REVIEW ARTICLE

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Therapeutic approaches in smoking cessation

Podejścia terapeutyczne w rzucaniu palenia

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Abstract

Introduction and Objective. Smoking continues to be a significant public health threat, causing some 8 million deaths annually. Although awareness of the problem is growing and the number of smokers is decreasing, more effective methods are still being sought to support the fight against this addiction. The aim of this review is to present the latest methods of treating nicotine addiction, assessing their effectiveness and safety in the smoking cessation process.

Review Methods. In order to collect the latest research and scientific articles on the treatment of nicotine addiction, databases such as Google Scholar, Medline, and PubMed were searched. The analysis covered publications available until January 2025.

Brief description of the state of knowledge. Modern digital interventions provide convenient and personalized access to therapy. Alternative therapies, such as yoga or herbs, have yet to be studied for their effectiveness. Nicotine vaccines are also promising, although so far ineffective, may be an option in the future.

Summary. There are a number of therapies that have shown effectiveness, including both monotherapy and combination therapies, some of which, such as digital interventions, have the potential to become the dominant approach to treating addiction. While traditional therapies, such as pharmacological drugs, are still widely used, new approaches, such as nicotine vaccines, although currently not fully effective, require further research to determine their future potential. A concerted effort to improve awareness and availability of therapies could help reduce the number of smokers and improve public health.

Key words

smoking cessation, nicotine addiction, nicotinism

Streszczenie

Wprowadzenie i cel pracy. Palenie tytoniu nadal stanowi poważne zagrożenie dla zdrowia publicznego, powodując ok. 8 mln zgonów rocznie. Choć świadomość problemu rośnie, a liczba palaczy maleje, wciąż poszukuje się skuteczniejszych metod wspierania walki z tym nałogiem. Celem niniejszego przeglądu było przedstawienie najnowszych metod leczenia uzależnienia od nikotyny, a także ocena ich skuteczności i bezpieczeństwa w procesie rzucania palenia.

Metody przeglądu. W celu zebrania najnowszych badań i artykułów naukowych na temat leczenia uzależnienia od nikotyny przeszukano bazy danych takie jak Google Scholar, Medline i PubMed. Analiza objęła publikacje dostępne do stycznia 2025 roku.

Opis stanu wiedzy. Nowoczesne interwencje cyfrowe zapewniają wygodny i spersonalizowany dostęp do terapii. Terapie alternatywne, takie jak joga czy zioła, nie zostały jeszcze zbadane pod kątem ich skuteczności. Szczepionki nikotynowe również są obiecujące, choć jak dotąd nie dowiedziono ich skuteczności, i mogą być opcją w przyszłości.

Podsumowanie. Istnieje wiele terapii, które wykazały skuteczność, np. monoterapia, jak i terapie skojarzone, a niektóre z nich, takie jak interwencje cyfrowe, mogą stać się dominującym podejściem w leczeniu uzależnień. Podczas gdy nadal powszechnie stosowane są terapie tradycyjne, oparte na podawaniu leków, nowe podejścia, takie jak szczepionki nikotynowe, choć obecnie nie dowiedziono ich pełnej skuteczności, wymagają dalszych badań w celu określenia ich przyszłego potencjału. Wspólny wysiłek na rzecz poprawy świadomości i dostępności terapii może pomóc zmniejszyć liczbę palaczy i poprawić zdrowie publiczne.

Słowa kluczowe

nikotynizm, uzależnienie od nikotyny, rzucanie palenia

INTRODUCTION

In 2021, there were approximately 847 million male and 157 million female smokers worldwide [1]. Smoking harms both active and passive smokers, and is estimated to contribute to about 8 million deaths annually [2]. Tobacco-related deaths are mainly caused by smoking-related diseases, such as malignancies (e.g., lung cancer), cardiovascular diseases (e.g., heart disease), respiratory diseases (e.g., chronic obstructive pulmonary disease), tuberculosis, stroke, diabetes and gastrointestinal diseases [1]. Treating the effects of tobacco dependence is a major burden on health systems around the world [3]. Women are more vulnerable to the negative health effects of smoking than men [4]. The most common smokers are those aged 25–64, with lower levels of education, and often divorced, separated or widowed [5]. There is a growing awareness of the harmful effects of smoking on health [2] which is contributing to a gradual decline in the number of

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cigarette smokers [6]. Two-thirds of smokers say they want to quit [7], with almost half of them making an average of two attempts per year [8]. Those who succeed in quitting usually attempt to do so on an average of six times before achieving long-term abstinence [9]. Currently, only three methods are FDA-approved as smoking cessation aids: nicotine replacement therapy, varencline and bupropion [6]. No new drug has been approved for this indication since 2006 [7]. The best results in smoking cessation are achieved by combining psychotherapy with pharmacotherapy [10]. However, only 42% of countries have smoking cessation guidelines [3]. Lack of sufficient trained counselors and shortages in human resources hinder access to effective interventions. Inequalities in health care and insufficient cost-effectiveness of programmes limit their effectiveness, leading to many cases of untreated or relapsed smoking [11]. In 2024, for the first time ever, the World Health Organization (WHO) published smoking cessation guidelines [3].

