Charaka samhita. Its properties and actions of are depicted in sutrasthana,[2] while, its use as pathyadravya (wholesome diet) for the patients suffering with raktapitta (bleeding disorder), udara (ascites), trishna (thirst), visha (poison) and yonivyapat (gynaecological diseases)[2] in Chikitsa sthana. Surprisingly, it is also considered as the etiology for the raktapitta (bleeding diseases) and kustha (skin diseases) in nidanasthana, if it is taken along with other food stuffs.[2] In Sushruta samhita, it is mentioned as a virookshana ahara (food that causes dryness), a vataprakopa kaahara (food that aggrevates Vata), a pitta nashaka dravya (drug that pacifies pitta) with kashaya (astringent) madhura (sweet) and sheeta (cold) properties in sutrasthana.[3]

In Astanga hridaya, its properties and actions are described in sutrasthana, while, it is recommended as a wholesome diet in kustha (skin disease) and its kshara (alkali) is recommended for darunaka (Dandruff).[4] Harita samhita also described its properties and actions.[5]

Kodrava in other ancient works

Kodrava is mentioned in Mahabharata (3000 BC)[6] where in it isprohibited for the offerings to the ancestors. Kautalya artha shashtra (2nd - 3rd century)[7] also described Kodrava as a food grain. Interestingly, Brihat samhita (6th century)[8] explained that thriving or availability of Kodrava can be judged by the flowering of Palasha tree (*Butea monosperma* (Lam.) Taub)

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Kodrava in lexicons

Kodrava finds its place in many lexicons of Ayurveda written on plants. Its different synonyms are mentioned in Amarakosha (4th century),[9] Astanga nighantu (8th century),[10] Paryaya ratnamala (8th century),[11] Siddhasara nighantu (9th century),[12] Nighnatu shesha (12th century)[13] and Saraswati nighantu (16th century).[14] Its properties and actions are explained Shodhala nighantu (12th century),[15] Madhava Dravyaguna (13th century)·[16] Siddhamantra (13th century AD),[17] Hridaya deepika nighantu (13th century AD)[18] and Raja vallabha nighantu (18th century AD)·[19]·Its synonyms and properties along with actions are found in Dhanvantari nighantu (10-12th century),[20] Madanapala nighantu (14th century),[21] Raja nighantu (15thcentury),[22] Bhavaprakasha nighantu (16th century),[23] Shaligram nighantu (19thcentury)[24] and Priya nighantu (20th century AD).[25]

Botanical source

Paspalum scrobiculatum L. is identified as the true botanical source of Kodrava. It is known as crown grass, rice grass, and ditch millet (Deshpande et al).[26] In India, it inhabits an area of 152.5 thousand hectares with the yield 41.2 thousand tonnes (Padulosi et al).[27] It is cultivated in different parts of Uttar Pradesh commonly in Gorakhpur, Basti, Gonda, Deoria, Mirzapur and Sitapur districts (Radheshyam and R.P Singh).[28] *Paspalum* genus belongs to Poaceae family which is one of the largest family of the plant kingdom. In India, it is represented by about 239 genera and 1,180 species (Singh V et al 2008).[29] *Paspalum scrobiculatum var. scrobiculatum* is grown India as an important crop. While, *Paspalumscrobiculatumvar come rsonii*is awild variety indigenous to Africa (T.P Mall and SC Tripathi).[30]

Taxonomical classification

Kingdom: Plantae
Sub kingdom: Tracheobionta
Superdivison: Spermatophyta
Divison: Magnoliophyta
Class: Lilipopsida
Sub class: Commelinidae
Order: Cyperales
Family: Poaceae
Genus: Paspalum
Species: scrobiculatum L

Vernacular names

Hindi - Kodon, Kodava
English - Kodo millet
Kannada - Araka,Haraka
Marathi - Kodra,Kodru
Tamil - Varagu
Malayalam - Varaku
Punjabi - Kodon,Kodra
Oriya - Kodua
Telugu - Arikelu
Gujarathi - Kodro
Bengali - Kodoaadhaan
Urdu - Kodon

