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Heart Healthy Nuts

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ABSTRACT

Nuts not only tastes great but are very healthy as they are the excellent plant source of nutrients like proteins, minerals, fats particularly of good type like mono and poly unsaturated fatty acids, several vitamins like vitamin B complex,vitamin E , minerals like magnesium, manganese, copper, selenium, zinc,and essential amino acids and fiber . Nuts are energy rich as 1 ounce of nuts provides approximately 150-200 calories of energy of which 80 -90 % comes from fats. This is the main reason why people shy away from eating nuts as they fear weight gain. The presence of above healthy nutrients and zero cholesterol makes it heart healthy. Several studies carried out over the years strongly suggested that substitution of the fat from one ounce of any type of nut for equivalent energy from carbohydrate in an diet is associated with reduction in the risk of coronary heart disease by 40%. Nuts also reduces blood cholesterol level particularly bad cholesterol (LDL) and increases level of good cholesterol (HDL), reduces inflammatory effects of free radicals on cells, prevents atherosclerosis and reduces risk of type II diabetes and certain cancers. Of the several tree nuts pistachio, almond, walnut will be discussed here for how and what makes them heart healthy.

Keywords: Nuts, cholesterol, atherosclerosis, coronary heart disease, diabetes type II.

INTRODUCTION

Most edible nuts and seeds come from plants, which are usually protected by a hard shell. The hard shells protects the main nutritional storehouse of natural edible oil, and are one of the richest sources of proteins, essential fatty acids, minerals and vitamins of a plant origin. Nuts come from different plant families. They are classified into two types: namely tree nuts (a one seeded fruit in a hard shell) and peanuts (belonging to leguminous family) [1]. Nuts are eaten preferably raw, unsalted and on empty stomach to ensure proper absorption of nutrients present in them. Nuts are rich in fatty acids of good types i.e. MUFA and PUFA and low in saturated fatty acids[2]. These good fatty acids are responsible for reducing blood cholesterol

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thereby preventing hardening of arteries and ultimately prevents heart attack and substitution of the fat from 1ounce of nuts for equivalent energy from carbohydrate in a diet is associated with decrease in CHD risk by 30% [3]. They are the richest source of high quality proteins (can be substituted for proteins from meat) in plant kingdom, and contain several vitamins and minerals, dietary fibers and are Gluten free[4]. They contain phytosterols which competes with cholesterol for intestinal absorption thereby decreasing blood cholesterol. Presence of antioxidant vitamin E and amino acid Arginine prevents development of plaques and improves health of artery wall by making it more flexible. Presence of dietary fiber improves peristaltic movements of GI tract, thereby decreasing residence time of food in colon thereby decreasing risk of colon cancer. Presence of selenium is also thought to be responsible for preventing certain cancers, presence of folic acid increases cognitive function, they have anti-inflammatory benefits useful in asthma, rheumatoid arthritis, eczema and psoriasis and reduces risk of diabetes type II, that's why Home economist Marilyn Smith, co-author of "Ultimate foods for ultimate health" calls Nuts a hero food and reminds us to eat them with the skin on as the skin is an important source of flavanoids[5]. Walnuts, Pistachio and Almonds several health benefits will be discussed in detail.

Walnut:

Walnut is known as king of nuts. It is a top choice amongst these three nuts[6] because it is the most energy dense nut and have high % of PUFA ,and is the only tree nut having significant amount of ω 3 fatty acid(α- linolenic acid)[7], have more and better antioxidants (20mmoles/100g) like Ellagic acid, Gallic acid which are 2-15 times more potent than the antioxidant γ-Tocoferol (vit E) , polyphenol, tannin like Tellimagrandin , flavonol like morin quinine like juglane (found in no commonly eaten food) which reduces risk of prostate and breast cancer and support immune system[8]. It have highest % of folate amongst these three nuts and minerals like copper, manganese and zinc.

Almond

Almond is a nutritious nut. It is an excellent source of vitamin E, B_2, niacin and minerals like calcium, phosphorus, iron, magnesium and zinc. Presence of fats of MUFA type makes it heart protective and being calcium, magnesium and phosphorus rich is responsible for maintaining bone density.It contains antioxidants like flavanoids and amaygdalin which help in fighting certain cancers. It is also a rich source of proteins and fiber[9].

