ISSN 2456-3110
Vol 8 · Issue 12
December 2023

JAiMS
INTERNATIONAL

Journal of Ayurveda and Integrated Medical Sciences

www.jaims.in

JAIMS

An International Journal for Researches in Ayurveda and Allied Sciences

Maharshi Charaka
Ayurveda

Indexed

Journal of
Ayurveda and Integrated Medical Sciences
ISSN 2456-3110
REVIEW ARTICLE December 2023

Ayurvedic perspective and clinical significance of millets

P. Neelayathatchi[1], Tanuja Manoj Neasri[2], Chandra Shekhar Sanwal[3]

[1]*Assistant Professor, Dept. of Dravyaguna, All India Institute of Ayurveda, New Delhi, India.*

[2]*Director, Professor & HOD, Dept. of Dravyaguna, All India Institute of Ayurveda, New Delhi, India.*

[3]*Deputy Chief Executive Officer, National Medicinal Plants Board, Ministry of AYUSH, Govt. of India, New Delhi, India.*

ABSTRACT

The study aims to elicit the the therapeutic potential of *Kudhanya*/*Kshudra Dhanya* (millets) in Ayurvedic perspective substantiated with conventional scientific findings. In this review methodology followed includes review of various literature beginning from ancient Ayurvedic classics, conventional scientific and research-oriented publications comprising research papers, journals, periodicals etc. Ayurvedic classical literature replicate that since long time *Kshudra Dhanya* (millets) have been widely utilised in day today practice as a supplementary dietary product as well as therapeutic potential to overcome sedentary lifestyle induced epidemic of Non-communicable diseases (*Santarpana Janya Vyadhi*). In Ayurveda explanation of millets in terms of its properties, therapeutic potential, indications, contra-indications, processing are explained well. Millets are endowed with rich source of minerals, micronutrients, phenolic -componds, anti-oxidants. This analysis was tending to put forth the proper usage of millets to better enhancement of health in mankind.

Key words: *Millets, Kshudra Dhanya, Phyto-chemicals, biological activity.*

INTRODUCTION

Millets are included in cereals crop variety having small seeds. Due to its rich nutrient content it could serve the nutrient purpose of the rural poor community. Hence, they are termed as nutri-cereals as well as poor men's cereals. Millet cultivation dates back to 8000 B.C, which constitute one among ancient foods utilized by human community. In early Indian history production of millets served the purpose of stable diet and also as nutritional supplement as well as economic growth of millions of people in arid as well as semi-arid tropical regions. Green revolution resulted in the decline of millet economy over a period of more than four decades. The threat of climatic variability and increasing awareness on importance of healthy living to combat non-communicable diseases across the globe paved the way to bring back millets into immense attention. millets are potent source of fibers, vitamins like B-complex and minerals. Also rich in phytochemicals such as lignans, phyto-oestrogens, polyphenols, phytocyanins, phytosterols, which imparts functions like detoxifying agents, immunomodulatory, antioxidants etc. and thus protect against degenerative diseases related to ageing, non-communicable diseases like diabetes, cardiovascular diseases, cancer etc.[1] Millets being non-glutinous, non-allergenic, easy to digest, non-acid forming nature are safe to serve the humankind suffering with celiac disease and gluten allergy.[2] Millet consumption enables reduction in risk of heart ailments, prevents diabetes mellitus, enhancement of digestive health, lowers cancer risk, detoxifies body, improves respiratory health immunity, emphasize energy levels

Address for correspondence:
Dr. P. Neelayathatchi
Assistant Professor, Dept. of Dravyaguna, All India Institute of Ayurveda, New Delhi, India.
E-mail: neelesyam@gmail.com