Botanical description

An annual grass growing wildly as well as found cultivated in many parts of India. Culm- 60- 90 cm in height. Root-fibrous along with short rhizome. Leaves- 20-30cm long, 0.5cm wide linear, distichous, stiff and erect. Inflorescence-spikes. Flower- unisexual, male flowers-stamens 3, female flowers- styles 2, caryopsis- small, brown, oval- round, 4mm in length, seeds- small, ellipsoid, brown with prominent ridges.

Ethnobotanical studies

The plant is used to clear the corneal opacity, to treat stiffness of lower limb, polyuria,[31] Diabetes,[32][33][34][35][36] obesity,[31][34] Epistaxis,[34] wound[36] indigestion[37] excessive hunger in diabetes,[37] eye

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infections,[40] dysuria,[41] hydrocele.[42] Typhoid[43] and its leaf and root paste are used to relieve labour pain,[44] Katewa et al reported that the paste of the whole plant and grain flour is taken as anti-dysenteric and to cure the skin diseases.[45] Tribal of southern Rajasthan in India boil the grains as rice and use in diabetes and dysentery.[46] (M. Lohar, Arora A). It is also used as delivery convalescence.[39] Most interestingly, the santal tribes use the grain to prepare a country liquor.[47]

Phytochemicals

Sharma S and Saxena P have reported that the ethanolic and methanolic extract of *Paspalum scrobiculatum* L. contain 175.94±0.29mg and 113.29±0.29mg GAE of extract respectively. TFC (Total flavonoid content) was found highest in ethanol extract.[48] It contains an anti-cancerous phytochemical-compesterol, which is effective in breast,colon and lung cancer.[49] Fractionation of the proteins showed glutelin as the major storage protein.[50] GC-Ms conducted on acetone extract, the oil was found to contain oleic acid, stearic acid, palmatic acid and linoleic acid.[50] Bhatia et al reported the presence of tannin, phenolic compounds, amino acids, fixed oils, fats, saponins and carbohydrates.[51] Chandraprabha K and Selvi.S reported phytosterols, caretonoids, flavonoids, saponins, alkaloids, Tannins, Fatty acids, glycosoides, caumarins, reducing sugar, protein, carbohydrates and aminoacids in Kodo millet.[52] It is rich in B vitamin especially niacin, pyridoxine, and folic acid as well as Calcium, Iron, Potassium, Magnesium, zinc and high amount of lecithin.[53] Kodo millet showed phenolic content 10.3±1.15%, reducing capacity 4±1.73 reducing sugar content 130.43±2.30mg/g, soluble proteins 239.42±3.46 mg/g and fibre content14.3±2.88.[54]100g of Kodo millet contain Potassium144-170mg, Sodium 4.6-10mg, Magnesium130-166mg, Calcium 10.0-31.0 mg, Phosphorous 215-310mg, Manganese1.10-2.9mg, Zinc 0.7-1.5mg, Copper 1.6-5.8 mg, Iron 0.7-3.6 mg.[55]

Physicochemical constants

Bhatia S et al reported that the total ash is 2.25% (w/w), acid insoluble ash is 1.33, water soluble ash is 1.66 and sulphated ash is 3.42%, Petroleum ether extractive value is 2.86%, Chloroform extractive value is 1.03%, Ethanol extractive value is 5.61% and water extractive value is 5.11%.[51]

Pharmacological activities

Anti hyperlipidaemic activity

Satish Narra et al has conducted an animal study to evaluate antihyperlipidaemic activity of *Pasapalum scrobiculatum* in the high fat diet induced hyperlipidaemic rats. The assessment was done on the basis of physical parameters like body weights feed intake, organ weights and biochemical parameters like blood glucose and lipid profile. The result showed significant reduction in total cholesterol, HDL cholesterol and LDL cholesterol compared to normal control when the animals are treated with hydro alcoholic extract of *Paspalum scrobiculatum.*[56]

