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A review on finger millet

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ABSTRACT:-
One of the oldest millets in India (2300 BC) is finger millet, also known as ragi. This review focuses on the history, applications, nutritional makeup, processing, and health advantages of this ancient grain. Finger millet has the greatest percentage of calcium (344 mg %) and potassium (408 mg %) of any cereal or millet. In comparison to white rice, which is currently India's main staple grain, it has more nutritional fibre, minerals, and amino acids that contain sulphur. Despite the rich nutritious profile of finger millet, new research shows that urban Indians consume fewer millets overall. Processing steps for finger millet include milling, popping, fermentation, malting, and decortication. Most poor countries struggle with food and nutrition insecurity; ironically, certain underutilized crops have the potential to improve food security. Finger millet, also known as Eleusine coracana L., is a small cereal grain that is widely grown for its many health benefits throughout Africa and India. The nutritional and health benefits of this crop have been extensively studied, but little is known about how processing and varietal differences impact these attributes. In order to ensure nutrition and food security, this study examined the impacts of variety and various processing techniques on the nutrition, anti-nutrients, phytochemicals, and antioxidant capabilities of finger millet. Finger millet shows the antioxidant, anti-inflammatory, anticancer, antimicrobial, and other activities. A degenerative total joint disease that affects the articular cartilage, subchondral bone, ligaments, capsule, and synovium, osteoarthritis (OA) is a chronic condition that progresses over time. Even while OA is still thought to be a mechanically driven illness, it is now recognized that underlying, coexisting inflammatory processes and mediators have a significant influence in both the disease's origin and progression. In pre-clinical models, post-traumatic osteoarthritis (PTOA), a subtype of OA that results from traumatic joint injuries, is frequently employed to shed light on OA in general. The worldwide burden is significant and growing, making the development of new treatments imperative.

KEYWORDS:- Finger Millet, Eleusine Coracana L., Antioxidant Activity, Osteoarthritis, Degenerative Disease.

I. INTRODUCTION:-

A degenerative joint condition that can impact the joint's numerous tissues is osteoarthritis. According to the Centres for Disease Control and Prevention, it affects over 32.5 million individuals in the US and is by far the most frequent type of arthritis. Osteoarthritis (OA) was once thought to be a "wear and tear" ailment that was typically connected to aging. However, we now understand that it affects every component of the joint, including the bone, cartilage, ligaments, fat, and synovium, the tissue that lines the joint[1].

Osteoarthritis can lead to pain, stiffness, and loss of movement by destroying cartilage, altering the form of bones, and causing inflammation. While OA can impact any joint, it usually affects the hands, knees, hips, neck, and lower back. It is not an inevitable aging disease; some people never develop it. There is no known cure for osteoarthritis (OA), but there are ways to manage it so that pain can be minimized, physical activity can continue, quality of life can be maintained, and mobility can be maintained. Its signs and symptoms usually appear more frequently in people over 50, but it can also affect much younger people, especially those who have had a prior joint injury, such as a torn ACL or meniscus[1].The incidence of this illness is anticipated to climb in tandem with longer life expectancies, potentially having significant worldwide ramifications. Academics and industry have recently focused more on this condition due to the increased awareness of its importance. This has pushed the therapeutic agenda forward. Still, there hasn't been much success in creating novel therapies, and one important problem is that there are currently no medications that change illness.

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The purpose of this review is to give an overview and talk about possible therapies and medication targets for osteoarthritis[2].

Because OA-related pain is produced via numerous inflammatory and mechanical nociceptive channels, it is difficult to treat. There is increasing conjecture that secondary neuropathic pain mechanisms in the spinal, supraspinal, and peripheral regions may also be triggered. The range of this disease also includes alterations in nearly all periarticular tissues, according to recent study. Pathology of the spongy bone, synovium, synovial fluid, cartilage and periarticular bursae, ligaments, and myofascial structures are associated with classical osteophytotic and subchondral degeneration, and can be quite substantial. Due to a variety of direct and indirect circumstances, the sensory nerve fibres in certain patients may also exhibit disease[3].

Around the world, osteoarthritis is a condition that many humans and animals suffer from. About 10% of adults over sixty experience it in humans, and in other 2. Animals, such as osteoarthritis in cats, which has been demonstrated to impact the appendicular joints of roughly 61% of cats older than six years. The hallmark of osteoarthritis (OA) is the deterioration of cartilage in the appendicular skeleton, which is accompanied by joint inflammation and changes in the subchondral bone, which is the bone that lies just beneath the cartilage's surface. It is thought that inflammatory diseases, mechanical overload, inadequate bone response, and good bone response are the four components that cause osteoarthritis (OA)[4].