Submission Date: 06/10/2023 Accepted Date: 22/11/2023

Access this article online

Quick Response Code

Website: www.jaims.in

DOI: 10.21760/jaims.8.12.25

ISSN: 2456-3110 REVIEW ARTICLE December 2023

and regenerate muscular and neural health, also potent enough to protect several degenerative ailments like parkinsonism, metabolic syndrome etc.[3-5] The health benefits of millets are the resultant, due to the presence of resistant starch, lipids, oligosaccharides, antioxidants like phenolic acids, lignans, avenanthramides, flavonoids, and phytosterols.[6,7] According to WHO's estimation the global prevalence of premature death due to NCD's such as cardiovascular diseases (CVDs), diabetes, cancers, or chronic respiratory conditions is 80%.[8,9] Increasing awareness among the humankind to stay fit and healthy to protect themselves from these illnesses, the whole world is turning towards the healthy diet intake as one among its tool to combat this situation. The need of altered dietary habit have imbibed the millet use in our diet due to their nutritional richness and health benefits.[10] *Ayurveda* being the science of wholistic approach give emphasize to healthy dietary intake both for the healthy and diseased. Millets in *Ayurveda* are described under the context *Dhanya Varga* (category of grains).[11] Here an attempt has been made to describe the qualities and actions of millets its indications, processing methods, administration and contra-indications. Millets based diet in Indian kitchen dates back to ancient times.[12] In addition to nutritional facts, there are many other factors responsible for millets cultivation since ages. They include resistant to Drought,[13] diseases and pests resistant,[14] occurrence of maturity in Shortperiod,[15] enormous nutritional values,[16] grain with Alkaline nature,[17] free of Gluten.[18] Owing to the enriched benefits of millets, at the injunction of the Government of India, the United Nations declared the year 2023 as "International year of Millets", with the intention of spreading awareness, as well as to accelerate the production and utilization of millets.

Types of millets

There are various type of millets such as Proso Millet, Little Millet, Finger Millet etc. Millets are mainly classified into Major millets and Minor millets. Major millets are: a) Pearl millet b) Finger millet. Minor millets are: a) Foxtail millet b) Proso millet c) Little millet d) Kodo millet e) Barnyard millet. In *Ayurveda* different varieties of millets are described namely: *Syamaka*, *Kangu*, *Nivara, Makustaka, Koradusa*, etc.[19]

Barnyard millet

It is enriched with high carbohydrate and crude fiber contents which enables the sow release of sugar in blood and thus helps maintain blood sugar levels.[20] The presence of resistant starch helps to lower blood cholesterol, glucose, and serum triglycerides are confirmed through study conducted in rats[21] and in clinical study conducted in volunteers.[22] The Branyard millet is found to be a rich source of proteins, minerals, fat, amino acids, iron.[23,24] Also the presence of alkaloids, steroids, carbohydrates, glycosides, tannins, phenols and flavonoids[25] in it accelerate the properties of antioxidant, anti-inflammatory, anti-carcinogenic, antimicrobial, promotes healing of wounds, relieve constipation associated with various illness[26,27] with the presence of all these characters barnyard millet plays a vital role in maintaining nutritional and physical well-being of the human community.

Finger millet

Finger millet is rich in poly phenols, possess anti-microbial, antioxidant and inhibitory activity of enzymes,[28] such as amylase and glucosidase.[29] Catechin is one of the major antioxidant principles present.[30] It is endowed with health benefit such as hypocholestrolemic, hypoglycemic and anti-ulcerative[31] potency in inhibition of cataract development,[32] type 2 diabetes management,[33,34] reduce postprandial hyperglycemia.[35] It is rich source of calcium, iron content,[36] less allergenic, digest easily hence it is most suitable for the growing children, females and aged people.[37,38] Finger millet reported to possess anti-inflammatory, antiviral, anticancer and platelet aggregation inhibitory activity.[39] Antimicrobial property will enhance defense mechanism of body, possess inhibition effect on angiotensin-I-converting enzyme (ACE) thus aid beneficial effect in treating hypertension, cardiac failure and hyperglycaemia.[40] Fermented finger millet (*Eleusine coracana* Gaertn.) flour found to inhibit *Escherichia coli* and *Salmonella typhimurium* was

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reported.[41] Antimicrobial activity of finger millet in gut flora helps to identify the pharma related nutritional facts about this millet. Hence in *Ayurveda* it is considered *Sattvika* food, which enhances natural balance of health.[42]

Proso millet

It has rich source of nutrition like proteins, vitamins and minerals. They are gluten free and easy to digest. It is rich in phytochemicals such as phenols, flavonoids and phytates.[43] They have shown the presence of phenolic compounds like frolic acid and P-coumaric acid especially in srilankan vaiety.[44]It is rich in phenolics and other biologically active phytoconstituents like ferulic acid, chlorogenic acid, syringic acid, caffeic acid and *p*-coumaric. In vitro study in cells of MDA human breast cancer and HepG2 human liver cancer revealed antiproliferative activity and cellular antioxidant properties which benefit health.[45] Study reported improvement in adiponectin levels and HDL (High density lipoprotein) cholesterol level in type 2 diabetic mice fed on porso millet protein.[46]

