

Health benefits and uses of Amaranth

Daman Preet Kour and Neeraj Gupta

Division of Food Science and Technology,
SK University of Agricultural Sciences and technology of Jammu, Chatha J&K

ARTICLE ID: 063

A major pseudo-cereal known as “Amaranth” which is believed to be originated from central or southern America, is an ancient plant belonging to family *Amaranthaceae* and *Amaranthus* species (Sangeeta and Grewal,2018).Amaranth has 60 different species, but all of these are not found in daily menus.Amaranthus edulis, and Amaranthus hypochondriacusetc. are among some leaves that are used in salads and soups. The grains used in breads, cakes, cookies, confectionary andsoups are *Amaranthus caudatus*, *Amaranthus hypochodriacus*,*Amaranthus cruentus*, *Amaranthus hybridus*, and *Amaranthus mantegazzianus*. As compared to true cereals amaranth having a superior amount of proteins is a highly nutritional cereal (Caselato and Amaya,2012).The erect stem and massive inflorescence of amaranth makes it a dicot herb,thatmay be aone amongsome C4 dicots and belongs to cluster of NAD-malic enzyme-type of C4 metabolism. Its C4-photosynthesis pathway and anatomical characteristics resulted in increasedefficiency of using CO₂ withvarious ranges of temperature(from 25°C to 40°C), under moisture stress environment.All these parameters contribute to thegeographic adaptability of crop to diverse environmental conditions (Mlakar *et al.* 2009).Grains of Amaranth werereparched, ground and taken with water or milk. Duringfasting day’s roasted grains were also eaten, especially by Hindus. Amaranth acts as a multipurpose cropalso used as a medicinal plant, vegetable, forage and asan ornamental (Sheikh and Singh, 2013).

Nutritional Composition of Amaranth

Nutritionally, amaranth is a gluten-free grain and actas an important source of bioactive components.Numerous biofunctionalities such as antimicrobial, antioxidant, antihypertensive and antitumor activity have been demonstrated by bioactive peptides derived from amaranth protein.Its pure peptides have an anti-atherosclerotic effect and amaranth protein is also associated with potential hypo-cholesterolemic effect (Ramesh and Prakash,2020). Protein and starch content of amaranth grain is 15 % and 60% respectively.

The presence of high lysine content and its amino acid profile makes it an attractive protein source. It can provide a “balanced” protein source, if consumed along with other cereals (Escudero *et al.* 2004). In the health food market, Amaranth grain is popular due to the presence of high fibre content and low saturated fat. Essential amino acids mainly methionine and lysine have been reported in the seed with the high amount of protein content. An important precursor for all steroids namely, squalene is present in significant levels in Amaranth. After elemental analysis of mg/100 g (dry weight), amaranth leaves were found to contain potassium (54.20), sodium (7.43), calcium (44.15), iron (13.58), magnesium (231.22), zinc (3.80) and phosphorus (34.91). The vitamin content in mg/100 g (DW) of the Amaranth leaves is carotene (3.29), thiamine (2.75), pyridoxine (2.33), riboflavin (4.24), niacin (1.54), ascorbic acid (25.40) and tocopherol (0.50). Amaranthus contain 5 % lysine and sulphur-containing amino acids (lacking in cereals and tubers) and considerably 17.5 – 38.3 % amount of protein. The quantity of Lysine content material in Amaranth is plenty better than maize (3-3.5 times) and wheat (2-2.5 times). Blending of Amaranthus with corn flour almost reaches the biological value 100 and thereby the biological value of Amaranthus protein is 75. The protein of Amaranthus is highly digestive (approx. 90 %). Patients suffering from celiac disease can consume Amaranthus protein as it is gluten free. Amaranth has an average oil content between 11-14%. Higher saponification value which is obtained from Amaranthus oil is (130-190) and the iodine value (100-113) and the unsaponifiable matter present is (5-7%) is of great importance. Oleic acid (26.5-31%), palmitic acid (14-20%), stearic acid (2-3.5%); linoleic acid (32-41%) and docosahexaenoic acid (DHA) (7-21%) were the 5 major fatty acids present in Amaranthus. The three polyphenols were isolated in Amaranthus viz. rutin, isoquercitrin, and nicotiflorin whereas in seed flour rutin was present in higher concentration (10.1 mg/g flour). Amaranth contains 11 phenolic compounds- gallic acid, protocatechuic acid, chlorogenic acid, gentinic acid, 2,4-dihydroxybenzoic acid, ferulic acid, salicylic acid, rutin, ellagic acid, kaempferol-3-lutinoside and quercetin (Joshi and Verma, 2020).

