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Avena sativa: a natural supporter of cognition and mental fitness

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*Avena sativa* L., or commonly known as oat, was used for more than 4000 years as animal feed as well as for human consumption (1). In 2017, *A. sativa* L. was chosen as medicinal plant of the year, emphasizing its significant role in medicinal usage tracing back to the 12th century (1, 2, 3, 4).

The plant, which belongs to the Poaceae family of grasses, originates from the Fertile Crescent of the Near East as it grows throughout in moist, temperate zones of North and South America, Canada, Russia, Australia, China, Western Eurasia and the Mediterranean Basin with an annual total oat production of 19.6 megatons in 2012 (2, 5, 6). The utilized parts of *A. sativa* are grain (fruits; mature seed) and the rapidly dried aerial green herb, which is harvested prematurely just before flowering (1, 7).

In regard to its aforementioned therapeutic potential, several bioactive chemical constituents have been described and grant *A. sativa* with antioxidant, immunomodulatory, anti-inflammatory, antidiabetic, wound healing, antipruritic, anti-atherogenic and anticancer properties (2, 8). Next to the main ingredients in oat which comprise starch and soluble polysaccharides (65–85 %), proteins (15–20 %), lipids (3–11 %) and fibers (5 %) the major pharmacological substances are polyphenols, saponin glycosides, flavonoids and tocopherol (vitamin E) (9). Within the group of polyphenols avenanthramides have been found to show the most antioxidative activity which is 10–30 fold of other phenolic substances found in *A. sativa* making oat a promising and unique candidate on various health indications (10, 11).

Oat avenanthramides were shown to suppress the production of several molecules that are known to bear a potential risk in the development of atherosclerosis which is a common hallmark of heart diseases (12). In this context clinical studies also reported a beneficial effect of oat products on cholesterol in healthy as well as hypercholesterolemic subjects (13, 14).

Several other clinical trials also revealed that β-glucan, a polysaccharide in fibers that is strongly enriched in oat food products, can moderate blood glucose levels of diabetic and pre-diabetic individuals (15, 16, 17).

Next to cardiovascular diseases and diabetes oat is traditionally known to improve skin irri-

*Wild green oat (Avena sativa)*

Photo: Anklam Extract GmbH
tations and wound healing. It was shown that an oatmeal extract had an anti-inflammatory effect in a skin irritation model induced by a chemical compound (18). Additionally, A. sativa has been used as therapeutic agent to cure eczema and renew UVA/UVB damaged skin (19). In clinical trials lotions containing colloidal oatmeal could significantly improve scratching lesions, scaling erythema, lichenification and pruritus in patients suffering from cutaneous xerosis (20, 21).

Another indication of A. sativa was described in the context of mental health and cognitive function. Here, few scientific studies reported a beneficial effect of oat on conditions like stress, depression and anxiety. Especially in regard to society’s increasing numbers of people suffering from burnout and fatigue syndrome it is reasonable to focus future research on the potential of such oat products. A large quantity of herbal and fruit oat products is available, mainly on the Asian market. However, only a small number of products are manufactured under GMP (good manufacturing practice) compliant conditions. This article aims to give an overview about the impact of A. sativa extracts on cognitive performance as well as mental health and to review the propagated mode of action.

Oxidative cell stress is known to alter neuronal function, neurotransmission as well as overall brain activity. Referring to this, oxidative stress is also implicated in terms of neuropsychiatric diseases including stress and anxiety (22). The seeds of immature oat are acknowledged to be amongst the most popular and safest nervines, as it is prescribed for acute and chronic anxiety, symptoms of tension as well as for neurasthenic syndromes (23). Several studies could show that antioxidant treatment with polyphenols, flavonoids or special diets that are rich in antioxidants can act protective and anxiolytic (24, 25, 26). This property of oat was confirmed in behavioral anxiety tests with rodents where a group of mice showed a more relieved behavior after the consumption of an oat extract that was almost comparable to the group that was administered with the standard anti-anxiety drug diazepam (27). In addition it could be demonstrated that the daily dietary intake of an oat herb extract for

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seven weeks in a study with rats led to an improvement of active stress response, an increased learning performance as well as a “friendlier” social behavior (28). Imbalances in social behavior are known to be indicative for several cognitive disorders (29).

Same beneficial effects were seen in a clinical trial conducted in Australia where elderly people with mild cognitive dysfunction were asked to perform the so-called Stroop test – a test that combines different colors and the reading of words. Test subjects that consumed the oat extract already showed within the short time of two hours after administration an improved ability to maintain task focus as well as a better executive attention and concentration (30).

Also another clinical trial in UK could reveal that the intake of a wild green oat extract results in an amelioration in speed of performance and an increased episodic memory in healthy middle-aged people who reported an aged-associated cognitive decline (31).

A group around Wilfried Dimpfel aimed to study the human electric brain activity during mental work and therefore analyzed the effect of an oat extract on the cognitive performance. They performed EEG measurements using CATEEM®, a quantitative brain mapping technology, and found the major effects in the frontotemporal region of the brain which is well known to be involved in cognitive function. Hence, the results suggest a direct benefit of oat on mental health (32). Taken the fact that oat seems to promote a true effect on the central nervous system (CNS) the question about the mode of action of A. sativa arouse. The mechanism in detail is currently still unknown.

Yet unpublished data of in vitro bioassays, provided by a European herbal extract company, demonstrated that a well-established standardized ethanolic green oat extract, manufactured by the same company, showed an inhibition of two distinct enzymes namely phosphodiesterase 4 (PDE-4) and monoamine oxidase B (MAO-B). Both enzymes act in the CNS and hold modulatory roles in anxiety, memory and depression (33, 34). Furthermore elevated levels of MAO-B in the brain are associated with neurodegenerative disorders like Alzheimer’s and Parkinson’s disease (35, 36). Next to CNS-related disorders MAO-B and PDE-4 inhibitors have a wide field of potential therapeutic applications including the treatment of rheumatoid arthritis or COPD (37). Also the standardized A. sativa extract of Anklam Extrakt GmbH could provide good and full equivalent effect of MAO-B and PDE-4 inhibitory capacity.
When compared with the aforementioned oat extract (see figure). Measurements of the inhibitory effect revealed an even stronger inhibition of MAO-B by the Anklam Extrakt GmbH A. sativa extract in comparison to the oat extract (IC\textsubscript{50} 97.6 μg/ml to 119.1 μg/ml). The inhibitory effect of herbal extracts was defined as the sample concentration of the oat extract that is required to reduce the maximal enzymatic activity to 50% (IC\textsubscript{50}).

Taken together, all above-mentioned animal and human studies could provide sound evidence that A. sativa is a powerful plant with enormous potential as a natural supporter of cognition and mental fitness. Since the intake is safe and exhibits no interactions, side effects or yet known contraindications green oat can be recommended as an attractive herbal medicine and food supplement.

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