Foxtail millet

The flour prepared out of germinated seeds of foxtail millet contain higher concentration of total phenolic (TPC), flavonoid (TFC) contents, antioxidant activity (AoxA), dietary fibre, protein, magnesium, sodium, calcium, iron, and low antinutritional factors. Which imparts the fact that Germinated seeds foxtail millet provide better health benefits to the mankind.[47] They are endowed with the presence of phenolics and flavonoid compound which promotes anti-oxidant and anti-inflammatory activity, in addition exhibited antiproliferative effect against breast cancer cell lines, mechanistically, by inducing G2/Mcell cycle arrest and by increasing the fragmentation of DNA, responsible for cell accumulation in the Sub-G1 phase.[48]

Kodo millet

Kodo millet is enriched with polyphenols, antioxidant, flavonoids etc. nutritional entities which aid positive health of individual.[49] Phytoconstituents and phytates content aid in anti-cancerous, reduction of body weight and anti-arthritic activity.[50] Kodo millet grains extracts found to have antioxidant potential in in vitro models, the grains as a whole shown potent antidiabetic effect in alloxan induced diabetic rats[51] and promote betterment of neurological disorders. In RAW 264.7 cells immunostimulant and immunomodulatory potential are reported.[52]

Little millet

Little millets are also termed as “cool food” as it produces impact of cooling of body when taken as food during summer season.[53] It is abundant with nutritional facts like phytates, resistant starch, phenolics, lignans, gamma-aminobutyric acid and sterols.[54] It is identified that phylate retention enables antidiabetic and anticancerous characteristics and thus act as antioxidant.[55] Presence of high fiber content prevents constipation and accelerates healing of stomach ailments. Also enables reduction of fat accumulation in body[56] and proper functioning of digestive system.[57] Among the phytoconstituents present in plant kingdom, Phenolic compounds being the source of antioxidant are found in abundance in little millets. Little millets are abundant in Biologically active constituents such as gallic acidp-hydroxybenzoic acid, vanillic, sinapic acid, caffeic acid, chlorogenic acid, ferulic acid, and p-coumaric acid.[58] Little Millet is healthy nutritious and best suitable diet substance in comparision to cereal crops.[59] Due to its rich anti-oxidant content best suited in preventing metabolic and life style disorders such as diabetes, obesity, cardiac ailments etc.,[60] They are devoid of gluten, non-acidic nature, and its nutritional abundance makes it a perfect add on to the balanced diet of even healthy individual who perform Yoga, body building etc.

Millets in Ayurvedic perspective

In Ayurvedic literature various varieties of millets are described which are as follows:[61]

Kangu (Priyangu) - Foxtail millet, *Shyamaka* - Barnyard millet, *Koradusha (Kodrava)* - Kodo millet, *Cheenaka* - Proso millet, *Nartaki* - Finger millet, *Gaveduka* - Adlay millet, *Yavanaala* - Sorghum.

1. *Kangu* or *Priyangu* (*Setaria italica* (L.) P.Beauv.- Foxtail millet)

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Guru (heaviness), *Sangrahi* (absorbs excess fluids and promotes faeces formation and kindles digestion), *Brumhaniya* (bulk promoting), *Shoshana* (drying up), *Bhagnasandhanakrit* (heals fractures), *Durjara* (difficult to digest) and *Vrushya* (aphrodisiac)

2. *Shyamaka* (*Echinochloa frumentacea* Link - Barnyard millet)

Sangrahi (absorption of excessive fluids and facilitates normal faeces formation and improves digestion), *Dhatu Shoshaka* (depletion of body tissues)

3. *Koradusha* or *Kodrava* (*Paspalum scrobiculatum* L. - Kodo millet)

Madhura-Tikta Rasa (sweet & bitter taste), *Guru* (heavy to digest), *Param Grahi* (absorption of excess fluids and regulates normal faeces formation and improves digestion), *Vishahara* (anti toxic activity), *Avrushya* (reduces sexual vigor), *Patya* in *Vrana* (used as food article diet in persons suffering with wounds, ulcers etc.)

4. *Cheenaka* (*Panicum miliaceum* L.- Proso millet)

Guru (heaviness), *Durjara* (difficult to digest), *Brumhana* (bulk promoting) *Bhagnasandhanakara* (enhances healing of fractures)

5. *Nartaki* (*Eleusine coracana* Gaertn.- Finger millet)

Tiktam-Madhura-Kashaya Rasa (bitter-sweet-astringent taste), *Sita* (cold potency), *Snigdha* (unctuousness), *Balya* (immunity promoter), *Vrushya* (aphrodisiac).

