Dietary Strategies for Osteoarthritis: An In-depth Look at the Sesame Seed Connection

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ABSTRACT

Sesame seeds are recognized for their high amount of oil content; they are commonly used in Asia and West, for both culinary and therapeutics. This article mainly focuses on the phytochemical composition, cultivation, and conventional uses of sesame seeds, along with their role in managing osteoarthritis. They are obtained from unhulled seeds; its cultivation is done in enriched soil during April, May, September, and October. It is harvested when its seed capsule changes color to yellowish brown, followed by sun-drying and baking to collect maximum seeds. Sesame seeds are loaded with flavonoids, thus possess many medicinal properties including anti-inflammatory, cardiovascular and wound healing properties. Presence of phenolic compounds contributes to the reduction of cholesterol and improves cardiovascular health. These seeds also hold flavonoids, tannins, phytates, phylates, tocopherol, phytosterols and unsaturated fats, each contributing to the nutritional and therapeutic values of seeds. According to the research studies, these seeds are associated with potential health benefits specifically their role in cure of osteoarthritis. It is also suggested to contain anti-inflammatory and antioxidant properties, consequently, reducing oxidative stress in osteoarthritis and improving lipid profile. Lignans found in sesame seeds are also related to reducing cholesterol levels and improving hormones in postmenopausal conditions and providing protection against breast cancer. Many years back it was also used to treat skin infections, also used as a key ingredient in mouth washes. Additionally, it was also used to treat CNS-related ailments such as insomnia, dizziness, and headache. Dose recommendation is 9 gram. However it should be cautiously used in pregnancy and breastfeeding, diabetes and post surgery. Osteoarthritis is a widespread musculoskeletal disease, affecting joints, mainly knees most common symptoms are joint pain, stiffness, swelling and difficulty in mobility. The disease progression is multifactorial, including imbalancement between antioxidants in body resulting in high oxidative stress. It is also very progressive disease influenced by genetic and environmental factors. Pathological findings show abnormal bone structure, narrow joint spaces and cyst. Risk factors include age, injury, diet and obesity. Treatment plan include analgesics, steroids and surgery in required cases, along with weight management, exercise and physical therapy. Sesame seeds have potency to cure and prevent osteoarthritis; further studies are suggested to validate this claim.

Keywords: sesame seeds, osteoarthritis, bacteriostatic, CVS diseases.

INTRODUCTION

Sesame seed has 50-60% oil as it is considered as king of oil seeds Asia is a largest consumer and also countries of west , they use it as a tahini as part of paste.Sesame (Sesamum indicum) or ajonjolí, as it's known in Spanish, arrived in the New World tropics with early colonists, and many Latin American countries remain traditional producers of sesame seeds(1)Unfortunately, Costa Ricans aren't big consumers of sesame, so it's often hard to find fresh seeds for recipes that require sesame or for planting. Look in local health food stores for sesame seeds Only fresh, unhulled seeds are used for planting. The highest amounts of flavonoids possess by seeds(2).

Sesame Seeds

Common Name:

Sesame, benne, beni

Species:

Sesamum indicum L.

Family:

Pedaliaceae

Synonym:

Sesamum mulayanum N. C. Nair, *Sesamum orientale* L.

Parts Useds:

- Seeds
- Roots

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- leaves[3].

Planting Method:

For planting or for recipes it is difficult to find fresh seeds. For planting unshelled, seeds are used. It has green leaves, strong and length up to 6 feet. Sesame seeds are produced with in capsules of pastel lavender flowers arising from panicles.april and may are the months for its planting and September or October is also consider for its planting. 5 gallons of sesame seeds can produce on 100 sq.meter area. The seeds require 90-120 days to get mature, the fertilizer must be used to enrich the soil, and then in rows seeds are sow At the first month it require the proper care to keep it weed free. They can also plant in flat where they attain 5-6centimeter in height then can be transferred into specific area of planting. The leaves, stems and seeds capsule turn yellow brown while dropped out by plants, then harvesting of plant is started and after drying under sun, the capsules bakes up, open and seeds comes out by using stick. Threshing out is also carried out to release the maximums seeds out[4].