The aim of this review is to present current treatments for nicotine dependence and analyze their effectiveness and safety in the context of the smoking cessation process.

MATERIALS AND METHOD

The literature review presents current therapies to support the treatment of nicotine addiction. A comprehensive literature search was conducted to identify all relevant studies published up to January 2025, using Google Scholar, Medline and PubMed databases. The selection of materials included both original and review publications; conference papers, master's theses and materials of an advertising nature were excluded. The following key words were searched: nicotine addiction, nicotine dependence, treatment of nicotine addiction.

Mechanism of addiction and risk factors. Nicotine addiction is a chronic brain disease that develops as a result of long-term tobacco use. The main component of cigarette smoke, nicotine, quickly reaches the brain, where it interacts with nicotinic acetylcholine receptors (nAChRs) [12]. Inhaling cigarette smoke causes nicotine to reach the brain in 7–30 seconds, delivering an average of 1 mg of nicotine per cigarette. This activates nicotinic receptors, which stimulate the release of dopamine in reward pathways in the brain. Smoking is the most addictive form of taking this substance, as it is the fastest way to deliver high concentrations of nicotine [5]. Nicotine binding to receptors in the brain triggers the release of dopamine, the neurotransmitter responsible for feelings of pleasure, leading to temporary euphoria and improved mood. However, with chronic nicotine exposure, the brain develops tolerance, meaning that increasingly larger doses are needed to achieve the same effect. When a smoker stops smoking, neurotransmitter release is impaired, resulting in withdrawal symptoms. Nicotine addiction is also reinforced by behavioural factors, such as conditioning [12]. Smoking becomes associated with specific situations, such as driving, drinking coffee or a particular meal, making it part of a daily routine. In addition, activities associated with smoking, such as the smell of smoke, the taste or touch of a cigarette, become triggers for the desire to light up [12, 13]. Risk factors for tobacco addiction include both genetic predisposition and environmental influences. Parental smoking, impulsivity, environmental influences and difficult childhood experiences increase the likelihood of developing an addiction in adulthood [5].

Cognitive-behavioural therapy. Cognitive-behavioural therapy for treating nicotine dependence combines cognitive (such as managing emotions and nicotine cravings), behavioural (modifying habits and building support networks) and motivational (therapist reinforcement of motivation) components to effectively help people quit smoking and maintain abstinence [7]. According to the 2024 WHO guidelines, brief councelling (lasting between 30 seconds and three minutes) is recommended for all tobacco users, regardless of their readiness to quit. [3] An example of techniques in behavioural therapy can be the 5A intervention, which is often used by family physicians [14]. The components of the 5A intervention are explained in Figure 1. Individuals interested in smoking cessation should be offered more intensive support [3]. Longer forms of therapy are also available, including shorter individual sessions (10–15 minutes) and longer sessions (50–60 minutes) [7]. A meta-analysis of 23 studies found that behavioural support is effective for smoking cessation without causing harm. It has been indicated that the benefits of councelling may be greater when the potential financial savings from quitting smoking are taken into account [15]. There is no conclusive evidence about which form of support – individual, group or telephone – is more effective; the choice should be tailored to the needs of the individual patient [3].

A systematic review of communication practices in primary care noted that linking health problems to a patient's habits can elicit resistance; therefore, it is more effective to refer to topics raised by the patient or to have a question-and-answer dialogue [16]. Implementing brief anti-smoking councelling in conjunction with citicoline is proving to be a cost-effective and efficient strategy at the national level. A study has shown that increasing the coverage of behavioural support with the addition of cytisine can yield significant health and economic benefits at the population level, such as in the Netherlands or England, at a relatively low cost [17]. Moreover, the benefits of behavioural therapies may be under estimated [18].