6. *Gaveduka* (*Coix lacryma-jobi* L. - Adlay millet)

Katu-Madhura Rasa (pungent-sweet taste), *Karshyakari* (promotes emaciation) *Kaphahara* (mitigates Kapha). Also has properties similar to that of *Shyamaka* viz, *Sangrahi* (absorptive), *Dhatu Shoshaka* (depletion of tissues).

7. *Yavanaala* (*Sorghum vulgare* Pers.- Sorghum)

Avrushya (reduces sexual vigour), *Ruchya* (improves perception of taste), *Trushnaghna* (quenches thirst), *Kledaghna* (depletion of excess moisture).

AIM OF THE PRESENT STUDY

The Aim of this study is to review the classical *Ayurvedic* literatures like *Charaka Samhita*, *Bhavaprakasha*, *Sodala Nighantu*, *Kaiyyadeva Nighantu, Madanapala Nighantu* and gather the information related to millets mentioned in them and to co-relate with various contemporary scientific findings to substantiate its health benefits and its clinical efficacy in treating various ailments occurred as a resultant of sedentary life habits. Highlighting its right understanding of its proper utilization to enhance better health among humankind.

METHODOLOGY

The methodology assigned for the review includes literary survey of Ayurvedic classic literature and scientific research-based publications, articles, periodicals etc.

RESULTS

Table 1: The properties and actions of millets mentioned in various classical texts.[62-65]

SN	Common name	Synonyms	Botanical name	Family name	Hindi Name	Sanskrit name	*Rasa* (taste)	*Guna* (attribute)	*Virya* (potency)	*Karma* (action)
1.	Foxtail millet	*Kanguni, Vatala, Cinaka, Pitatandula, Vatala, Sukumara*	*Setaria italica* (L.) P. Beauv.	Poaceae	*Kangani*	*Kanguni*	*Madhura, Kashaya* (sweet, astringent)	*Ruksha* (dryness)	*Sita* (coldness)	*Ruchya* (enhances taste), *Vatakrit* (aggravates *Vata*), *Pittahara* (alleviates *Pitta*), *Dahahara* (reduces burning sensation), *Bhagnasthibandhakrit* (promotes binding of fractured bones)

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2.	Proso millet / Indian millet	*Varaka, Sthulakangu, Stulapriyangukа*	*Panicum miliaceum* L.	Poaceae	*Cina*	*Varaka*	*Madhura, Kashaya* (sweet, astringent)	*Ruksha* (dryness)		*Vatapittakrit* (increases *Vatapitta Dosha*)
3.	Japanese branyard millet	*Shyamaka, Shyaamaka, Avipriya, Tribija*	*Echinochloa frumentacea* · (Roxb.) Link. ·	Poaceae	*Sanba*	*Shyamakа*	*Madhura, Kashaya* (sweet, astringent)	*Laghu* (lightness), *snigdha* (unctuosness)	*Sita* (coldness)	*Vatakrit* (aggravates *Vata*), *Kaphapittaghna* (alleviates *Kaphapitta*), *Sangrahi* (helps binding *Malas*) , *Vishadoshanut* (anti toxic), *Pittanashaka* (destroys *Pitta*).
4.	Kodo millet	*Kodrava, Koradusha, Kuddalo, Madanagraja*	*Paspalum scrobiculatum* L.	Poaceae	*Kodaum*	*Kodrava*	*Madhura, Tikta* (sweet, bitter)	*Guru, Ruksha (*dryness)	*Sita* (coldness)	*Kaphapittahara* (alleviates *Kapha Pitta*), *Vatala* (*Vata* vitiating), *Mohakrit* (increases delusion), *Vishaghna* (anti toxic), *Pittanashaka* (reduces excess *Pitta*)
5.	Finger millet	*Bahudalakanisha,Guccha-Kanisha, Lancchana, Madhuli, Ragika, Nartak, Madua*	*Eleusine coracana* (L.) Gaertn.)	Poaceae	*Manduwa*	*Ragi*	*Tikta, Madhura, Kashaya* (bitter, sweet, astringent)	*Laghu* (lightness),	*Sita* (coldness)	*Raktapittanashana*(all eviates rakta pitta), *Balada/ Balakarak* (promotes physical strength), *Pittanashaka* (alleviates *Pitta*), *Brumhana* (bulk promoting) *Truptikarak* (promotes satiation).
6.	Adlay millet / Job's Tear	*Vaijyanti*	*Coix lacryma jobi* Linn.	Poaceae	*Samkru*	*Gavedhuk*	*Madhura, Kashaya (*sweet, astringent)	*Ruksha (*dryness)	*Ushna(hotness)*	*Sthaulyam* (Obesity), *Kapaja Cardi* (vomitting)
7.	Great Millet / Sorghum millet	*Jurnahwa, Yavnal, Raktika Krostupuccha, Sugandhika,*	*Sorghum vulgare* pers.	Poaceae	*Jwar*	*Yavanala*	*Madhura* (sweet)	*Guru,*	*Sita* (coldness)	*Brumhana* (bulk promoting), *Malarodhak* (causing obstruction to stools), *Rucikarak* (enhances taste), *Viryavardhak* (Increases potency), *Raktavikar* (beneficial in *Raktavikara*)
8.	Pearl Millet	*Bajranna, Sajak, Nalika, Neelkaran, Agrayadhanya*	*Pennisetum typhoides* Burm.f.Stapf. & Habbard		*Bajra*		*Madhura* (sweet)	*Ruksha* (dryness)	*Ushna*(hotness)	*Balya* (promotes physical strength), *Agnidipana* (digestion and metabolism enhancing), *Strikamodpadaka* (aphrodisiac), *Punstvahar* (relieving

