Oats

Avena sativa

Common names

Oat seed

Family

Poaceae/Graminaceae (grass)

Part used

Seed

Background and traditional uses

Oats is an annual grass plant with non-articulate leaves and diffuse panicle flowers,that grows up to 1.5m high.[1] The indigenous origin of oats is unknown, however, the plant was cultivated in Europe 4,000 years ago and it is now widely grown in temperate and sub-tropical areas.[1,2]

The medicinal use of oats extends back many centuries, with reports of its use in ancient Greece by Hippocrates, Pliny the Elder, and Galen as a tonic and feeding remedy.[2] The flowering parts and seed of oats have been used traditionally for a range of therapeutic concerns including as a nervous tonic for nervous exhaustion, weakness and irritation, hysteria, depression and as a sedative.[2]

As a tea it was also used as a diuretic, for rheumatic disease, gout and urinary tract diseases.[2] Uses for oat seed in traditional western herbal medicine include for menopausal neurasthenia, debility, nervous exhaustion, depression and as a general body and heart tonic.[3]

Actions

Primary:[2,3]

- Nervine tonic
- Tonic
- Thymoleptic
- Sedative
- Nutritive
- Cognitive enhancing

Secondary:[4]

- Antioxidant

Applications and indications

- For nervous exhaustion and associated issues including insomnia, general debility and convalescence.[3]
- Constituents of oats seed have been shown reduced exercise-induced inflammation.[5,6]
- Constituents of oats have demonstrated antioxidant activity.[4]

Active constituents and pharmacodynamics

There are a significant range of chemical components present in oats, however, the primary constituents that exhibit the most pharmacological properties are the phenolic compounds, flavonoids and saponins. The main **phenolic** compounds characteristic to oat seed are the avenanthramides (AVA).[7] More than 40 types of these have been identified, however AVA A, B, C compounds are the most predominant and pharmacologically relevant.[4,5]

AVA have been observed to have a variety of biological effects, including antioxidant, antiproliferative, antiatherogenic and anti-inflammatory activity, the latter through the inhibition of NFkB.[4,6-10]

There have been 28 **flavonoids** identified in both the seeds and aerial parts of oats, including kaempferol, linarin, tilianin, myricitrin, quercetrin, rhamnosylisoswertisin, luteolin tricin, apigenin and apigenin derivatives.[2,7,9] These constituents are well known antioxidants.[9] Saponins found in oats include avenacosides A and B, avenacin, avenacosid, isoorientin-2"-O-arabinoside (1) and isovitexin-2"-O-arabinoside, with different constituents observed to have antibiotic, anti-inflammatory and immunoregulatory activity.[2,7,11]

Organic acids include p-coumaric acid, caffeic acid, ferulic acid, p-hydroxyenzoic acid and vanillic acid, with caffeic and ferulic acids exhibiting antioxidant properties.[9] In the seeds of oats, sterols present include avenasterin, stigmasterin, beta-sitosterol and avenasterol, with cholesterol-lowering and antioxidant effects exhibited by different sterol constituents.[2,7,9]

Beta-glucans are a type of soluble fibre that is present in different parts of the whole oat plant including the seed.[2,7] They are known to promote the synthesis of bile acids and consequently reduce serum cholesterol levels.[7] Vitamins and minerals found in oats include vitamins A, beta-carotene, B1, B6, C, E, K, potassium, calcium, magnesium, manganese, iron, zinc, copper, silicic acid and phosphorus.[2,7]

Summary of clinical evidence

Exercise-induced inflammation

Several studies have observed that constituents from oats had a beneficial effect on exercise-induced inflammation and antioxidant activity. In a double-blind, randomised study, post-menopausal women aged 50-80 years were given AVA at a daily dose of 9.2mg (treatment group n=8) or 0.4mg (control group n=8) for eight weeks in cookies made from oat flour.[5] All subjects performed two down-hill walking sessions (DW) comprised of four 15 minute walking sessions, separated by three lots of five minutes' rest. Assessments included plasma glutathione and total antioxidant capacity, creatine kinase, erythrocyte superoxide dismutase and glutathione peroxidase, neutrophil respiratory burst, (interleukin) IL-1 beta, IL-6, tumour necrosis factor (TNF)-alpha, C-reactive protein (CRP) and NFkB assays.[5]

At the end of the study period, the treatment group had reduced exercise-induced neutrophil respiratory burst ($p<0.05$) and CRP ($p<0.05$) levels 24 and 48 hours respectively after DW sessions, as well as significantly reduced NFkB binding in mononuclear cells and IL-1 beta, concentrations at rest, compared with controls.

