Journal of Comprehensive Pharmacy

Review Article

Available Online at: www.jcponline.in

ISSN NO: 2349-5669

A NOVEL REVIEW ON *SETARIA ITALICA*

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ARTICLE INFO

Article history:

Received 15 February 2015

Accepted 20 March 2015

Available online 27 April 2015

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ABSTRACT

Setaria italica is commonly known as foxtail millet. It is a universally cultivated crop majorly cultivated in China, India, and Russia. In India Andhra Pradesh and Tamilnadu are the places where it is cultivated much, that belongs to the family of Poaceae. It is majorly cultivated for the fodder for animals it can be distinguished from wild weeds with its characteristic features like length, shape, colour of leaves. The major constituents present in *Setaria italica* are Proteins, Carbohydrates, Glycosides, Minerals, Phosphorous, Iron, Vitamins, Oxalates, Nitrates and Coumarins. The seeds of *Setaria italica* are traditionally used as astringent, digestive, emollient and stomachic, also used in the treatment of dyspepsia, poor digestion and food stagnancy in abdomen and as a diuretic. Several pharmacological studies were performed and scientifically proved that the plant possesses Antihyperglycemic, Hypolipidemic, Cytotoxic Antioxidant, Anti-lipase, Hepatoprotective, Antimicrobial, Appetite stimulant, Anti-inflammatory activities and also has neutraceutical properties. It is also used in family planning and for the treatment of STD diseases. This review shows a detailed survey of the literature resting on therapeutic uses, chemical constituents and pharmacological activities of *Setaria italica*.

Key words: *Setaria italica*, Foxtail millet, Poaceae, Pharmacological activities.

INTRODUCTION

Setaria italica is commonly known as foxtail millet. In India it is cultivated in Andhra Pradesh and Tamilnadu. The seeds of *setaria italica* can be eaten as a sweet or savory food in all ways that rice is used. It is also an important grain crop in the world wide today, thought to have been domesticated from the wild species green foxtail in North China. *Setaria italica* (foxtail millet) is one of the oldest cultivated cereal grain and usually grown for its grain but also cultivated as a fodder plant. Foxtail millet is an erect annual grass, fast growing leafy and tufted, 90-220 cm high. It has a dense root system of thin adventitious roots. It stems are erect, and tiller from the base. The leaves are alternate with lanceolate and serrated blades, 15-50 cm long and 0.5-4 cm broad. Flowers two per spikelet, the upper bisexual. In cultivated varieties there are two to three

bristles per spikelet. Fruit a caryopsis; grain of various colours; seeds enclosed in thin, papery hulls, largely removed by threshing, leaving free the small, convex seed, which is oval or elliptical [1, 2].

There are many wild and cultivated types of *Setaria italica*, which are interfertile. Wild types are annual weeds (green foxtail millet) that are very common in temperate areas, and cultivated types are different like their height, habit structure of inflorescence, number and colour of grain. Moha cultivars are high-tillering with more or less erect inflorescences [3]. Foxtail millet (*Setaria italica*) is grown in cooler, droughtier regions, than other millets [4]. It is widely grown throughout China, India, Russia, Africa, and the United States. In the United States, foxtail millet is mainly grown in the northern and western Great Plains, Midwest, The Dakotas, Colorado, Kansas, Nebraska

Figure No. 1. *Setaria italica* monographical presentation

and Wyoming [5, 6]. In Europe, it is cultivated as a summer crop until the 17th century, & now it is the main area of production [7]. Microbiological analysis showed this millet cereal to be deficient in lysine but high in tryptophan content. Seeds contains Proteins, Carbohydrates, Fiber, Ash, Minerals, Phosphorous, Iron, Vitamin B₁ (Thiamine), Vitamin B₂ (Riboflavin). Leaves contain two coumarins; 6-7-dimethoxy coumarin and 5, 8-dimethoxy coumarin. A chemical investigation revealed that the leaves of *Setaria italica* contains six known o-glycosylflavones and 10 C-glycosylflavones including the new compounds scoparin 2'' O-xyloside and scoparin 2''-o-glycoside and six new acylated C-glycosylflavones [8]. Foxtail yellow seeded cultivators, medicinally used as astringent, digestive, emollient and stomachic. It is also used in the treatment of dyspepsia, poor digestion and food stagnancy in abdomen. White seeds are refrigerant and used in the treatment of cholera and fever while the green seeds are diuretic and strengthening to virility [9, 10]. Seed can be cooked and eaten as sweet or savory food [11].