Uses:

Osteoarthritis:

Sesame oil has anti inflammatory and antioxidant property that is has useful impact in treating atherosclerosis[5]. In patient with osteoarthritis sesame seeds are seen to decrease oxidative stress and it improve lipid profile,lipid profile,LDL cholesterol,MDA and total cholesterol in patient suffer from knee osteoarthritis[6]. In people with knee osteoarthritis after eating 40 grams of powder of sesame seeds for 2 months, observed relative low inflammatory chemicals in blood.It reduces muscle damage and oxidative stress and enhance aerobic capacity by using 40 grams of powder of sesame seeds by athelets[7].

Cardiovascular Disease:

Ligans are present in sesame seeds, named sesamin. One of important dietry soruce of lignin. Lignin is converted into enterolactone by gut bacteria which work as estrogen, heart diseases and breast cancer are associated with low levels of lignin[8].

Cholestrol Level:

It helps to reduce blood cholesterol and also improvise sex hormone status in women after menopause, should take 5 grams of power of sesame seeds for 5 weeks(9).

Wound Healing:

It has important and pre dominant role in india and china medicinal system. It is helpful in healing process when applied on sun burn and minor healing when applied to the part of skin, where needed. It has emollient properties which causes sesame oil excellent massage oil[10].The chronic diseases of skin is also cured by applying it to the site of skin. It has courage against skin pathogens e.g. streptococcus and staphylococcus and also against common fungi of skin[11].

Bacteriostatic:

It use as a mouthwash because of excellent anti bacterial properties also in treatment of insomnia, blurred vision, dizziness, headache and anxiety[12].

Physicochemical properties of seed oil:

- **Acid value** 2.48mg KOH/g
- **Iodine value** 1.27g T2/100 g
- **Saponification number** 1.87mgKOH/g
- **Colour dark brown**
- **Odour strongly aromatic**

It contains:

- Flavonoids
- Tannis
- Phenol
- Phylate

CHEMICAL COMPOSITON OF SESAME SEEDS(13):

Chemical Constituents:	Composition:
Moisture	6-7%
Minerals	20-28%
Sugars	14-16%
Oil	48-55%
Fiber Content	6-8%
Proteins	20-28%

One ounce (28 grams) of sesame seeds contains

- **Calories:** 160
- **Copper:** 57% of the RDI
- **Manganese:** 34% of the RDI
- **Fiber:** 3.3 grams
- **Protein:** 5 grams

- **Omega-6 fats:** 6 grams
- **Monounsaturated fat:** 5.3 grams
- **Magnesium:** 25% of the RDI[14].

Unsaturated Fats:

- linoleic acid (46.9%)
- oleic acid (37.4
- palmitic acid (9.1%).

Tocopherpols:

- tocopherols (γ-tocopherol) (90.5%).
- phytosterol (β-sitosterol) 59.9%

protein (22%)

lipids (52%)[15]**.**

Tocopherols:

Radical-chain breaking antioxidant is the important function α-tochopherol in membranes and lipoproteins, in foods as well. The risk of cardiovascular disease and chances of other cancers, is due to its antioxidants property, and at molecular level its various function are responsible for its main function.It has higher hypocolestrolemic property, anti tumor and anti oxidant potential[16].

Phytosterols:

It reduces the cholesterol level in body; also it decreases the risk of certain cancers and improve immune response by decreasing cholesterol level, because its bio active component has similar structure to cholesterol[17].

Phylates:(18)

It has strong chelating activity by complexation with proteins with minerals because of presence of 6 reactive groups thus attributes to anti nutritional activity[19].

Traditional Use:

It is consider as immortality symbol in Hindi culture, in case of death of any individual it is use in performing different rituals.it is use in Middle Eastern as a ingredient in cooking called butter of middle east tahini. It has been use as animal feed, as part of seed cake which is full of nutrition,. Sesame oil is use in southern india cuisine[20].