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										impotence), *Durjara* (difficult to digest)
9.	*Nivara*	*Tini, Aranyadhanya , Munidhanya, Trinodbhav*	*Hygroryza aristata* Nees.	Poaceae	*Nivara*	*Nivara*	*Madhura* (sweet)	*Laghu* (lightness), *Snigdh*(unctuosness)	*Sita* (coldness)	*Raktapittahara* (reduces bleeding disorder), *Vataraktahara* (alleviates rheumatism), *Pathya* (wholesome diet article), *Kaphkarak* (aggravates *Kapha*), *Malamutra Rodhak* (causing obstruction to faeces and urine)

Table 2: Phytoconstituents and biological activity of different varieties of millets.

SN	Millets	Phyto constituents	Pharmacological activity	Biological activity
1.	Kodo millet (*Paspalum scrobiculatum* L.)	Catechin	Anti-obesity, Anticancer, and helpful in treatment of Parkinson's and Alzheimer's disease.[66-68]	Severity of asthma, migraine attacks, reduce high blood pressure, Coronary Heart disease, atherosclerosis and Diabetes.[69-72]
		Naringin	Anti-apoptotic, anti-carcinogenic, anti-inflammatory, anti-ulcer, anti-osteoporotic.[73]	
		p-Coumaric acid	Peroxidation, cholesterol-oxidation, and LDP.[74-76]	
		Taxifolin	Anti-inflammatory.[77]	
		Ferulic acid	Antithrombotic, anti-allergic, anti-microbial, anti-inflammatory, anti-viral, anti-carcinogenic, heptaprotective, vaso-dilatory effect.[78-81]	
		Sinapic acid	Anti-carcinogenic, anti-inflammatory.[82]	
		Pterin-6-carboxylic acid	Antitumor.[83]	
		Campesterol	Lowers blood cholesterol, anticarcinogenic, chemo-preventive.[84]	
2.	Foxtail millet (*Setaria italica* (L.) P.Beauv.)	Phenolics, carotenoids, flavanoids.	Anti proliferative, Anti-oxidant.	In Vitro study in Breast cancer cells showed reduction in viability of cancer cells by promoting arrest of cell cycle and inducing fragmentation of DNA.[85] Useful in Type-2 diabetes.[86]
3.	Finger millet (*Eleusine coracana* Gaertn.)	Poly phenols & phenols, such as gallic, vanillin, syringic, p-hydroxy benzoic, protocatechuic, p-	Hypoglycemic, hypocholestrolemic activity,[87] anti-ulcerative, anti cancer (intestinal-cancer).[88-90] Anti oxidant, anti-microbial, inhibits the activity of digestive enzymes.[91]	Prevent cataract formation, Inhibits of Salmonella typhi & E-coli.[92] Helpfulin treating type 2 DM.[93] Maintain body temperature during rainy.[94] Cardio-vascular disease, Colon-cancer, constipation, Diverticulosis, wound