PHARMACOLOGICAL STUDIES DONE ON *SETARIA ITALICA*

Antihyperglycemic and hypolipidemic activities

The aqueous extract of *Setaria italica* seeds have been evaluated for Antihyperglycemic and hypolipidemic activities. The different doses of *Setaria italica* seed aqueous extract (SISAE) was screened by oral administration of SISAE in Streptozotocin induced diabetic rats and it was compared with that of Glibenclamide (A standard oral hypoglycemic agent).

The effect of long-term treatment with 300 mg of SISAE/kg b.w./day on blood glucose, glycemic control and serum lipids were evaluated in normal and diabetic rats. The dose of 300 mg of SISAE/kg b.w. produced a significant fall in blood glucose in diabetic rats after 6h of administration of the extract. After 30 days treatment there was a significant decrease in fasting blood glucose associated with a significant improvement in glycemic control as evidenced by lower levels of HbA1c in diabetic treated rats, when compared to those in untreated diabetic rats. The aqueous extract also exhibited significant hypolipidemic effect by lowering levels of triglycerides, total, LDL and VLDL cholesterol and increase in the levels of HDL [12].

Cytotoxic, antioxidant and hypoglycemic activity

The crude ethanolic extract of *Setaria italica* was screened for various pharmacological properties. The ethanolic crude extract showed analgesic activity by acetic acid induced writhing method. In Radiant heat tail-flicking test, anti-nociceptive effect of crude ethanolic extract was found to be moderately significant. Ethanolic crude extract, chloroform and pet ether fractions have shown potent free radical scavenging activity. The crude extract also showed significant cytotoxic, antioxidant and hypoglycemic activity [13].

Antioxidant activity

The foxtail millet-milled fractions like whole flour & bran rich fraction was studied for its antioxidant potency. Phytochemical screening revealed Phytoconstituents like alkaloids, phenolics, reducing

sugars and flavonoids in methanolic & aqueous extracts, while tannins and terpenoids. Methanolic extracts of whole flour and bran rich fraction exhibited a significantly higher radical scavenging activity using DPPH model system, and reducing power at 2 mg. Bran rich fraction showed the highest antioxidant activity, due to the presence of antioxidant components in the bran layer [14].

Anti-lipase activity

The methanolic extract of *Setaria italica* was evaluated for antilipase activity using a radioactive method. In this study the assay of pancreatic lipase activity was done by using a radioactive substrate TRIOLEIN and the enzymatic reaction was also carried out. After this, the assay of pancreatic lipase inhibitory activity of *Setaria italica* was determined. The extracts were pre incubated with the enzymes. Negative control was served without inhibitor and positive control was served with inhibitor. Results of methanolic extract of *Setaria italica* exhibited strong invitro Anti-lipase activity [15].

Hepatoprotective activity

The oil extract from foxtail millet bran (FMBO) was evaluated for physiochemical characterization, antioxidant activity and hepatoprotective effects against acute ethanol induced hepatic injury in mice. GC-MS analysis revealed the unsaturated fatty acids (UFAS), in particular, the linoleic acid is the predominant Polysaturated fatty acid (PUFA), Squalene & Phytosterols. The invitro antioxidant activity of Foxtail millet bran oil showed highly ferric reducing antioxidant power & scavenging effects against DPPH and OH⁻ radicals. The protective effect of FMBO against acute hepatic injuries induced by ethanol was evaluated. The intragastric administration with different doses of FMBO in mice head of acute ethanol administration could antagonize the ethanol induced, increases in serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), TG & hepatic malondialdehyde (MDA) levels and showed the enhanced hepatic superoxide dismutase (SOD) levels as that of control. Hepatic histological changes confirmed that FMBO is capable of attenuating ethanol induced hepatic injury [16].