Millets are regarded as one of the original grains, having been domesticated thousands of years ago at the start of human civilization. Currently ranked as the sixth most important cereal in the world, millets offer a significant number of minerals and multigrain and gluten-free cereal goods' health advantages. One of the most significant members of the millet family, finger millet (Eleusine coracana L.), is grown extensively in Asia and Africa and is a staple food for many people living in poor nations[5].Finger millet has a high nutritious content and can have its nutritional value enhanced by processing. Finger millet contains enough of the important elements, such as minerals, dietary fibre, vital amino acids, and carbs. Whole finger millet seeds have 0.34 percent calcium content, compared to other main grains' 0.01 to 0.06 percent calcium content. The grains' known anti-ulcerative qualities and their hypoglycaemic and hypocholesterolemic effects are some of its health benefits[6].

An antioxidant's primary feature is its capacity to sequester free radicals. Biological systems contain highly reactive free radicals and oxygen species from a range of sources. These free radicals have the ability to damage DNA, proteins, lipids, nucleic acids, and can also start degenerative illnesses. Phenolic acids, polyphenols, and flavonoids are examples of antioxidant chemicals that scavenge free radicals such peroxide and hydro peroxide, thereby inhibiting the oxidative processes that cause degenerative illnesses. Antioxidants may lower the risk of chronic illnesses including cancer and heart disease, according to scientific research.Eleusine coracana L., sometimes known as finger millet, is a highly nutritious millet that holds great potential as a nutrient-dense food source. Among India's tiny millets, it is the most cultivated, and it needs to be made more widely known by locating additional nutritional qualities including antioxidant capacity[7].

Millet is known for its many possible health benefits, which include improving wound healing, preventing cardiovascular disease, and lowering blood glucose and cholesterol levels, in addition to its nutritional worth. According to a prior study, oxidative stress may be the root cause of a number of chronic illnesses, such as diabetes, cancer, neurological diseases, arthritis, and cardiovascular disease. It is believed that antioxidants have a significant role in lowering oxidative damage[8].

1. FINGER MILLET:-

Finger millet is also known as Ragi, Nachani, and Eleusine coracana L.One of the oldest millets in India (2300 BC) is finger millet, also known as ragi. This review focuses on the history, applications, nutritional makeup, processing, and health advantages of this ancient grain. Finger millet has the greatest percentage of calcium (344 mg %) and potassium (408 mg %) of any cereal or millet. In comparison to white rice, which is currently India's main staple grain, it has more nutritional fibre, minerals, and amino acids that contain sulphur. Despite the rich nutritious profile of finger millet, new research shows that urban Indians consume fewer millets overall[9].

It has been demonstrated that supplementing diets with foods high in phenolic acids confers ant mutagenic, antiglycemic, and ant oxidative qualities. This can be utilized in the creation of health foods. About 5-8% protein, 1-2%

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ether extractives, 65-75% carbs, 15-20% dietary fibre, and 2.5–3.5% minerals are present in finger millet.Out of all the cereals, it has the highest calcium concentration (344 mg/100 g). Phytates (0.48%), polyphenols, tannins (0.61%), trypsin inhibitory factors, and dietary fibre are also present in millet; these substances were formerly referred to be "anti-nutrients" because of their ability to chelate metals and block enzymes, but they are now known as nutraceuticals. In addition to being an edible part of the kernel, the millet seed coat provides a rich source of phytochemicals such dietary fibre and polyphenols (0.2–3.0%). It is now known that the antioxidant activity of millet foods, which is crucial for good health, aging, and metabolic disorders, can be influenced by Phytates, polyphenols, and tannins[10].

Table No. 1. Taxonomical classification of finger millet.

1.	Kingdom	Plantae
2.	Subkingdom	Trachcobionta
3.	Super division	Spermatophyte
4.	Division	Magnoliophyta
5.	Class	Liliopsida
6.	Subclass	Commelinidae
7.	Order	Poales
8.	Family	Poaceae
9.	Subfamily	Chloridoideae
10.	Genus	Corcana
11.	Species	Eleusine[11]
12.	Origin	India & Africa
13.	Common name	Ragi, Nachani, Mandua, Mangal, Taidalu

Table No. 2. Nutritional composition of finger millet.