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		coumaric, ferulic, trans-cinnamic acids, and quercetin, Chlorogenic acid,tannin, catechins.		healing.[95] Ascaris, folk remedy against leprosy, liver diseases.[96] Diabetes mellitus, gastrointestinal tract (GIT) disorder.[97] Cancer, Hyperglycaemia.[98,99]
4.	Ethiopian finger millets (*Eleusine coracana* Gaertn.)	Poly phenols.[100]	anti-diabetic, anti-tumor, antioxidant antimicrobial, anti-atherosclerogenic .	Diabetes, Blood pressure, Anaemia, stomach-cancer, Alzheimer.[101,102]
5.	Pearl millet (*Pennisetum glaucum* R.Br.)	Phenolics, flavanoids	Hypoglycaemic, anti-cancer, anti-ulcer and Hypotensive activity.	Neuro degenerative disorder, Diabetes mellitus, Nephritis, Rheumatism, Alzhiemer disease, Cataracts, Cardiovascular disease, Acute liver toxicity and DNA damage.[103] Cancer, cardiovascular disease, reducing tumor incidence, lowering the blood pressure.[104] Gastrointestinal disease, and Ulcer.[105]
6.	Proso millet (*Panicum miliaceum* L.)	phenolic acids ferulic acid, chlorogenic acid, syringic acid, caffeic acid and p-coumaric	cellular antioxidant andantiproliferative activity.[107]	Effective in management of Liver disease.[106]
7.	Branyard millet (*Echinochloa frumentacea* Link)	alkaloids, steroids, carbohydrates, glycosides, tannins, phenols, and flavonoids, resistant starch	Anti-oxidant, anti-cancer, anti-inflammatory, anti-microbial.	Woundhealing,reduce biliousness, relievesconstipation.[108,109] potent enough to lower blood glucose, serum cholesterol, and triglycerides (pre clinical study in rats).[110,111] lowers glycemic index (GI) in type 2 diabetic.[112]
8.	Japanese Banyard millet (*Echinochloa utilis* Ohwi & Yabuno.)	Triterpenoids, sterols	potential cytotoxic effect over HeLa (human tumor-cell lines-study on in vitro models),	Beneficial in Tumor necrosis.[113]
9.	Little millet (*Wheat semoline*)	Kaempferol, Luteolin, Apigenin. Rich in amino acids, methionine, cysteine lysine, phenols, tannins, phytates, γ-aminobutyric acid	Anti-cancer, Anti-diabetic, anti-rheumatic, anti-cancerous.[116] anti-inflammatory, anti-oxidant.[117] ant-iviral and neuro-protective activity.	Lowers the risk of chronic diseases.[114] Improves health, delays aging and prevent metabolic disorders. Beneficial in treating obesity, diabetes and cardiovascular conditions.[115]

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		(GABA), carotenoids and tocopherols		

Discussion

Owing to its general qualities and effects millets are best suited in *Kaphaja Vyadhi* (disease due to *Kapha*), *Pittaja Vyadhi* (disease due *Pitta*) and *Raktaja Vyadhi* (disease of *Rakta* origin). Hence, millets are mainly indicated in obesity (*Sthula*), skin disease (*Tvak Vikara*), diabetes (*Prameha*), Diarrhoea (*Atisara*), disease due to high lipid accumulation (*Medoroga*), *Vrana* (wounds) and other *Santarpanotta Vyadhis* (Disease due excessive nourishment of tissues) generally termed as lifestyle disorders.[118] Found to be more beneficial in Diabetes and obesity disorder.[119] Millets are rich in proteins, dietary fibres and less carbohydrate contents, thus care should be taken while administering to the individuals in terms of *Agni Bala* (strength of digestion) as they are heavy (*Guru*) and dry (*Ruksha*) which results in difficulty to digestion.[120,121] The presence of *Lekhana* (scrapping) and *Kledana* (moistening) effects of millets also make them beneficial in treating *Santapanajanya Vyadhi*. Millets are gluten free and thus they may benefit as diet of choice in IBS.[122] Also found beneficial in reversing the process of IBS.[123] As there is no direct reference that millets are directly indicated in certain diseases we have to derive the utility of them in disease conditions with the help of *Gunas* (attributes) and *Karmas* (actions). Here an attempt has been made to derive the clinical significance of the millets in respect to its properties and actions.