Pistachio

Pistachios have low fats of MUFA type and are lowest calorie nuts, highest protein ,high non essential amino acid arginine, rich source of thiamine (vitB_1), vitamin A, potassium, iron,

magnesium and highest Phytosterols and β- carotene content among all three nuts[10]. It also contains oleanolic acid a compound with anti- inflammatory effects.

The nutritive values of the nuts are given in Table no: 1[11]

Table No. 1 Nutritive Value of 1 Oz of Nuts

	ALMOND	WALNUT	PISTA
Botanical name	*Prunus dulcis*	*Juglans regia*	*Pistachio vera*
Family	Rosaceae	Juglandaceae	Anacardiaceae
Nutritional value			
Energy(kcal)	160	190	160
Carbohydrates (g)	6	4	8
Protein (g)	6	4	6
Total fat(g)	14	18	13
Saturated	1	1.5	1.5
Monosaturated	9	2.5	7
Polyunsaturated	3.5	13	4
Ω-6,linoleic acid	3	11	4
Ω-3,α linolenic acid	0	2.6	0
Dietary fibre(g)	4	2	3
Vitamins(mg)			
Thiamine(vit B_1)	0.06	0.10	0.24
Riboflavin(vit B_2)	0.29	0.04	0.05
Niacin(vit B_3)	0.96	0.32	0.4
Pantothenic acid(vit B_5)	0.13	0.16	0.15
Pyridoxine(vit B_6)	0.04	0.15	0.36
Folate(vit B_9) µg	14	28	14
Ascorbic acid(vit C)	0	0.4	0.7
ϒ Tocopherol(vit E)	0. 18	5.91	6.36
Retinol(vit A) iu	1	6	74
Vitamin k (µg)	0	0.8	3.7
Electrolytes(mg)			
Sodium	0	1	3
Potassium	200	125	295

Minerals(mg)			
Calcium	75	28	31
Copper	0.23	0.45	0.38
Iron	1.05	0.82	1.19
Magnesium	76	45	34
Manganese	0.65	0.97	0.36
Phosphorus	137	98	137
Selenium(µg)	0.7	1.4	2.6
Zinc	0. 87	0.88	0.65
Phytonutrients			
Phytosterols(mg)	39	31	61
B-carotene (µg)	1	3	45
Leutien-zeaxanthine(µg)	0	3	342

Minimal amount of nuts need to provide statistically significant health benefits equal to 1 oz/day.

Table no 2 gives no of nuts in one ounce

Table No. 2: Number Of Nuts / 1 Oz Serving

NUT	NO. OF NUTS
Almond	24
Pistachio	49
Walnut halves	14

HEALTH BENEFITS OF NUTS:

Nuts have several important nutrients and good fats that our body needs; they provide variety of great health benefits if consumed regularly and sensibly. If ate in moderation and if substituted for saturated fats in diet they provide several benefits like:

Benefits on brain, nerves and eyes

- Walnut and Almond improves the memory and brain performance**.** Eating of almonds and walnuts induces high intellectual level because of presence of copper, iron, phosphorus, vitamin B and folate (increases serotonin in brain).

- Walnuts containsof 15 to 20 % protein, linoleic (omega-6 fatty acids) and alpha-linoleic acids (omega-3 fatty acids), vitamin E and vitamin B1,B3,B6, making them an excellent source of nourishment for the nervous system.
- Vitamin B1 improves use of glucose by brain and thereby increases mental energy, decreases fatigue and depression.
- The deficiency of omega-3 fatty acids leads to mood swings and depression and the presence of omega-3 fatty acids, iron and zinc in the nuts improves the cognitive as well as behavioral function.
- Walnut contains essential amino acids like tryptophan, glutamic acid, niacin and "feel good" neurotransmitter serotonin .Tryptophan is needed by the body to produce melatonin which induces sleep and boosts memory. Serotonin makes the person calm, relaxed and elevates the mood[12].
- Glutamic acid is responsible for improving mental capacities and enhances normal nerve functioning. It crosses BBB and gets converted into L-glutamine and improves cerebral function and is unique in that it can be converted into an energy source for neuronal cells when blood sugar is low and is also responsible for removing toxic ammonia from the brain. This nutrient is responsible for treating CNS disorders like – depression, fatigue, alcoholism, epilepsy, muscular dystrophy and schizophrenia[13].
- Almonds have amino acid phenylalanine which is good for bodies mental and neurological health, it crosses BBB and stimulates brain to produce mood boosting and painkiller neurotransmitters like dopamine, adrenaline and noradrenalin and can reduce the symptoms of Parkinson's disease.
- Almonds also contains brain boosting nutrients like riboflavin and L-carnitine , L-carnitine helps brain to metabolize acetyl-L-carnitinetransferase which helps to metabolize choline ,which in turn is utilized by brain to prevent neuronal degeneration. It also releases acetylcholine in brain which is necessary for good memory[14].
- Presence of magnesium increases blood flow to brain which is good for brain functioning[15].
- The presence of omega-3 fatty acids and phytonutrients like β-carotene, Lutein and Zeaxanthine makes nuts beneficial for eyes. β-carotene is a precursor of vitamin A, and Lutein and zeaxanthine found in macula is responsible for filtering blue light from retina and inhibit oxidative damage which leads to macular degeneration which