1.	Protein	7.6g
2.	Fat	1.5g
3.	Carbohydrates	88g
4.	Calcium	370mg
5.	Vitamin (A)	0.48mg
6.	Thiamine (B1)	0.33mg
7.	Riboflavin (B2)	0.11mg
8.	Niacin (B3)	1.2mg
9.	Fibre	3g

1.1) Morphology of Finger Millet:-

Eleusine coracana (L.), sometimes known as finger millet, is a cereal grass that is primarily farmed for its grain, which is a staple diet in many South Asian and African nations (see the Finger millet, grain datasheet for details on the grain's feed applications). Up to 170 cm tall, finger millet is a sturdy, tufted, tillering annual grass with upright, thin stems that root at the lower nodes. The fibrous, robust shallow root system is challenging to remove. Typically, leaves and stems measure up to 75 cm in length and 2 cm in width. The term "finger millet" comes from the panicle-shaped inflorescence, which has four to nineteen finger-like spikes and matures to resemble a fist. Up to 70 alternating spikelets bearing four to seven tiny seeds are carried by the spikes[12].

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Figure 1. Finger Millet

1.2) Therapeutic uses of finger millet:-

There are many therapeutic uses of finger millet. It is more beneficial for human beings. The therapeutic effects includes :-

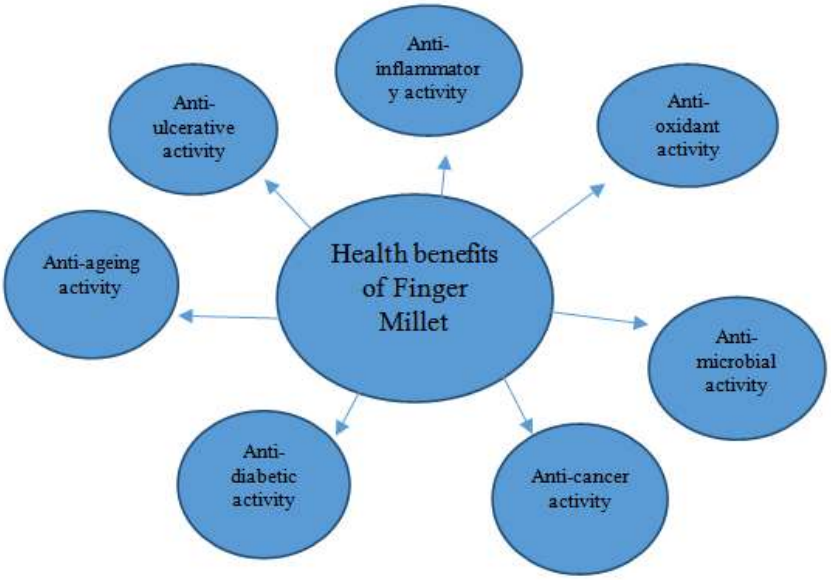

Figure no. 2. Health benefits of finger millet.

1. Antioxidant Activity:-

Plant-based antioxidants, like flavonoids and phenolics, have a wide range of biological effects. Antioxidants are important in lowering lipid peroxidation, which is a process linked to aging and cancer.Antioxidants offer persistent radical intermediates that shield fatty acids and oils from oxidative degradation. The millet seed coat contains polyphenols such as tannins, flavonoids, and phenolic acids, which function as reducing agents by quenching free radicals, chelating metals, and quenching singlet oxygen. Polyphenols have strong antioxidant properties because they can donate hydrogen atoms to electron-deficient free radicals through the hydroxyl groups on phenol rings[13].The antioxidant capacity of phenolics and other bioactive substances that were separated from millet grains and their fractions has been the subject of numerous investigations. Three antioxidative phenolic chemicals, two flavonoids, and one serotonin derivative were found in an ethanol extract of barnyard millet grains. Furthermore, 1,1,diphenyl-2-picrylhydrazyl (DPPH) was suppressed by 70% in kodo millet flour methanol extracts as opposed to 15% to 53% in other millet extracts. Furthermore, compared to their colored counterparts, the white types of finger millet, foxtail millet, and sorghum shown less quenching, suggesting that phenolics in the seed coat may be the source of the antioxidant activity. Furthermore, finger millet extracts were found to have much greater radical-scavenging activity than extracts from wheat, rice, and other millet species[19].

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2. Antiaging Activity:-

A wide range of structural scaffolds found in natural chemicals can provide promising candidate chemical entities with antiaging potential. It is strongly stressed in several published works of literature that consuming millet could help prevent aging and age-related problems. However, the precise mode of action remains unknown. Based on these findings, however, it is possible that stress-responsive pathways, protein glycation, genetic repair, and aging-related disorders can all be significantly suppressed by phytochemicals derived from millets. As numerous aging theories explain below, the impact of millets on all these pathways can be related to their antioxidant properties and potential anti-aging effects[13].