It nourishes the internal viscera along with lubricating the intestines.the black sesame also use blacken the hair, also it is effective in lactation and constipation. Intestinal worms are also treated by sesame oil.sesame seeds also has beneficial effects on body like stomach,spleen,kidney and liver[21].

TR Phytochemical constituents (%) of various parts of Sesamum indicum.

Plant parts Flavonoid Alkaloid Tannin Phenol Phytate

Leaves 13.90 ± 9.27 b 10.04 ± 6.70 a 1.81 ± 1.21 c 0.013 ± 0.01 a 0.52 ± 0.35 b

Seeds 16.12 ± 10.7 a 6.28 ± 4.19 c 2.04 ± 1.37 b 0.013 ± 0.66 a 0.18 ± 0.12 c

Roots 4.98 ± 3.32 d 1.96 ± 1.31 d 2.03 ± 1.36 b 0.016 ± 1.04 a 0.43 ± 0.29 b

Whole plant 9.36 ± 6.24 c 7.72 ± 5.14 b 3.318 ± 2.21 a 0.016 ± 0.01 a 0.79 ± 0.53 a

Test values carrying different letters within a column are significantly different (P> 0.05) using the

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Dose:

4 tablespoon is found to be clinical dose as one table spoon of sesame seed is maximum 9 grams. The dose is vary in person to person depends on age,weight,gender of the person[22].

Precautions:

During Pregnancy And Breast Feeding:

When taken by mouth it is commonliy safe use in food. The research is not complete on whether it is safe to use in breast feeding and pregnancy so should not use it on safe side.

Diabetes:

Blood sugar levels may effecyed by sesame. In theory, diabetic patient should use it with as it may effects blood sugar levels.

Child:

when taken by mouth it is safe and effective sesame oil has been use easily and in effective way at a dose of 5 ml at bed time for 3 days.

Effects On Surgery:

Sesame may effects the levels of blood sugar pre and post surgery so patient should stop using before 2 weeks of surgery.

Blood Pressure:

In theory, it may low blood pressure .It may cause lower the blood pressure especially in people with already low blood pressure[23].

Osteoarthritis:

Introduction:

A musculoskeletal disease which is the most commonly found, named osteoarthritis.the disorder cause joint pain, limited joint motion and disability by causing harmful effects on articular cartilage(24). In osteoarthritis the effects on knee joint is the most common. The development of osteoarthritis is due to different mechanism as it is multi factorial process. Progression of osteoarthrithritis is due to imbalances between antioxidants and pro oxidants results cellular oxidative stress.production of super oxide anions increases and anti oxidants bioavailability reduces causes reactive oxygen species causes oxidative damage(25).

Synovial inflammation, peri articular muscles weakness, laxity of ligamentous, formation of osteophyte and remodeling of subarticular bone also causes with loss and damage to articular cartilage. pain and disability with joint failure results when disease progresses. The disease is defined as clinical as well radiological.Osteophytes appearance, joint space loss, cysts and sclerosis with related to severity grades of disease are defined as 0 -4. Foe visualizing detail structure of joint, world health organization has adopted the method of cross sectional imaging metod like MRI. The assesement of patient require for confirmation of presence of disease, subjective osteoarthritis. Radiographic changes are not seen in people with early osteoarthritis(26)

Clinical Features:

Stiffness at Early morning is felt for 30 minutes or less. Patients of age over to 50 have complains of stiffed joints and pain, rest for some time shows relieve. Effusion results by synovial accumulation of fluid and osteophyte formation causes swelling . Presence of crepitus on movement and joint tenderness.