is a cause of blindness. Deficiency of these nutrients increases the risk of blindness[16]. Pistachio is the richest source of β-carotene.

Cardiovascular benefits:

No other aspects of nuts are better evaluated than its benefits for the heart and circulatory system. Table No: 3 summarize some key research finding about nuts and heart health.

Table: 3 **Effects of nuts on heart and circulatory system**

Cardiovascular aspects	Benefits	Causative factor
Blood quality	Decreases LDL, total Cholesterol and triglycerides Increases γ-tochopherol. and **ω**-3-fatty acids in red blood cells.(α-linolenic acid)	MUFA,PUFA, Fiber, phytosterols, β carotene and lutein
Vasomotor tone	Decreases aortic endothelin, improved endothelial cell function.	L- arginine, Ellagic acid, vitamin E, glutamic acid
Risk of excessive clotting	Decreases platelet adhesion rate, decreases platelet activation.	ω 3fatty acid, L-arginine,Folic acid, γ-tochopherol.
Risk of excessive inflammation	Decreases C- reactive protein(CRP) , interleukin-6 and tumor necrosis factor- α.(TNF-α)	Vitamin E,Magnesium,ALA

Now we will see how cardio protective effects are produced after consumption of nuts:

- The presence of good quality fats (MUFA,PUFA) in nuts instead of saturated fats lowers LDL and TC and increases HDL thereby improving HDL/LDL ratio ,this HDL is good for heart and elevation of LDL and TC is risky ,and persons with elevated LDL and TC are susceptible to heart diseases[17-18]. This lowering of LDL was found to be due to its decreased oxidation which is a key step in the hardening of arteries which leads to heart disease, peripheral vascular disease and stroke[19-20]. LDL oxidation is reduced because of increased blood level of antioxidants present in nuts like γ tocoferol, β carotene, leutein and omega 3 fatty acids (in case of walnut). This effect on LDL and TC is dose dependant i.e. more amount of nut consumption is associated with more reduction in blood cholesterol level[21].
- Fiber and phytosterols present in nuts reduces blood cholesterol by inhibiting its

intestinal absorption. The mechanism by which this is achieved varies: fiber particularly, soluble type adheres to cholesterol and due to its increased size absorption is reduced[22]whereas phytosterols competes with cholesterol for absorption[23-24]. Ultimately unabsorbed cholesterol is excreted.

- L- arginine and ellagic acid in the nuts is responsible for improving endothelial function.Impairement in it leads to cardiovascular diseases. L-arginine improves health of artery walls by making it more flexible and less prone to development of blood clots which may impair blood flow. L-arginine is a precursor of nitric oxide; a potent vasodilator which relaxes blood vessels and inhibits platelet aggregation and adhesion[25-26]. Ellagic acid and vitamin E exhibits anti-inflammatory effect on aorta endothelial cells and improves the activity of endothelium derived nitric oxide[27].
- Vitamin E inhibits platelet aggregation by reducing platelet cyclooxygenese activity and inhibits lipid peroxide formation[28].L arginine and ω 3 fatty acids reduce platelet aggregation through arginine – nitric oxide pathway. Folic acid decreases level of amino acid homocystein, which causes fatty plaque buildup in arteries[29].
- C reactive protein ,IL -6 and TNF-α which causes artery damaging inflammation is reduced by Magnesium and vitamin E thereby preventing heart attacks.ALA found in walnuts also decreases inflammatory TNF-α [30].
- Nuts have high level of potassium which is an important electrolyte in nerve transmission and contraction of all muscles including heart. Potassium along with calcium, magnesium, phosphorus and negligible sodium maintains healthy level of blood pressure[31]. Magnesium is a natural calcium channel blocker as it maintains calcium levels in blood, as excess of calcium is responsible for muscle tightening and elevated blood pressure. Thus magnesium's this effect on level of calcium and its vasodilator effect is responsible for maintaining blood pressure and is also responsible for reducing erratic heart rhythm[32-33]. Presence of ω 3 fatty acids in walnut is responsible for reducing and controlling blood pressure.
- Presence of folic acid prevents cardiac strokes[34].