AVA also resulted in elevated erythrocyte superoxide dismutase activity ($p<0.05$) compared with the control group.[5]

Similar results were observed in a subsequent trial by the same study group conducted on younger women (aged 18-30 years, n=16).[6] Using the same study design, subjects were given a daily dose of AVA (9.2mg in treatment group n=8 or 0.4mg in control group n=8) for eight weeks in cookies made from oat flour. At the beginning and end of the study period, subjects performed downhill running (DR) sessions for one hour, with blood samples taken at rest, straight after and 24 hours following DR. The physiological assessments done were the same as those in the previous study. Following AVA supplementation, neutrophil respiratory burst, plasma IL-6 and mononuclear cell NFkB levels were reduced 24-hours after DR compared with no effect in the control group ($p<0.05$ for each). The treatment group also had increased resting plasma glutathione levels ($p<0.05$) and reduced glutathione disulphide and erythrocyte peroxide activity ($p<0.05$) following DR.[6]

These studies demonstrate that AVA from oat seed reduce systemic exercise-induced inflammation and increases plasma antioxidant activity.[5,6]

Antioxidant

Clinical trials have demonstrated that constituents from oats have antioxidant activity in humans. In a randomised, placebo-controlled crossover pilot study six healthy subjects (60.8 ±3.6y) were given either 1g or 0.5g of AVA in skim milk, or skim milk only (placebo) with one-week washout periods in between.[4] Following the intervention, blood samples were taken at 15, 30, 45 minute and at one, two, three, five and 10 hours' post-ingestion, with assessments including plasma reduced glutathione (GSH) and oxidized glutathione (GSSG) and plasma malondialdehyde (MDA) concentrations. Free and conjugated plasma AVA concentrations and AVA A, B and C levels were also measured. AVA intake at the 1g dosage resulted in reduced GSH levels increasing by 21% at 15 minutes ($p<0.005$) and by 14% at 10 hours ($p<0.005$).[4]

In a separate study, healthy subjects (35-55 years) were given either placebo (corn oil capsules), AVA in capsules at a dose of 1.56g in four capsules or 3.12g in eight capsules, or no treatment (control) for four weeks. Data collected included reduced GSH, superoxide dismutase (SOD) and plasma MDA. When taken at the higher dose, AVA resulted in significantly increased levels of reduced GSH (17.9%) and SOD (8.4%) ($p<0.05$ respectively). Both doses of AVA also resulted in significantly decreased plasma MDA concentrations (16.6% for the four capsule dose and 28.1% for the eight capsule dose).[12]

Hyperlipidaemia

Constituents of oats have been observed to have a beneficial influence on blood cholesterol parameters. In healthy subjects aged 35-55 years, the intervention consisted of either placebo (corn oil capsules), no treatment (control), or AVA (in capsules at doses of either 1.56g in four capsules or 3.12g in eight capsules) for four weeks.[12] Data collected included total cholesterol, triglyceride and low density lipoprotein cholesterol (LDL-C). The higher dose of AVA resulted in significant reductions in total cholesterol, triglyceride and LDL-C (by 11.1, 28.1 and 15.1% respectively, $p=0.05$) and an increase of 13.2% of high density lipoprotein (HDL) cholesterol levels.[12]

Dosage summary

Liquid extract (1:1): 20-40mL weekly[3,7,16]
Dried herb equivalent: 1-4g three times daily[7]

Safety information

- Considered to be safe in pregnancy and lactation under guidance from a healthcare professional.[7]
- Contraindicated in individuals hypersensitive to members of the *Poaceae* family.[2]
- Caution is advised regarding concomitant use with antihypertensive, lipid lowering or insulin medications.[7]
- Caution is advised in individuals with coeliac disease.[2]

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