Anti-depressant activity

Swati sharma and Jyoti sharma conducted a study to evaluate anti-depressant potential of ethanolic extract of *Paspalum scrobiculatum* L. by subjecting the experimental animals to undergo FST (Forced swimming test) and TST (Tail suspension test).The study revealed that the ethanolic extract of *Paspalum scrobiculatum* at dose of 200mg/kg and 400mg/kg exhibit significant reduction in the immobility time compared to the vehicle and similar to that of control drug.[57]

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Anti-diabetic activity

Jain et al conducted a study to evaluate the anti-diabetic activity of aqueous and ethanolic extracts of grains of *Paspalum scrobiculatum* L. at the dose 250 mg and 500mg/kg body weight respectively to male wistar rats in whom Alloxan monohydrate was used to induce diabetes mellitus. The results were assessed on the observations based on oral glucose tolerance test, fasting blood glucose, serum lipid profile and changes in body weights. The maximum reduction in FBG (35.14%) was observed in the rats treated with ethanolic extracts given at the dose of 500mg/kg. A significant increase in serum insulin level along with reversal of serum lipid levels towards near normal were recorded.[58]

Anti-psychotic activity

V.R Deo conducted a randomized cross over double blinded clinical study to evaluate the tranquilizing effect of the dried ethanol extract of *Paspalum scrobiculatum* L. in 40 psychotic patients. The results indicated that the extract exerted tranquilizing effect.[59]

Wound healing activity

Saini and Verma conducted a study to investigate the wound healing potential of ethyl acetate and ethanolic extract of shade dried root of *Paspalum scrobiculatum* L. to wistar albino rats in whom diabetes was induced by streptozotocin and wounds were created. Ethyl acetate and ethanol extracts were given in the concentration 100mg/kg, 200mg/kg and 400mg/kg for 21 days. The study revealed that the ethyl acetate and ethanolic extracts of root of *Paspalum scrobiculatum* L. reduced the blood glucose level and wound size suggesting promising supplement for diabetic patients with wound healing defect.[60]

DISCUSSION

On analysing the literature available on Kodrava in Ayurveda, it is clearly evident that it is used primarily as a food grain in spite of its medicinal value. It is advised to treat vitiated kapha and pitta. Ironically,it is considered as aetiology for few diseases if used alone for longer duration. Interestingly, Siddhamantra – a lexicon of a kind, has described its action as kaphanashaka, vatakara and pittodaseena which means it pacifies kapha, aggravates vata, but, it is neutral to pitta i.e., it might aggravates or pacifies pitta according to the other factors such as age, season etc. The pharmacological activities of this plant such as kleda shoshana, and lekhana, perhaps, very much useful in treating many diseases that have aetiology of dietic error of modern life style.

Its grahi karma is supported by the ethno-botanical use which recommends it in the treatment of dysentery. Phytochemical studies reveal many phyto-constituents among which the presence of compesterol, flavonoids and phenolic compounds direct towards the fact that the plant *Paspalum scrobiculatum* L. could be a good source with anti-cancerous, anti- inflammatory, anti-oxidant, and anti-allergic potentials. The animal studies and clinical studies done on the plant clearly show that the plant can be a better food supplement for diabetics and to the people with mental stress.

CONCLUSION

Kudhanyavarga or trinadhanya varga explained in Ayurveda has its own importance in bestowing the healthy factors. Re identifying their value in therapeutics will make them sudhanya (superior cereals) for the patients suffering with many life style diseases of modern life. Kodrava (*Paspalum scrobiculatum* L.) is also a grain hidden with many medicinal values.

This review will help the researchers to validate its ethno-botanical claims such as its use in epistaxis, hydrocele and typhoid. Furthermore, it also directs the researchers to do clinical studies on its anti- inflammatory, anti-cancerous activities and toxicological studies.

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