



Benefits of Nicotine

Nicotine, the primary psychoactive component of tobacco, has been shown to have several potential cognitive benefits. These benefits are primarily related to its action on nicotinic acetylcholine receptors (nAChRs) in the brain.

1. **Cognitive Enhancement**: Nicotine has been found to improve attention, short-term memory, and long-term memory. This is particularly evident in individuals with cognitive impairments such as Alzheimer's disease, Parkinson's disease, schizophrenia, and attention-deficit/hyperactivity disorder (ADHD).^[1-3]
2. **Neuroprotective Effects**: Nicotine may offer neuroprotective benefits, particularly in neurodegenerative diseases like Parkinson's disease. It is thought to reduce neuronal damage by interacting with nAChRs, which can modulate calcium signaling and immune responses, ultimately reducing neuronal apoptosis and promoting neuronal survival.^{[1][4]}
3. **Anti-inflammatory Properties**: Nicotine has been shown to have anti-inflammatory effects, which may contribute to its neuroprotective and cognitive-enhancing properties. This is achieved through the activation of nAChRs, which can inhibit the release of pro-inflammatory cytokines.^[5-6, 19]
4. **Mood Enhancement**: Nicotine can enhance mood and reduce symptoms of depression, which may be beneficial in certain psychiatric conditions. This effect is likely mediated through its action on nAChRs and subsequent modulation of neurotransmitter release.^[7]
5. **Improvement in Visual Attention**: Nicotine has been shown to strengthen gamma oscillations in the prefrontal cortex, which are associated with enhanced attentional capacity. This effect is particularly noted with repeated nicotine exposure.^[8]

Nicotine & Anti-Aging

In the context of longevity medicine, nicotine has shown potential benefits primarily through its effects on cellular and molecular pathways associated with aging.

1. **NAD Homeostasis and Aging**: Nicotine has been found to restore age-related declines in nicotinamide phosphoribosyltransferase (NAMPT) activity, which is crucial for NAD synthesis. This restoration helps improve cellular energy metabolism, reduce oxidative stress, and inhibit neuroinflammation, thereby ameliorating age-related symptoms and cognitive decline.^[5]
2. **Telomerase Activity and Cellular Senescence**: Nicotine can delay endothelial progenitor cell (EPC) senescence by augmenting telomerase activity via the PI3K/Akt pathway. This delay in cellular aging enhances the proliferative and functional capacity of EPCs, which are vital for vascular repair and regeneration.^[11]
3. **Neuroprotection and Neurodegenerative Diseases**: Nicotine has demonstrated neuroprotective effects in models of Parkinson's disease (PD) by enhancing autophagy and the ubiquitin-proteasome system (UPS), reducing oxidative stress, and improving mitochondrial function. These effects contribute to increased lifespan and improved motor and cognitive functions in PD models.^[12-13]
4. **Cognitive Function**: Nicotine has been shown to modulate cognitive function in aging models by reducing oxidative damage, apoptosis, and enhancing neurotrophic factors. This results in improved spatial and episodic memory, which are critical for maintaining cognitive health in aging populations.^[14]

Negative Side Effects of Nicotine Patches

While nicotine patches are effective for smoking cessation by reducing withdrawal symptoms, improving compliance, and aiding in smoking cessation, they can also have several negative side effects:

1. **Skin Irritation**: The most common side effect is localized skin reactions, including redness, itching, and rash at the application site. These reactions are usually mild but can be bothersome.
2. **Sleep Disturbances**: Nicotine patches can cause vivid dreams and insomnia. Removing the patch at bedtime can help mitigate these effects.
3. **Cardiovascular Effects**: Nicotine can increase heart rate and blood pressure. Patients with heart disease, recent heart attack, or irregular heartbeat should use nicotine patches with caution and under medical supervision.
4. **Gastrointestinal Symptoms**: Nausea and vomiting are reported side effects, particularly if the patch dose is not tapered appropriately.
5. **Neurological Symptoms**: Dizziness and headaches are also common, though typically mild and transient.
6. **Nicotine Overdose**: Symptoms of overdose include nausea, vomiting, dizziness, weakness, and rapid heartbeat. These symptoms necessitate immediate medical attention.
7. **Allergic Reactions**: Rarely, users may experience allergic reactions such as difficulty breathing or severe rash, which require discontinuation of the patch and medical consultation.

Negative Side Effects of Oral Nicotine Pouches

Oral health issues associated with nicotine pouches include a range of adverse effects. A cross-sectional survey reported that users of oral nicotine pouches (ONPs) frequently experience mouth lesions (48%), sore mouth (37%), and sore throat (21%).^[15] Additionally, in vitro studies have shown that nicotine pouches can induce cytotoxicity, inflammation, and oxidative stress in human gingival fibroblasts, suggesting potential for local lesions in the buccal mucosa with chronic use.^[16]

Furthermore, nicotine pouches have been associated with oral keratosis, a condition characterized by thickened patches on the mucosal surfaces, which can be a precursor to more serious conditions.^[17] The presence of flavorings and other additives in nicotine pouches may also contribute to their toxicity and adverse effects on oral tissues.^{[16][18]}

In the NRT products we quantified low levels of acetaldehyde, ammonia, cadmium, chromium, lead, nickel, uranium-235, and uranium-238.^[20]

Overall, while nicotine pouches may present a reduced risk compared to traditional tobacco products, they are not without significant oral health risks, including mucosal lesions, inflammation, and potential for keratosis.

The American College of Cardiology recommends nicotine patches as a first-line treatment for smoking cessation, emphasizing their benefits despite these potential side effects.

Nicotine has complex effects on blood flow, which can vary depending on the vascular bed and the duration of exposure.

Acute exposure to nicotine generally causes vasoconstriction. This effect is mediated by the release of catecholamines, which increase peripheral vascular resistance and reduce blood flow in certain vascular beds,

such as the skin and subcutaneous tissues. Nicotine also amplifies norepinephrine-induced vasoconstriction in human skin vasculature. ^[1-2]

In contrast, nicotine can induce vasodilation in specific vascular regions through different mechanisms. For example, in the mesenteric resistance arteries of rats, nicotine induces vasodilation via the release of calcitonin gene-related peptide (CGRP) from sensory nerves. Similarly, in the renal vasculature, nicotine causes vasodilation through the release of nitric oxide (NO) and activation of K⁺ channels.

Safety Profile: Nicotine patches are considered safe, even for patients with cardiovascular conditions. They do not induce the harmful cardiovascular effects associated with smoking, such as platelet aggregation or coronary vasospasm.

Long-term Use: Extended use of nicotine patches beyond the standard 8 weeks has been shown to be **safe** and can improve long-term abstinence rates. A study found that 24 weeks of treatment *was more efficacious* than 8 weeks, although extending beyond 24 weeks did not provide additional benefits (from an abstinence perspective).

Links:

1. <https://pubmed.ncbi.nlm.nih.gov/33786606>
2. <https://pubmed.ncbi.nlm.nih.gov/36736944/>
3. <https://pubmed.ncbi.nlm.nih.gov/11230877>
4. <https://pubmed.ncbi.nlm.nih.gov/22693036>
5. <https://pubmed.ncbi.nlm.nih.gov/36797299>
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