Metabolic syndrome:

- It's not a disease but a combination of metabolic disorders like high level of blood triglycerides, high blood pressure, low HDL cholesterol and abdominal obesity.
- If not treated increases the risk of developing cardiovascular disease, type II diabetes, prostate and breast cancer. Studies have shown that substitution of saturated fats in

diet by nuts helps to reduce several of these problems without increase in the weight in fact studies on walnut had shown reduction in abdominal obesity[35].

Type II diabetes:

- The common misconception about diabetes is that it is considered as a problem related to blood sugar control and insulin metabolism. However persons diagnosed with diabetes have problems with other systems also and are especially at risk for cardiovascular problems.
- Thus an important goal of diabetes management is to design a diet plan for persons with type II diabetes is, lowering the risk of future cardiovascular problems. Thus regular consumption of nuts in diet instead of saturated fats increases the flexibility of cardiovascular system, as they increases the good fats in circulating blood.

  After meal consumption there is rise in blood glucose level and insulin which is harmful for both diabetes and in cardiovascular diseases as it generates free radicals which damages cholesterol. This is particularly observed with consumption of high glycemic index (GI) food. Thus food with low GI results in lower risk of diabetes and heart disease. Consumption of nuts not only reduces after meal rise in blood sugar, but also provides antioxidants which scavenge generated free radicals. Studies have shown that nut consumption reduces GI of meal and subjects rise in blood glucose in a dose dependant manner i.e. more nuts consumed lower the GI of meal and less rise in blood sugar after eating meal[36].
- Presence of magnesium in nuts reduces risk of type II diabetes[37]. Studies have shown that presence of vitamin E in nuts may reduce risk of diabetes related complications like nerve, kidney and eye diseases as diabetic individuals have less amount of antioxidants they are prone to such complications [38].

Anticancer benefits:

- **Re**cent studies suggest that the Mediterranean diet is not only good for cardiovascular health but also decreases risk of development of certain cancer. This diet is particularly rich in nuts.
- The presence of nutrients like MUFA, Vitamin E, Selenium, vegetable fiber, and folic acid has been linked to combating cancer. All these nutrients together not only prevent cancer but fights and slow down the progression of cancer[39]. Presence of vitamin E which regulates cellular reproduction and its antioxidant nature which mops up free radicals are responsible for cancer prevention it also blocks the

formation of nitrosamines, carcinogen formed in the stomach from nitrites consumed in the food and also enhances immune system[40].

- Research carried out on mice suggested that presence of MUFA in all the three nuts reduces risk of breast and prostate cancer however human studies are needed to substantiate this findings of animal studies[41].
- Selenium is an element found in walnut which is a part of antioxidant enzyme that helps in cancer prevention, it forms selenium superoxide dismutase powerful antioxidant enzyme which neutralizes cancer producing free radicals, and is also responsible for binding with heavy metals in the body which are thereby excreted easily and increases production of macrophages which is responsible for engulfing foreign carcinogenic material[42].
- Folic acid present in nuts might be involved in DNA related processes like the function, production and repair of DNA. Lack of folic acid in diet may result in genetic instability and torn chromosomes thereby increasing risk for cancer[43].
- Presence of high amount of insoluble fibers in nuts speeds up peristaltic movements, thus reducing exposure of intestine to carcinogens and thus can prevent colorectal cancer[44].
- Walnuts contain an antioxidant compound called ellagic acid, which blocks the metabolic pathways that can lead to cancer. Ellagic acid not only helps protect healthy cells from free radical damage, but also helps detoxify potential cancer-causing substances and helps prevent cancer cells from replicating[45].
- Apart from the above nutrients almond particularly bitter almond have vitamin B_{17} – laetrile a hyrocyanic acid an effective cancer cure agent it is eliminated by normal cellular oxidation process. When cancer cells are present they are unable to destroy acid and absorb it getting destroyed in the process[46].