The common clinical features includes:

- Swelling in bones
- Reduced motion of joints
- After rest or in morning stiffness while moving joints
- Crepitus in joints
- Pain in joints(27)

Pathogenisis:

It is seems to be disease that is degenerative, inevitably progressive. A variety of genetic,biochemical stress and environmental factors are responsible for synovial joints adaption to certain responses characterized the disease as heterogenic disease.the disease progress episodes wise, in a dynamic process.(28, 29)

Chondrocytes produces proteoglycans and glycosaminoglycans with collagen framework of type 2 an 70% of water are combined to form cartilage(30). The macromolecule. Stabilizes by proteoglycans, when binds with hyaluronate.joint movement causes synovial fluid to circulate and by diffusion the chondrocytes receive nutrition from synovium. chondrocytes may go in shock an cartilage repair may also ceases, if the movement of joints will stops and nutrition of chondrocytes will lose.

Proteoglycan degradation and collagen catalysation take place by metalloproteinases. levels of interleukin-1 (IL-1) and tumour necrosis factor-alpha (TNF-α), cytokines increase cause the inflamed synovium in osteoarthritis produces it in large amounts, the nitric oxide and metalloproteinase production is also induce by cytokines. Th destruction is even more because of binding of IL-1 and TNF-α with cartilage catabolic cytokine receptor also induces because of interleukin-6 and mechanical loading of joints(31).

It is also found that changes in bones is occur while changes of cartilages in animal model. Causes subchondral sclerosis and osteophyte are also seen while body trying to cover the lack of cartilage. Destruction of

cartilage is further more cause of abnormal bone. Insulin formed in dysfunctional way such as growth factor-1 and beta causes building blocks of cartilges in poor synthesis or formation of new cartilage is also suffered(32).

Pathological Findings:

At the edge of joint abnormal and irregular bone formation and joint space becomes narrower, and also surrounding of joint , bones cystic degeneration results by the process of osteoarthritis.bony cysts along with holes formation at cartilage microarchitecture and surface of articular cartilage is also fibrilled and flaked(33).

The periosteum continued by synovium, formation of callous and new bone along in some area sclerosis is cause by alteration vascularity and cellularity of bone of subchondral.

The three zones is present in cartilage, collagen arranged on the surface parallel to it with the surface layer of synovium, a thicker middle zone, where molecules of collagen are arranged in wide spaces , and then finally with the bones an inner zone is present, where arrangement of collagen with perpendicular to the surface(34).

Classification Of Osteoarthritis:

Knee osteoarthritis: many years may taken for progression of disease. When established, while for many years joint joint may retain in stable condition.

- In study of 63 patient spector et al found, in one third radiographic deterioration occur.
- For eight years , 31 patients with knee osteoarthritis are followed up for another study. Shows seven patients remained same while twenty patients get worse. Radiograph,symptoms and disability does not correlate(35).

Hip osteoarthritis:variable natural history is found

- Two third of hips are studied in a Danish study, which radiographically deteriorated in 10 years or more,with common symptomatic improvement.
- More common clinical deterioration is seems in other studies.
- Symptomatic and radiological recovery in hips in possible as compared to knee osteoarthritis. Major problem is that avascular necrosis is late of femoral head in disease.(36)

Hand osteoarthritis:a disease is remitting and relapsing with episodes of inflammation along with swelling and redness of joint.the joint swellings is hard and fixed when the frequency flares and reduces of disease, this cause pain to reduce(37).

Risk Factor:

Age:

With the process of ageing laxity around joints increases, causes decrease proprioception of joint, calcification of cartilage, and also function of chondrocyte is also decreases, results progression of osteoarthritis. studies found that in between age of 63 to 70, 27% of the people have knee osteoarthritis proven by radiographic evidences, the percentages increases to 44% when the age cross to 80. According to other researchers above 65 age 80% people has osteoarthritis on bases of proven by radiographic evidence, but around men and women of 80 years of age has declined the incident of osteoarthritis with symptoms.

Elderly patient has reduced rate of proprioception in osteoarthritis who have knee osteoarthritis.

Trauma:

Risk of osteoarthritis increases with meniscal tears, cruciate and collateral ligament. Studies shown that chances of osteoarthritis development upto 5-6 folds in a men with history of knee injury. Unemployment and disability may prolonged, if the injury occurs in younger age group. Tibiofemoral osteoarthritis development chances increases, when meniscectomy take place after knee injury.