Ask (about use, history and smoking habits)
Advice (discuss health risks & encourage to quit)
Assess (willingness to quit)
Assist (help create best plan to quitting)
Aarange (for follow up)

Figure 1. Components of the 5A intervention [14]

Digital interventions for smoking cessation. Modern digital interventions for smoking cessation are a promising form of therapy that can be used alone or in combination with other methods [3]. Potential is seen in these tools especially due to the prevalence of smartphones [3, 9, 19]. Sha et al. in a meta-analysis showed that digital interventions have moderate efficacy in smoking cessation, comparable to most traditional therapies, although pharmacotherapy with varenicline remains more effective. However, the drugs are associated with risks of side-effects. The results suggest that digital interventions may be as effective as behavioural therapies [11]. Amiri et al. reached similar conclusions,

showing that digital interventions significantly increase both continuous abstinence (OR = 1.68) and prolonged abstinence (OR = 1.60) [20]. Luo et al. noted the effectiveness of social media-based interventions in smoking cessation. Participants in these programs achieved higher rates of 7-day abstinence compared to both baseline and control groups. Abstinence was confirmed bio-chemically in about half of those declaring abstinence. Advantages of these methods include their universality and low cost [21].

Studies of digital support for smoking cessation among pregnant women have identified major advantages, such as convenience, greater privacy and impartiality. However, limitations have also been noted, including lower effectiveness and lower user engagement [19]. Interactive digital tools can be easily customized, making them particularly useful in developing countries or among populations with limited access to traditional health services [9].

Pharmacotherapy. According to the guidelines of the Agency for Healthcare Research and Quality (AHRQ), the primary drugs for treating nicotine dependence are varenicline, bupropion, and nicotine replacement therapy (NRT) [22]. Varenicline acts as both an agonist and antagonist of nicotinic receptors, alleviating nicotine craving and blocking the addictive effects of nicotine. It also increases basal dopamine release while reducing nicotine-induced dopamine release, which reduces the desire to reach for cigarettes [23]. A study by Shang et al. showed that varenicline is the most effective drug in monotherapy [1], and its efficacy is particularly noticeable in women [6]. Bupropion, approved in 1997, inhibits norepinephrine and dopamine reuptake, which helps with smoking cessation [24]. It acts selectively, minimizing the risk of side-effects, such as sedation and gastrointestinal problems [25], and is particularly beneficial for overweight people, as it can prevent weight gain after quitting smoking [26]. NRT delivers nicotine in a controlled manner, helping to gradually reduce addiction. It works by stabilizing nicotine levels, preventing the fluctuations characteristic of smoking [27]. A cohort study showed that after two years, 28.8% of varenicline users and 24.3% of NRT users maintained abstinence [28]. Patches are the most effective form of NRT, while sprays and inhalers are the least effective [12]. When first-line medications are ineffective or intolerant, clonidine and nortriptyline are recommended [22]. A 2022 meta-analysis showed that combination therapies, such as varenicline with NRT or bupropion, are more effective than monotherapies [1]. Cytisine, a natural alkaloid, is a promising drug for the treatment of nicotine dependence, and is scheduled for approval in this indication in 2025 [7]. It increases abstinence by 5.1% at six months and by 11.1% in the longer term, compared to placebo, showing similar efficacy to varenicline, but with fewer side-effects. Compared to NRT, varenicline showed 6.2% higher efficacy, but caused more adverse events [29]. It is a cheaper alternative to varenicline and has a shorter duration of therapy. It is indicated that cytisine is one of the oldest smoking cessation aids [30]. Herbal therapies, such as lavender oil and Vernonia cinerea extracts, may complement treatment, although they require further research [31].

E-cigarettes. These devices operate on the principle of battery power, converting a liquid containing nicotine or other substances into an inhaled aerosol that mimics the experience of smoking traditional cigarettes. Currently, there is no conclusive evidence that nicotine e-cigarettes increase smoking cessation rates compared to NRT therapy and compared to nicotine-free e-cigarettes [32]. Furthermore, it is proposed that e-cigarettes should be covered by tobacco control policies, including bans on their use in places where smoking traditional cigarettes is prohibited. Educational campaigns should be conducted and marketing restrictions introduced. Claims that e-cigarettes are an effective smoking cessation aid should also be prohibited [33, 34].

Yoga. Yoga has been proposed as an alternative method to support traditional smoking cessation techniques. Studies have shown that yoga participants were 37% more likely to achieve nicotine abstinence compared to those participating in a cognitive-behavioural therapy programme. It has been noted that yoga may particularly increase the chances of successful abstinence among occasional smokers [35]. Other studies indicate positive effects of yoga and cognitive-behavioural therapy in the smoking cessation process, especially at the end of treatment [36]. Rosen et al. found that yoga can be an effective adjunct to smoking cessation therapy, improving overall well-being and feelings of relaxation among participants [37].

