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A Medicinal plant with antioxidant activity in Iranian folk medicine: Amaranthus

Sepideh Miraj

Infertility Fellowship, Medicinal Plants Research Center, Shahrekord University of Medical Sciences, Shahrekord, Iran

ABSTRACT

Amaranthus belong to family, native to Asia and the America is a cosmopolitan genus of annual or short-lived perennial plants. While this plant has lots of properties. The aim of this study is to overview its therapeutic effects than its nutritive and industrial effects. This review article was carried out by searching studies in PubMed, Medline, Web of Science, and IranMedex databases up to 2016.totally, of 120 found articles, 40 articles were included. The search terms were "Amaranthus", "therapeutic", "pharmacological", herbal remedy. Various studies have shown that Amaranthuspossess In vivo properties, Qualitative and quantitative aspects, Protein quality, Antioxidant effect, Modulatory effect ,Anti-cancer effect, Anti-obesity effect, Amino transferase activity, Physical, thermal, and structural properties ,Potential Treatment for Hypercholesterolemia, Antimicrobial properties . Amaranthus is widely used for therapeutic and purposes that trigger its significant value. Various combinations and numerous medicinal properties of its extract, essential oils, its stems and leaves demand further and more studies about the other useful and unknown properties of this multipurpose plant.

Keywords: Amaranthus" ,therapeutic", "pharmacological", "herbal remedy".

INTRODUCTION

It is proved that herbal medicine is effective in the treatment of many diseases [1-10].

Amaranthus belong to family Amaranthaceae, native to Asia and the America, is a cosmopolitan genus of annualor short-lived perennial plants [11, 12]. Some amaranth species are cultivated as leaf vegetables, pseudocereals, and ornamental plants. Most of the species from Amaranthus are summer annual weeds and are commonly referred to as pigweed [13]. Catkin-like cymes of densely packed flowers grow in summer or autumn [14]. Approximately 60 species are recognized, with inflorescences and foliage ranging from purple and red to green or gold [15, 16]. Members of this genus share many characteristics and uses with members of the closely related genus Celosia. Cooked amaranth leaves are an excellent source of vitamin A, vitamin C, calcium, manganese and folate[17-22]. Amaranth contains phytochemicals that may be anti-nutrient factors, such as polyphenols, saponins, tannins and oxalates which are reduced in content and effect by cooking[23].

The genus also contains several well-known ornamental plants, such as *Amaranthus caudatus* [love-lies-bleeding], a vigorous, hardy annual with dark purplish flowers crowded in handsome drooping spikes. Another Indian annual, A.

hypochondriacus [prince's feather], has deeply veined lance-shaped leaves, purple on the under face, and deep crimson flowers densely packed on erect spikes [24].

Amaranths are recorded as food plants for some Lepidoptera [butterfly and moth] species including the nutmeg moth and various case-bearer moths of the genus *Coleophora: C. amaranthella, C. enchorda* [feeds exclusively on Amaranthus], *C. immortalis* [feeds exclusively on Amaranthus], *C. lineapulvella* and *C. versurella*[recorded on A. spinouts][25, 26].

In vivo properties

The decay of P fr has been investigated at different temperatures and follows first order decay kinetics throughout. The effect of energy on decay has been investigated under red and blue light. The rate of phytochrome decay is dependent on the P fr /P total ratio and only becomes energy dependent when the light intensity is so low that the photostationary state is never attained. Under white tungsten lights of high intensity there is a deviation from the expected first order decay kinetics. The nature of this low rate of decay cannot be explained at the present time (27).

Seedlings of *Amaranthus caudatus* L. var. Pendula were used to study the influence of several treatment.The amaranthin biosynthesis seemed to be favored in the absence of DOPA. Under the combined effect of kinetin and white light a small quantity of betanin was also synthesized. Adding exogenous DOPA led to a more diversified production which included betacyanins (amaranthin and betanin), betaxanthins (vulgaxanthin and miraxanthin), and even dopachrome [28].

Protein quality

The effect of thermic processing on the protein quality of amaranth (*A. caudatus*) was evaluated. No clear effects were detected when the amino acids were added, but there was an interaction between protein in the diet and amino acids. No effect occurred when leucine was added, suggesting that it is not a limiting amino acid. Possibly, threonine is a more limiting amino acid, but the effects were not as high, probably due to the level added to the diets [29].