3. Anti-diabetic Activity:-

Finger millet's antidiabetic qualities are mostly linked to its high dietary fiber and phenolic component content. In order to effectively manage diabetes mellitus, the postprandial blood glucose level must be regulated. Dietary fibers can aid in reducing this rise in blood glucose levels after meals. Furthermore, compared to other cereals, the carbohydrates in finger millet are more slowly absorbed and digested, which helps to control the postprandial blood glucose level. Because dietary magnesium and calcium have been shown to lower the risk of type II diabetes mellitus, the presence of these minerals in finger millet may also contribute to its antidiabetic properties. Separate studies conducted on rat models have demonstrated the effect of a finger millet-based diet on delaying the onset of cataractogenesis and speeding up dermal wound healing, indicating that finger millet can prevent cataracts and impaired wounding—two conditions that are associated with diabetes—and also that finger millet-based food products have lower glycemic indexes and lower glycemic responses[14].

4. Anticancer Activity:-

One significant element found in plant cell walls is dietary fiber. Cell wall polysaccharides, or dietary fibers, are important components of the human stomach that aid in digestion and promote gut health. There are two types of dietary fiber made from millet:soluble dietary fiber (SDF) and crude fiber, often known as insoluble dietary fiber (IDF). IDF is insoluble in water and contains cellulose, hemicellulose, and lignin, while SDF is soluble in water and consists of pectins, glucans, and some hemicellulose. SDF is more nutritious than IDF, absorbs more water, develops a gel-like structure, reduces the level of cholesterol (fatty substances stuck in the GI tract), ferments the gut flora in the large intestine, controls the immune system, and has anti-tumor capabilities[15].

5. Anti-Inflammatory Activity:-

The many types of finger millets and their ability to reduce inflammation. Our immune system uses inflammation as a defense strategy. Finger millet has several enzyme inhibitory activities, including XO and A5-LOX enzyme inhibitory activities, which are responsible for the plant's anti-inflammatory properties activities, oxidative burst inhibitory activity, and inhibitory effects of the hyaluronidase enzyme[17].Out of all the extracts, the Oshadha methanolic extract showed the strongest inhibitory activity against A5-LOX (IC50 value: 484.42 µg/ml) and XO (IC50 value: 764.34 µg/ml). At a dosage of 1 mg/ml, all extracts exhibited less than 50% hyaluronidase inhibitory efficacy.

When compared to ibuprofen (IC50 value: 11.18 µg/ml), methanolic extracts demonstrated a moderate level of inhibitory capability on reactive oxygen species (ROS) produced from whole blood phagocytes, with IC50 values ranging between 26.9 and 27.7 µg/ml. When compared to ibuprofen (IC50 value: 2.47 µg/ml), all extracts shown a strong reduction of ROS generated from polymorphonuclear neutrophils isolated from human blood. The IC50 values of the methanolic and ethanolic extracts ranged from 1.35 to 1.70 µg/ml and 0.29 to 0.47 µg/ml, respectively. The concentrations of phenolic components in all extracts were notably high, and they included flavonoids and the ability to scavenge oxygen radicals, 2,2-diphenyl-1-picryl-hydrazyl (DPPH), and 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic) acid (ABTS) cation[18].