In-vitro antioxidant & Antimicrobial activity

The antioxidant activity of ethyl acetate extract of *Setaria italica* seeds have been evaluated by Nitric oxide assay. The antimicrobial studies was evaluated against the microbial strains like *Aspergillus niger*, *Aspergillus flavus*, *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Proteus vulgaris* by disc diffusion method where dicloxacyclin was used as control & the zone of complete inhibition was measured. The ethylacetate extract of *Setaria italica*

showed significant activity against the test organisms, when compared to the control [17].

Appetite stimulant

Analysis of 12 cultivators of *Setaria italica* showed the ash and fiber content to be comparable to other millets while protein and calcium are slightly higher. Invitro digestibility studies exhibited that *Setaria italica* has high pepsin content and low trypsin content. The acid treatment of flour showed increased invitro protein digestibility with trypsin [18].

Anti-inflammatory and antioxidant activities

The ethanolic extract of *Setaria italica* was evaluated for its anti-inflammatory activity. Administration of ethanolic extract of *Setaria italica* in acute carrageen-induced rheumatoid female rats significantly reduced the levels of cathepsin, uric acid, LDH, ALT and AST as well as increased the levels of antioxidants in serum, liver and kidney tissue. Results showed effective control of scavenging free radicals and potent antioxidant probably due to the presence of flavonoids and alkaloids [19].

Effects of glycemic index on diabetes

The *Setaria italica* biscuits and burfi, a sweet product have been evaluated for its lipid benefits on diabetic patients. The study showed the supplementation of low glycemic index of foxtail millet biscuits causes a significant reduction of baseline serum glucose, serum cholesterol and LDL with a 19.68% reduction of glycosylated haemoglobin. Results suggested that millets have a potential protective role in the management of type2 diabetes [20].

Screening of antimicrobial activity

Two coumarins from *Setaria italica* and their microbial activity were evaluated. Antimicrobial studies showed moderate activity against different strains of bacteria and fungi. The leaves yielded two coumarins: 6, 7-dimethoxycoumarin and 5, 8-dimethoxycoumarin [21].

Family planning and sex diseases treatment

This study revealed that thirty six ethanomedicinal plants of twenty six families are used by tribals as ethanomedicines to control birth rate and sex-related disease. The crushed seeds of *setaria italica* was mixed with ghee as in the form of a cake, and eaten to get sexual vigor and potency. The oil of *setaria italica* was used as contraceptive and also used to increase fertility both in female and male [22].

Nutraceutical properties

The nutraceutical properties of *Setaria italica* (foxtail millets) was evaluated by using the common qualitative analysis methods such as phytochemical

screening. It showed the presence of flavonoids, phenols, alkaloids, Saponins and also the water-soluble proteins. It was observed that the crude fibre possess reducing power. When compared to the other millets the foxtail millet has shown the major yield of the phytochemicals such as 2.5% of phenols, 305.76mg/g of protein content [23].

CONCLUSION

Medicinal plants have provided copious leads to combat diseases, from the dawn of civilization. The literature survey revealed that *Setaria italica* can be regarded as widespread herbal medicine with diverse pharmacological activities. This medicinal plant is a unique source of various types of chemical constituents which are responsible for the various activities of the plant. Several studies have performed to explore the potential of this *Setaria italica* (foxtail millets).

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Cite this Article as: Kattamanchi V, Pujari L, Nallabattini V, Lankipalli K, Mallapu P, Lahari K. A NOVEL REVIEW ON *SETARIA ITALICA*. J Compr Phar 2015;2(2):31-35