Other health benefits

- **Good for bone health:** Nuts are high in magnesium, boron and zinc which is essential for bone health. Boron enhances calcium absorption and estrogen metabolism. Magnesium increases bone mineral density[47]. Magnesium is good for muscles and for maintaining balance of calcium and potassium in the body. It also regulates body temperature[48]. Manganese and zinc helps certain enzymes and local regulators to function properly so that bone matrix is formed properly. Almonds are rich in calcium it strengthen skeletal system and is good for persons suffering from

osteoporosis.

- **Good in pregnancy:** Presence of folic acid makes it good in pregnancy ,it is involved in making red blood cells and if consumed by pregnant women reduces occurrence of congenital defects in newborns particularly spina-bifida which involves incomplete formation of spine[49-50]. Presence of ω-3- fatty acids in walnuts is good for unborn baby's nerve, eye and brain development[51].
- **Weight loss:** Studies have revealed that nut rich low calorie diet is good for obese people to assist in losing their weight. Presence of good fats MUFA, PUFA, proteins and fibers satisfies appetite and prevents overeating thereby overall reduction in weight[52-53].
- **Boosts energy**: presence of manganese, copper, and riboflavin helps in energy production[54].
- **Prevention of constipation:** as nuts are fibers rich. Fibers are of two types soluble and insoluble, consumption of nuts with sufficient water prevents constipation as insoluble fiber swells in the intestine thereby increasing bulk and peristaltic movement[55].
- **Presence of vitamin E** decreases chances of cataract and is required for maintaining the integrity of cell membrane helps in building healthy tissues and blood cells and is good for skin as it protects it from harmful effects of free radicals apart from its beneficial effect on heart and against certain cancer[56].
- **Presence of iron** is beneficial in Anemia. Iron along with copper forms hemoglobin which transport oxygen to organs and cells[57].
- **Presence of zinc** helps in wound healing and is good for protein metabolism. It is beneficial for the development of the reproductive system[58]. Zinc, helps maintain collagen, which keeps the skin smooth, supple, and firm, and also keeps the nails strong. Zinc with pyridoxine (vitamin B6) and biotin, makes hair healthy[59].
    - **Presence of copper** reduces chances of cardiac diseases and it carries oxygen to various parts of the body and can keep the nerves, blood vessels and bones healthy. Its presence in nuts in organic form along with iron and vitamins contributes to formation of blood hemoglobin in persons with anemia. It is a cofactor for many important enzymes, like cytochrome c-oxidase and superoxide dismutase[60].
- **Presence of phosphorus** is responsible for building strong teeth and bones. It also

helps in processing of carbohydrates, fats and proteins by the body[61].

- **Presence of anti-inflammatory** agents like ω-3-fatty acid in walnut makes it good for inflammatory diseases like asthma, rheumatoid arthritis, eczema and psoriasis[62].
- Presence of magnesium, manganese along with thiamine, riboflavin and vitamin B 6 improves PMS symptoms[63-64].
- Regular consumption of nuts prevents occurrence of gallstones due to presence of fiber, phytosterols and magnesium which are responsible for improving health of gall bladder[65]
- Walnuts because of its ω-3-fatty acids and magnesium can prevent migraines, ω-3-fatty acids reduces nerve inflammation associated with headache , serotonin level drops in migraines which can be elevated by eating walnuts and almonds which have tryptophan: precursor of serotonin[66].

CONCLUSION

Very few people in India consume tree nuts of any kind, as they may not be aware of the several health benefits they have. Others may be concerned about weight gain as they are calorie dense food having high fats. However fats present in nuts are healthy like monosaturated and polyunsaturated as oppose to artery clogging saturated fats. And if eaten sensibly do not cause weight gain. Several studies conducted over the years have strongly suggested that eating an ounce of nuts four or five times a week can greatly reduce the risk of coronary heart disease. In fact by 2003, the accumulated data has compelled the US FDA to issue a formal statement saying that "Scientific evidence suggests but does not prove that eating 1.5 ozs. Per day of most nuts [such as name of specific nut] as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease." The health claim applies to almonds, hazelnuts, peanuts, pecans, some pine nuts, pistachio nuts and walnuts.Thus the consumption of nuts not only reduces the blood cholesterol (effect is comparable to statins) but is good for heart health, brain, bones and reduces rectal and colon cancer if eaten sensibly and substituted for fats in the diet.

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