Seventeen amino acids (isoleucine, leucine, lysine, cysteine, phenylalmine, tyrosine, threonine, methionine, valine, alanine, arginine, glutamic acid, aspartic acid, glycine, histidine, proline and serine) have been detected in Amaranthus and as a result making it a

nutritious pseudo-cereal. Amino acid content of amaranth is presented in tabular form as mentioned below:

S.No	Amino Acids	Unit Value Per 100g
1.	Arginine	1.060 g
2.	Alanine	0.799 g
3.	Aspartic acid	1.261 g
4.	Tryptophan	0.181 g
5.	Threonine	0.558 g
6.	Isoleucine	0.582 g
7.	Serine	1.148 g
8.	Leucine	0.879 g
9.	Lysine	0.747 g
10.	Methionine	0.226 g
11.	Phenylalanine	0.542 g
12.	Glycine	1.636 g
13.	Proline	0.698 g
14.	Tyrosine	0.329 g
15.	Valine	0.679 g
16.	Histidine	0.389 g
17.	Glutamic acid	2.259 g

Table 1: Amino acids content of *Amaranthus* spp. (Maurya and Arya, 2018).

Health benefits of Amaranth

Amaranth crop has high nutraceutical value. Several biological processes such as anti-hypertensive, anti-oxidant, antithrombotic, anti-proliferative and among others are supported by consuming Amaranth. Presence of many essential amino acids in amaranth's seed helps in building of new cells and helps immune system and recovery of muscles. Consumption of pseudo-cereals such as Amaranth reduces chronic disease caused by inflammation. Calcium is required for maintenance of healthy bones and to prevent osteoporosis. Amaranth contains more calcium than other seeds. Total and bad cholesterol (LDL) has been reduced by Amaranth's oil and thereby increasing good cholesterol.



Chronic gastritis and peptic ulcer caused by *Helicobacter pylori* can be treated with Amaranth oil. Presence of high amount of manganese in Amaranth helps in regulating sugar level and control diabetes too. Patients suffering from Diabetic mellitus type II have shown that when Amaranth starch has been taken, glucose absorption is driven at regular intervals. In pregnant women's, in order to avoid spina bifid, heart defects, intake of folic acid is suggested. Presence of 88.0mcg of folate in Amaranth grain helps in the formation of new cells and acts as a nutritional advantage. The Amaranth's starch binds water and additionally that insoluble fibre is found in a better proportion (round 80%) than soluble fibre allows to keep away from constipation. Thus, to avoid chronic inflammation, high cholesterol, bad nutrition due to gluten intolerance, Amaranth should be considered as super crop in our diet (Soriano *et al.* 2018).

Amaranth Uses

Amaranth species with different pharmacological properties has also been investigated. *Amaranthus cruentus* and *Amaranthus paniculatus* have been shown to be excellent sources of flavonoids, especially rutin. Amaranth was used as livestock feed relatively having high protein qualities. Amaranth may be processed in popped, flaked, extruded and ground flour forms like other small grains. The flour or flaked forms are combined with wheat or other flours to make bread, cereals, cookies and other baked goods. Functional properties and flavour of Amaranth can still be maintained by blending it at 50-75% level. A nutritious and tasty porridge cooked by itself or mixed with other grains and pseudocereals such as oats (*Avena spp.*), milled flax seed (*Linum usitatissimum*), wheat germ, and canihua (*Chenopodium pallidicaule*) can be made from coarsely ground Amaranth. Non-poisonous natural dyes, microcrystalline starch for food industries and squalene, specialised oil utilized in pores of skin cosmetics, laptop and pharmaceutical industries may be made from seed additives with beneficial capacity including (red) pigments of anthocyanin (Alegbejo, 2013). Edible films of Amaranth were also produced with antimicrobial essential oil of Mexican oregano, cinnamon, or lemongrass and evaluation of antifungal activity *Aspergillus niger* and *Penicillium digitatum* after exposure to vapors arising from added essential oils. Thus, antifungal activity was seen in Amaranth films but, it was weaker than chitosan films (Venskutonis and Kraujalis, 2013).

Conclusion

Thus, Amaranth is highly nutritious crop. It is rich in protein, fibre, essential amino acids and well as many micronutrients. The food products made from Amaranth helps us to cure many health-related issues that we suffer in our daily life such as high cholesterol, diabetes, celiac disease etc. The demand for this nutrient-packed grain is growing rapidly. Despite being one of the maximum historic type of cultivated food, amaranth grain stay extraordinarily crucial for human health.

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