Mindfulness techniques. It has been noted that mindfulness-based techniques can be an effective therapeutic method for treating substance abuse [38]. A 2016 study showed that 25.2% of participants in the mindfulness group maintained abstinence for more than four months, compared to 13.6% of those in the control group [39]. In another study, mindfulness meditation had no significant effect on reducing cigarette smoking or abstinence, compared to the control groups [40]. Studies indicate that the improved quality of life resulting from mindfulness training can shorten treatment time and reduce the risk of relapse. The therapy also reduces symptoms such as irritability, anxiety and stress. Mindfulness appears to promote mental health which, in turn, can promote long-term abstinence from nicotine [38]. In 2023, mindfulness techniques were confirmed to be helpful in smoking cessation, as well as supporting coping with other health behaviours [41].

Hypnotherapy. In 14 studies comparing hypnotherapy with 22 different control interventions, there was no reliable evidence that hypnotherapy provided greater benefit over other methods or no treatment in the smoking cessation process [42]. However, in a more recent review based on 33 studies, 66.7% of participants reported a positive effect of hypnotic intervention on smoking cessation [43]. In a meta-analysis based on nine randomized, controlled trials, hypnotherapy was shown to increase smoking cessation, with a SMD = 1.32. This indicates a moderate but statistically significant effect of this intervention [44]. Another study found no significant differences between hypnotherapy and cognitive-behavioural therapy after 12 months. Hypnotherapy also had no effect on reducing the number of cigarettes smoked in those who did not quit [45].

Family and social support. It has been indicated that informing those close to you of your intention to quit smoking can create a supportive environment conducive to success in the process. In addition, it is important to avoid so-called

Table 1.

Method	Effectiveness	Side-effects/remarks
Cognitive-behavioral therapy	Effective, especially when combined with pharmacotherapy. Short advice (30 seconds - 3 minutes) recommended by WHO [3].	No serious side-effects. May cause resistance if not tailored to patient's needs [16].
Digital interventions	Moderate effectiveness, comparable to behavioural therapies [11, 20].	Low cost, convenience, but less user involvement [19].
Pharmacotherapy	Varenicline: most effective in monotherapy [1]. Bupropion: indicated especially in overweight patients [26]. NRT: slightly less effective than varenicline [12]. Cytisine: similar efficacy to varenicline [29]. Herbal medicines can supplement treatment [31].	The different therapies vary in duration and cost. [30].
E-cigarettes	Moderate evidence of efficacy in smoking cessation therapy [32, 33].	They cannot be an alternative to regular cigarettes due to lack of sufficient research. [34]
Yoga	37% greater chance of abstinence compared to cognitive-behavioural therapy [35].	Improved mood and relaxation [37].
Mindfulness techniques	25.2% abstinence after 4 months in the mindfulness group vs. 13.6% in the control group [39].	Reduction of stress, anxiety, and irritability. Mental health support [38, 41].
Hypnotherapy	Moderate efficacy (SMD = 1.32) [44]. No significant differences with cognitive-behavioural therapy [45].	No serious side-effects, but efficacy not always proven [42, 43].
Family and social support	Can reduce the number of smokers by 16-32% [47].	Effectiveness dependent on family structure and cultural differences [46]..=
Nicotine vaccines	No efficacy in human studies [48, 49].	Further research is needed to assess the potential [48].

'triggers', i.e., situations, places or people that may trigger the desire to light up [39]. It is noted, however, that there are too few studies evaluating the involvement of family members in smoking cessation interventions. It is also worth noting that the results of such interventions may vary depending on family structure and cultural differences [46]. Other studies indicate that introducing a family intervention that promotes a supportive attitude can reduce by 16–32% the number of smokers or those experimenting with smoking [47].

Nicotine vaccines. High hopes have been placed on nicotine vaccines as a potential tool for treating tobacco dependence. Their action was supposed to mimic the mechanism of the immune system – similar to infectious diseases, these vaccines were supposed to stimulate the body to produce antibodies that bind nicotine in the blood, forming complexes too large for them to pass through the blood-brain barrier. Despite the promising results obtained in animal model studies, they have not been replicated in humans [48]. Another review of 15 studies found no evidence for the efficacy of nicotine vaccines [49]. The need for further studies to assess their potential for treating nicotine dependence is indicated [48]. A summary of efficacy, side-effects and comments on each therapy is summarized in Table 1.

CONCLUSIONS

Smoking remains a significant threat to public health, contributing to millions of deaths annually. Despite the decline in the number of smokers, more effective methods of combating this addiction are still being sought. A review of the literature indicates that currently available therapies include both pharmacological and behavioural approaches, as well as modern digital interventions and alternative approaches. Successful treatment of nicotine addiction requires an individualized approach, combining pharmacotherapy with behavioural interventions and social support. Modern approaches, such as digital interventions, can complement traditional therapies, making treatment more accessible and effective. Further research into alternative therapies and nicotine vaccines may bring new opportunities in the fight against this global health problem.

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