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2. Osteoarthritis:-

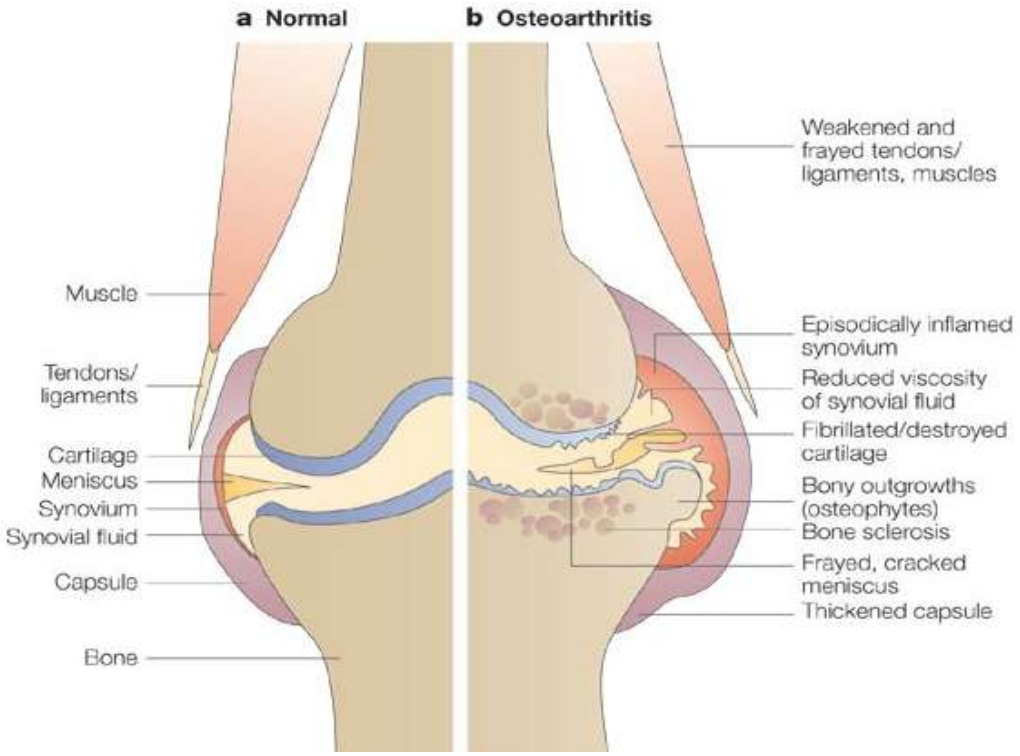

Figure no.3. (a) Normal condition of knee joint, (b) Osteoarthritis condition of knee joint

Osteoarthritis (OA) affects the articular cartilage, subchondral bone, ligaments, capsule, and synovium. It is a degenerative disease that progresses over time and affects the entire joint. OA was once thought to be a mechanical illness caused by wear and tear that degenerates cartilage; however, it is now known that the cross-talk between different joint structures and local inflammation is a key component of the pathophysiology that underlies it. The categorization of OA patients into distinct phenotypes is gaining traction. A form of osteoarthritis known as post-traumatic OA (PTOA) develops as a result of traumatic joint insults including fractures or damage to soft tissues like menisci, ligaments, tendons, and chondral surfaces, or even joint surgery. Roughly 12 percent of instances of OA with symptoms are PTOA[20]. The prevalence of musculoskeletal disorders at the beginning of the In the World Health Organization's (WHO) report on the worldwide burden of illness for the new millennium, OA is placed fourth in the Western world's health impact on women and seventh in that of males. It is believed that 70–80% of adults over 55 suffer from OA. Between 1.3 and 1.75 million persons in England and Wales suffer from OA symptoms. Severe knee OA affects more than 500,000 persons in the UK, and in 2000, 80 000 hip or knee replacements costing £405 million were done there[21]. It has been repeatedly demonstrated that women over fifty are far more likely than males to have OA. The menopausal transition often begins in women over the age of fifty. This has been demonstrated to be because estrogens have been proved to protect against a wide range of illnesses, including those affecting the bones, such as osteoarthritis. This is mostly because mineral storage is critical before to menopause. This is mostly because women require the minerals far more before menopause than they do after menopause.For a variety of reasons, women before menopause need these minerals; however, the primary cause of their greater need for minerals stored in their bones than other women is the fonnation of the fetal skeleton during pregnancy and the nursing of a newborn. Because most women who are older than fifty have reached menopause and have run out of eggs, they no longer require the same amount of mineral storage. As a result, their estrogen levels decline, which lowers their bone density[4].

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2.1) TREATMENT OF OSTEOARTHRITIS: -

There is no official treatment is available for the management of osteoarthritis. But healthy life style and proper diet is the best way to treat osteoarthritis. If we add some highly calcium containing food for the fulfillment of calcium in the human body. Self-care and exercise are also the good way for treatment of osteoarthritis. Transplantation of knee and other bones are the best way of the management of osteoarthritis. Some treatments are: -

1. Medications: -

Medications that can relieve the primarily pain which is caused by osteoarthritis, include: - 1. Acetaminophen 2. Nonsteroidal anti-inflammatory drugs 3. Cymbalta

2. Therapy: -

Therapies can effective in osteoarthritis, include: - 1. Physical therapy 2. Occupational therapy 3. Transcutaneous electrical nerve stimulation

3. Surgical and other procedures: -

1. Cortisone injections 2. Lubrication injections 3. Realigning bones 4. Joint replacement[22].

II. CONCLUSION:-

Finger millet shows many therapeutic activities like anti-inflammatory, antioxidant, antifungal, antiviral, antidiabetic etc. Finger millet contain polyphenols, phenolic, flavonoids and other contents which is very useful for human beings. Finger millet shows the activity against the osteoarthritis and shows very helpful effect against other diseases and disorders. Finger millet contain the calcium content which is beneficial for the human beings.Antioxidant property of finger millet is useful for osteoarthritis or degenerative disease.

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