Kangu (Foxtail millet) a variety of *Kudhanya* is *Sangrahi* in nature (absorbtion of excessive fluids and helps normal formation of faeces and aids digestion) is suitable to treat *Atisara* (Diarrhoea), *Grahani* (Irritable Bowel Syndrome). Also due to *Brumhana* (bulk promoting) and *Shoshana* (drying up excessing moisture) qualities, it is used for *Dhatu Shoshana* (drying up body tissues) of excess nourished *Medo* and *Mamsa Dhatus* (Adipose tissue and Muscle tissue) in addition it can help nourishment by its micro nutrient potential.[124] Keeping these principles in mind it may be concluded it is suitable in treating *Sthaulyam* (Obesity) and *Prameha* (Diabetes Mellitus) *Rogas*. Multi-millet therapeutic food including foxtail millet is found beneficial in reduction of blood sugar level in type 2 Diabetes.[125] Due to its *Gunas*, *Bhagnasandhanakrit Karma* (fracture healing activity) is indicated in *Asthi Bhagna* (fractures), also found beneficial *Kapha-Pitta Pradhana Charma Vikara* (Skin ailments due to *Kapha-Pitta* vitiation), *Amavata* (Rheumatoid Arthritis).

Shyamaka (Barnyard millet) is being *Sangrahi* (drains excessive fluids and promotes normal faeces formation and aids digestion) in nature, is beneficial in *Atisara* (Diarrhoea), *Grahani* (Irritable Bowel Syndrome). Due to its *Shoshana* (absorbtion of excessive moisture), *Ruksha* (dryness) properties beneficial in *Santarpana Janya Vyadhi* (Diseases due to over nourishment) like *Sthaulyam* (Obesity), *Prameha* (Diabetes Mellitus), *Medoroga* (Diseases due to excessive lipids). Due to *Lekhaniya* (Scraping) and other qualities, beneficial in *Kapha-Pitta Pradhana Rogas* (Diseases due to *Kapha* and *Pitta* vitiation) like *Carma Vikara* (Skin Diseases), *Amavata* (Rheumatoid Arthritis). Barnyard millet is reported with low glycemic index which is helpful in reducing Diabetes Mellitus.[126]

Kodrava (Kodo millet) due to its *Grahi* (absorbs excessive fluids and helps for normal formation of faeces and enhances digestion), *Badda Vitkara* (increases constipation) is beneficial in *Grahani* (Irritable Bowel Syndrome). Due to *Shoshana* (drying up excess moisture), *Rukshana* (dryness), *Lekana* (scrapping) properties beneficial in healing *Vrana* (Wound/ ulcers) and *Santarpana Janya Vyadhi* (excess nourishment of tissues) like *Sthaulyam* (Obesity), *Prameha* (Diabetes Mellitus), *Medoroga* (Diseases of excessive lipids) occurs. Due to *Pitta-Rakta Shamaka* (mitigates *Pitta* and *Rakta*) properties treats *Vatarakra* (Rheumatism), being *Visha Hara* (anti toxicity) and *Kapha-Pittahara* benefits *Vishartha* (person afflicted with poison) other *Kapha-Pitta Pradhana Roga*

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(ailments of vitiated *Kapha* and *Pitta*). Beneficial effect of millets in combating and overcoming Cardio-vascular diseases are well reported.[127]

Cheenaka (Proso millet) due to its *Ruksha* (dryness), *Kaphahara* (pacifying *Kapha*), *Lekana* (scrapping) and *Medohara* (pacifies *Medas*) properties is beneficial in in *Santarpana Janya Vyadhi* (Diseases of excess nourishment of tissues) such as *Sthaulyam* (Obesity), *Prameha* (Diabetes Mellitus), *Medoroga* (Diseases due to hyper lipids) and *Kapha Pradana Roga* (Diseases due to vitiated Kapha), due to *Brumhana* (Nourishing), useful in *Asthibhagna* (Fracture). It is endowed with anti adipotic and pro apoptic activities, thus found beneficial in Obesity.[128] Also plays vital role in raising the HDL levels, thus effective in preventing the risk of Coronary Disease occurrence.[129]