Antioxidant effect

The biological properties, antioxidant and antidiabetic, of two varieties of *Amaranthus caudatus* seeds, Oscar blanco and Victor red was reported. Oil, squalene and phenolic contents were also determined. Seeds of both investigated varieties were found to possess very different levels of squalene (2.2% in Oscar blanco variety and 7.5% in Victor red variety). Although the antioxidant activity of *A. caudatus* var. Oscar blanco and *A. caudatus* var. Victor red statistically did not differ significantly from each other [30].

The bioactivity of tannin from amaranth (*Amaranthus caudatus* L.) extracts was investigated. The results suggest that tannin from the leaves of *Amaranthus caudatus* L. is a promising source of antioxidant component that can be used as a food preservative or nutraceutical [31].

Phytoavailability of Cd, growth yield, cellular Cd accumulation and oxidative stress responses were studied in leafy vegetable *Amaranthus caudatus* under soil amendments. Correlation analysis of growth yield, Cd concentration and oxidative stress under these conditions suggest that with the decrease in cellular Cd concentration following amendment the level of oxidative markers and H_2O_2 and lipid peroxidation: malondialdehyde; MDA) declined as a result of significant enhancement in the activity of enzymatic antioxidants (peroxidase, ascorbate peroxidase, superoxide dismutase, dyhydroascorbe reductase and catalase)[32].

Modulatory effect

The protective effects of *Amaranthus caudatus* and A. hybridus against sodium arsenite-induced toxicity in rats was evaluated. *A. caudatus* has a more protective effect on reducing the micronuclei formation when compared with *A. hybridus*. This study suggests that *A. caudatus* and *A. hybridus* possess anticarcinogenic effect [33].

Anti-cancer effect

Effect of cress (Lepidiumsativum) seed (ling) exudates on seedling growth in *Amaranthus caudatus* and *Lactuca sativa* was reported. The effect of the allelochemical(s) on organ morphology was imposed primarily by regulation of cell expansion, not cell division. It is concluded that cress seeds exude endogenous substances, probably including lepidimoide, that principally regulate cell expansion in receiver plants [34].

The antioxidant, anti-proliferative and antimicrobial activity of stem and seed extracts of Amaranthuslividus (AL) and Amaranthus hybridus (AH), respectively was evaluated. Findings suggest that both of the Amaranthus species have strong antioxidant, lectin and anti-proliferative activity on EAC cells. The current anticancer potential was observed due mainly to the mitochondria mediated apoptosis of EAC cells (35).

Anti-obesity

The antihypercholesterolemic and antiatherogenic effect of hydroalcoholic extracts of *Amaranthus caudatus* L (A. caudatus) on regression of atherosclerosis in experimental rabbits maintained on a high cholesterol diet. The results thus suggest that hydroalcoholic extracts of *A. caudatus* can reduce risk factors and cause regression of fatty lesions in aorta [36].

Amino transferase activity

In vitro callus cultures were established from two plants that are naturally rich in tocopherols, *Amaranthus caudatus* and Chenopodium quinoa, in order to examine whether callus cultures were able to produce these compounds at levels comparable to those observed in planta. In C. quinoa cultures, elicitation with MJ did not have any effect, neither on tocopherol production, nor on TAT activity. These results are discussed in relation to chloroplast differentiation and the interplay between jasmonates and phytohormones [37].

Physical, thermal, and structural properties

Amaranth protein-lipid (PL) and protein (P) films were elaborated and compared with amaranth flour films in order to determine the contribution of the interactions between the biopolymer (starch and protein) and the lipids to the film properties. Result showed that the flour film properties depended on the interactions formed by their polymers (starches and proteins) and by the lipid, on the distribution of these interactions within the film matrix and on the concentrations of each component in the film [38].

Hypercholesterolemia activity

Different parts of *A. viridis* (leaf, stem, and seed) were evaluated for potential anti-HMG-CoA reductase, antioxidant, and anti-inflammatory activities. *A. viridis* leaf extract was proven to be an effective inhibitor of hyaluronidase, lipoxygenase, and xanthine oxidase enzymes. The experimental data suggest that *A. viridis* leaf extract is a source of potent antioxidant and anti-inflammatory agent and may modulate cholesterol metabolism by inhibition of HMG-CoA reductase [39].

Antimicrobial activity

Two antimicrobial peptides (Ac-AMP1 and Ac-AMP2) were isolated from seeds of amaranth (*Amaranthus caudatus*), and their physicochemical and biological properties were characterized. Some activity on Gram-positive bacteria. The antimicrobial effect of Ac-AMP1 and Ac-AMP2 is strongly antagonized [22].

The antibacterial potential of the fatty acid isolated from the *A. spinosus* against some Gram-positive and Gram-negative bacteria was examined. The fatty acid from the *A. spinosus* possesses potent antibacterial action [40].

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