Occupation:

The people who are are performing more physical work have increase chances of developing osteoarthritis especially those with kneeling, squatting or knee bending. The people with sedentary jobs have low prevalence of knee osteoarthritis than in miners and dockers.

A relationship is pronounced in between those who repeatedly using joints and knee osteoarthritis(38).

Exercise:

Chances of development of knee osteoarthritis in elite athelets have pronounced or increase.property of muscle to absorb shock and stability of joint is decreasing with development of primary quadriceps weakness.

Gender

Men under the age of 50 have high prevalence than women.while women of age over 50 have prevelance than men.after the age of 80 the difference is marked less, may be trigger by pestrogen withdrawal after menopause.

Ethnicity:

In Europe osteoarthritis is more common than in asia.

- 7%-25% of Europeans suffered from hip osteoarthritis than in china,Liberia,Nigerians.
- Women in Europe has more commonly suffered from osteoarthritis than women in afro-caribbean descent.
- A conflicts is present on whether replacement therapy of oestrogen based hormone protects against the large joint osteoarthritis(39).

Genetics:

Gene susceptibility of disease is seems, as concordance is increases for osteoarthritis in twins who are monozygotic as compared to dizygotic twins

Osteoarthritis has been linked to many genes. Chromosomes that is more concordance are 2q, 4 and 16.inherited osteoarthritis is seems in families with rare autosomal patterns in dominant form. The collagen proteins and extracellular matrix of joint of structural proteins are often coded of defective gene. parents with early onset osteoarthritis has chances of developing it in their childrens as compared to those families where no case is found(40)

Obesity:

It is one of the most considerable risk factor.during walking three to six times body weight is transferred to the joints.when an overweight person is walked the wait is multiplied and it this the more force is exerted to the knee joint. The radiograph knee osteoarthritis development odd ratio is increases to 1.36 with increases of every two units of body weight(4).

In women with established one knee osteoarthritis has increased risk of development of contralateral osteoarthritis of knee. Chances of development of osteoarthritis is increases in the patient being overweight at age of 36-37.a women loses 5 kg of weight may reduce the risk of symptomatic knee osteoarthritis of height of average 50%. An overweight people with localized disease have increase risk of developing progressive osteoarthritis(41).

Diet:

Progression of knee osteoarthritis has increases to three fold risk in people tertile less vitamin C and vitamin D blood levels. Vitamin C may delay the onset of osteoarthritis so the properties of vitamin C promoting by antioxidant and collagen is may be beneficial.as vitamin D intake has not effected the development of osteoarthritis by it low levels may progress the disease.

Any benefit of vitamin E has not been shown.(42)

BONE DENSITY:

The osteoarthritis and bone density has inverse relation with each other. Weight bearing cartilage of joint may loaded more when density of subchondral bone is increases.(43)

Symptoms:

Sign and synptoms to diagnose osteoarthritis and then radiograohy is carried out to confirm the diagnosis.

Diagnosis is been made possible on main clinical feature includes:

- Joint Pain
- Stiffness
- Swelling
- Crepitus
- Movement of joints

Joint pain is typically present in osteoarthritis. Knee pain is persistent in approximately quater of people age over 50 for period of one year, among them only one out six conults to the doctor about the condition. Radiographic knee osteoarthritis is present in half of them, while of them have disease that is undetectable like iliotibial band syndrome, on plain radiography.

Some rest commonly relieve the joint pain of osteoarthritis and any activity may exacerbate it. In some condition when disease is getting more advance it may be increase pain at night time. biopsychosocial frame work is best frame, otherwise source of pain is not understood well. cartilage loss, as it is aneural does not cause any contribution in direct pain. In osteoarthritis, synovium, periosteum, joint capsule and subchondral bone can be the nociceptive stimuli source and are richly innervated(44).