Nartaki (Finger millet) posses, *Tikta-Madhura Rasa* (Bitter-Sweet in taste), *Kashaya Rasa* (Astringent), *Sita Virya* (cold potency), *Snigdha Guna* (Unctuousness) hence beneficial in *Raktapitta* (Bleeding disorder), *Amlapitta* (hyperacidity), *Twak Vikara* (Skin diseases). Due to *Tikta-Kashaya Rasa* beneficial in *Sthaulyam* (Obesity) and *Prameha* (obstinate urinary disease). *Balya* property (promotes physical strength) helps to overcome *Durbalata* (loss of physical strength). Its anti obesity potential effect, combat obesity induced oxidative stress.[130] Potent against hyperglycaemia in NIDDM (Non- insulin dependent Diabetes mellitus).[131] Being store house of nutrients helps boost energy in consumption.[132]

Gaveduka (Adlay millet) is endowed with *Krusata* (emaciation), *Kapha Hara* (mitigates *Kapha*) property is prescribed in *Sthaulyam* (Obesity) and obese *Prameha Rogi* (overweight Diabetes mellitus) and *Kapha Pradhana Rogas* (Diseases of excess *Kapha*). Its use is recommended in Diabetes and Rheumatism.[133]

Yavanaala (sorghum) possess *Tikta-Kashaya Rasa* (Bitter and Astringent in taste), *Pittaghna* (Pacifying *Pitta*), *Rakta Shamaka* (alleviates *Rakta*), *Kaphahara* (Pacifying *Kapha*) as it is *Trushnaghna* (Pacifies thirst), is advised in *Raktapitta* (Bleeding disorders), *Amlapitta* (hyperacidity), due to its *Rakta* and *Pitta Samana* property useful in *Twak Roga* (Skin diseases). Beneficial in *Sthaulyam* (Obesity) and *Prameha* (Diabetes Mellitus) as it is *Tikta-Kashaya Rasa* (Bitter and Astringent in taste), and *Kaphahara* (mitigates *Kapha*). Abundant in nutitional facts and phytoconstituents.[134] Bestows anti-obesity and anti diabetic activities.[135]

Contra-indications

Inspite of its usefulness here some of its contra-indications are being discussed. Millets are generally *Ruksha* (dry), *Vatakara* (aggravates *Vata*), hence not adviced in *vatatika Rogas* (*Vata* predominant diseases) such as *Sandhigatavata* (Osteoarthritis), *Krusata* (emaciation), *Sosha* (wasting) etc., Due to *Durjarata* (difficult to digest) not to be prescribed in *Ajirna* (Indigestion), *Mandagni* (diminution of *Agni*), *Vibandham* (retention obstruction to passage of feces). Millets utility in above conditions need to undergo *Samskara* (Processing) such as soaking in water before cooking, frying in ghee, adding drugs which enhancing metabolic fire and promotes digestion (*Dipanam* and *Pacanam*), those pacifying *Vata* (*Vata-Samana Dravyas*) etc., renders pacification of *Vata Dosha* helps regulate nervous function and hastens digestion. Also volume and frequency of intake i.e., optimal digestible quantity of millets (*Matra*) is to be regulated. Traditional way of processing millets like soaking, frying etc. result in considerable reduction of anti-nutritional factors as well as helps enhancement of nutritional facts and biological activity.[136]

In *Ayurvedic* science millets are not recommended as *Nitya Ahara* (food substance used on daily basis), also described under *Kudhanya* (inferior) variety of *Dhanya Varga*. Regular intake of pearl millet resulted to possess anti-thyroid and goiterogenic activity especially in reference to iodine deficient individuals. Thus, it is recommended even the healthy individuals are required to consume millets in limited quantity.[137] It is reported anti-thyroid and goitrogenenic activity of pearl millet on regular consumption especially in iodine deficiency areas. This enlightens that even in healthy individuals' millets need to be consumed in moderate quantities and frequency.

CONCLUSION

Currently the world is facing the risk of epidemic of Non-communicable diseases due to sedentary life

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styles resultant of modernization. This being the case millets are best suited in *Santarpanajanya Vikaras* and *Kaphapitta Doshajanya Rogas*, also used as preventive measure in healthy and as therapeutic aid in the form of diet to manage disease condition. While administering millet care should be taken that it is to be administered after assessing the *Agni* along with proper processing based on *Rogi* and *Roga Bala*. Millets are to be avoided in *Vata Vikara* or care to be taken while administering in *Vata Vikara*.

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How to cite this article: P. Neelayathatchi, Tanuja Manoj Neasri, Chandra Shekhar Sanwal. Ayurvedic perspective and clinical significance of millets. J Ayurveda Integr Med Sci 2023;12:161-174.
http://dx.doi.org/10.21760/jaims.8.12.25

Source of Support: Nil, **Conflict of Interest:** None declared.

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