Diagnosis:

Using plain radiographs, the following changes may seen:

- Osteophytes.
- Subchondral sclerosis.
- Joint space narrowing.
- Bony cysts.

Other Diagnostic Tests:

X-Rays:

Cartilage breakdown is suggested by narrow space among joints.also it may show the spurs, if present in or around a joint

MRI scan:

The cause of pain is determined by MRI scan.(45)

Analysis Of Joint Fluid:

It is also called arthrocentesis, in lab observation of fluid , which is withdraw form a joint that is inflamed, withdrawal take place by using sterile needle. presence of crystals uric acid indicated the gout. The presence of inflammation or infection is also determined by this test(46).

Blood Test:

It is also helpful in detecting the other problems(47)

Effects Of Osteoarthritis:

Osteoarthritis can occur in any joint but neck,lower back,hands, hips and knees are affected most commonly.

Knees:

If osteoarthritis is not due to any injury or other condition then both knees are effected normally.synpomatically it is characterized by pain while walking.

during movement the grating soft sound make by knees. straighting the leg become difficult as position of knees lock down.

Hips:

problems faced while moving hip joints. hip pain is very common is osteoarthritis patient also experience pain in ankles , buttock and thighs. pain is felt while resting as well as while in walking.

Hands:

Osteoarthritis may effect

- fingers joint especially near the nails
- the thumb base
- finger middle joint
- on finger joints development of bump may occur also may be stiffness and swelling of the fingers occur. in some condition bumps remain on fingers while pain reduces.

On the back of fingers cysts or lumps full of fluid may also develop on the back side of finger and finger also bended slightly on the side of joints which is affected.at the base of wrist where thumb joining it a development of bump also causes difficulty in moving thumb such as writing.

The person should consult a doctor if pain persistent to over two weeks. person should also consult a doctor if nausea, constipation, drowsiness black stools and abdominal discomfort is experienced while taking medicines of osteoarthritis(48).

Treatment:

Pharmacological Approach:

Analgesics:

- In mild to moderate pain paracetamol at a dose of 4g PO/day is indicated.
- NSAIDs are prescribed as a first choice because it has better efficacy and also patient prefere it
- Selective COX2 selective inhibitor and a gastro protective agent nonselective NSAIDs plus should also be used, especially in patient with gastrointestinal risk is increases.
- In patients who are contraindicated by NSAIDs may be use opioid analgesic as an alternatives.
- A great deal of attention is also attracted by glucosamine compound for osteoarthritis(49).

Intra -Articular Steroids:

For pain and function,intra articular corticosteroids are of short term benefit especially when joint effusion, inflammatory arthritis is present with pain and inflammation at local site(50).

Intra -Articular Hyaluronan:

The size of effect is not so high with significance response of placebo, the intra-articular hyaluronan, efficacy is review by meta analysis shows it is not in complete agreement because of study method variation(51).

Surgery:

If other treatments are available, the surgery should be resisted.if major functions are limited and pain is debilitated then surgery is indicated(52)

Non -Pharmacological Treatment:

Education:

People must educate to copying skills by participating in the programmes of self management and also resources should supply to support them socially.

Weight Loss:

By taking proper diet and exercise to loss weight, specially those patient who has osteoarthritis due to obesity.

Exercise:

Improvement in function and reductions in pain may be possible is quadriceps are strengthen by exercise. patient should encourage to take part in aerobic exercise so that their muscle gets strengthen up, also aerobic capacity would increases and loss of weight also facilitate.

Orthotics and Knee Braces:

Pain relieve and functions are also improved by orthotics and valgus bracing which causes the load shifting from compartment of medical and are also very helpful for those with varus misalignment and instability of knee, also some studies proved that medical compartments loads is decreases by heel wedges, whether there use, alone would relief the symptoms are not evidence based.

People with knee and hip osteoarthritis should wear the supportive foot wear.

Physical Therapy:

Mobilization of soft tissues, muscle strengthening and muscle stretching exercise should practice for the improvement of functional deficits and also helpful in resolution of symptoms of osteoarthritis(53).

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