

Can dance and health-related training be effective in helping women quit smoking?

GRAŻYNA SZMYT¹, TOMASZ PODGÓRSKI², AGNIESZKA SZMYT¹, JOANNA GRONEK³,
ROMAN CELKA³, KONRAD JAKUBOWSKI¹

Abstract

Smoking as a major social and health problem in 20-30-year-old women. About 70% nicotine addicted are determined to kick the habit with the aid of one of available smoking quitting methods such as medication, behavioral therapy, self-control or group support. Authors analyze different smoking quitting programs.

KEYWORDS: nicotine addiction, therapeutic programmes.

Received: 20 September 2015

Accepted: 25 November 2015

Corresponding author: podgorski@awf.poznan.pl

¹ University School of Physical Education, Department of Dance Sciences, Poznań, Poland

² University School of Physical Education, Department of Physiology, Biochemistry and Hygiene, Poznań, Poland

³ University School of Physical Education, Department of Gymnastics, Poznań, Poland

What is already known on this topic?

One of reasons of the low effectiveness of commonly available smoking quitting methods is the fact that the causes of nicotine addiction are still unclear. Another adverse factor affecting tobacco addiction is the ever *faster lifestyle*, increasing stress and limited time for relaxation, healthy eating and regular physical activity. These are all hindrances to effective smoking cessation.

Smoking addiction is a chronic and recurrent disorder accompanied by forced smoking behaviors aimed to reach for a cigarette, despite the common awareness of smoking harmfulness [1]. Smoking is a serious medical and social problem [2]. Every day people smoke about 15 billion cigarettes worldwide [3], and according to the World Health Organization (WHO) more than a billion people worldwide are active smokers. More than 50% of the Chinese population smoke cigarettes (cf. 20% in the USA and 27% in Poland), and about 1.2 million Chinese die of tobacco-related diseases every year. Following global standards China introduced a nationwide smoking ban in public places, which is, in fact, commonly disregarded. In 2011, about 5 million tobacco-related deaths were recorded worldwide, i.e. one in ten smokers [3]. Tobacco smoking is estimated to be responsible for more deaths annually than AIDS, car and airplane crashes and all military conflicts combined. Currently, about 45.5% of men and 12% of women smoke cigarettes, and every day about 100 thousand young people fall into the habit under the influence of advertising campaigns of tobacco companies [4]. Even limited cutting down on smoking can be effective and prevent premature death [5]. Smoking is, in fact, one of the most significant factors of premature death [2].

Figure 1 shows a world map of 187 countries classified according to the level of tobacco consumption by men and women combined. Countries were classified as those with low prevalence of smoking, if their age-standardized prevalence was below the median of all 187 examined countries. Cigarette consumption was estimated as low, medium, or high. Countries with low cigarette

consumption (10 and fewer cigarettes a day) were marked in blue, and countries with medium consumption (10 to 20 cigarettes a day) in green. Countries with high cigarette consumption (20 and more cigarettes a day) include China, Russia, Kazakhstan, USA, Canada, Brazil, and Australia. Poland is classified as a country with medium cigarette consumption and higher prevalence [2]. The global annual sales of the tobacco industry amount to 263 billion US dollars [6]. Poland remains a country with one of the highest prevalence of smoking among women (Figure 2).

Figure 3 demonstrates the numbers of cigarettes smoked daily in 2012 with regard to smokers' age. The daily consumption rate is different for developed and developing countries. Women aged 20-24 years smoke significantly more cigarettes daily in countries with a high GDP (about 22%) than in slowly developing countries with a low GDP (about 3%). Also the daily consumption of cigarettes in rapidly developing countries decreases with smokers' age [6]. The Poles are a population of heavy smokers, and although the number of tobacco-addicted adults has

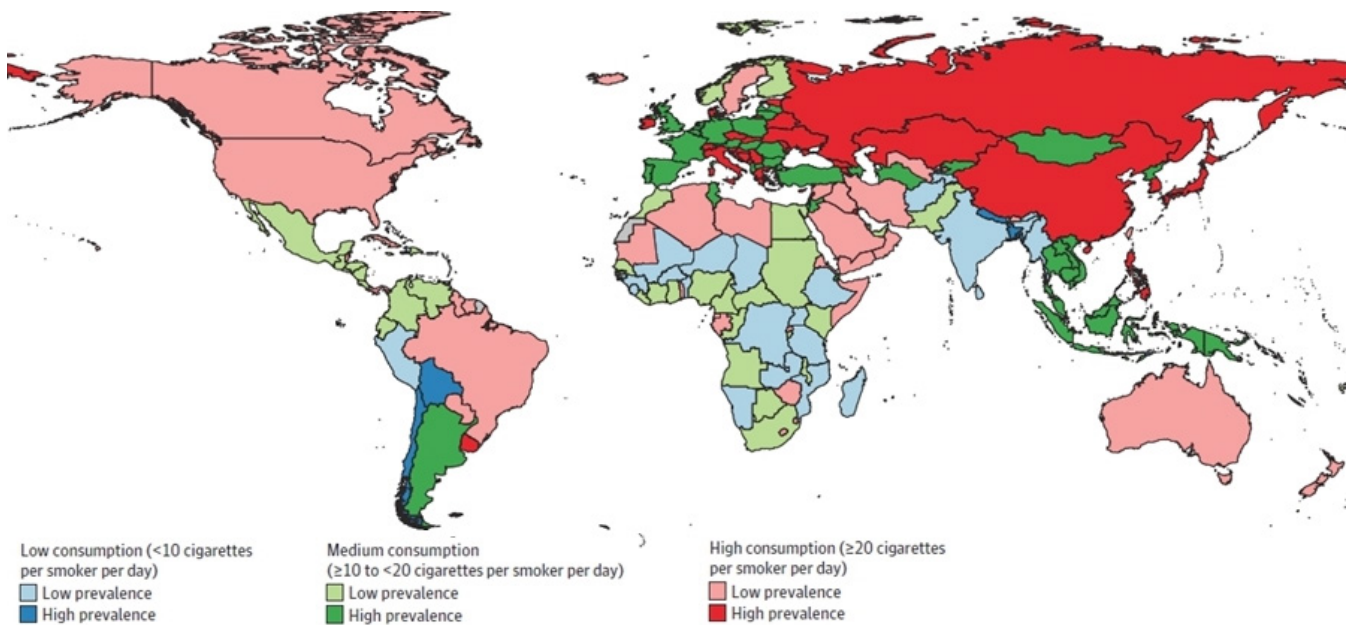


Figure 1. Daily smoking consumption and prevalence in men and women in 2012 [adapted from Ng et al., 2014]

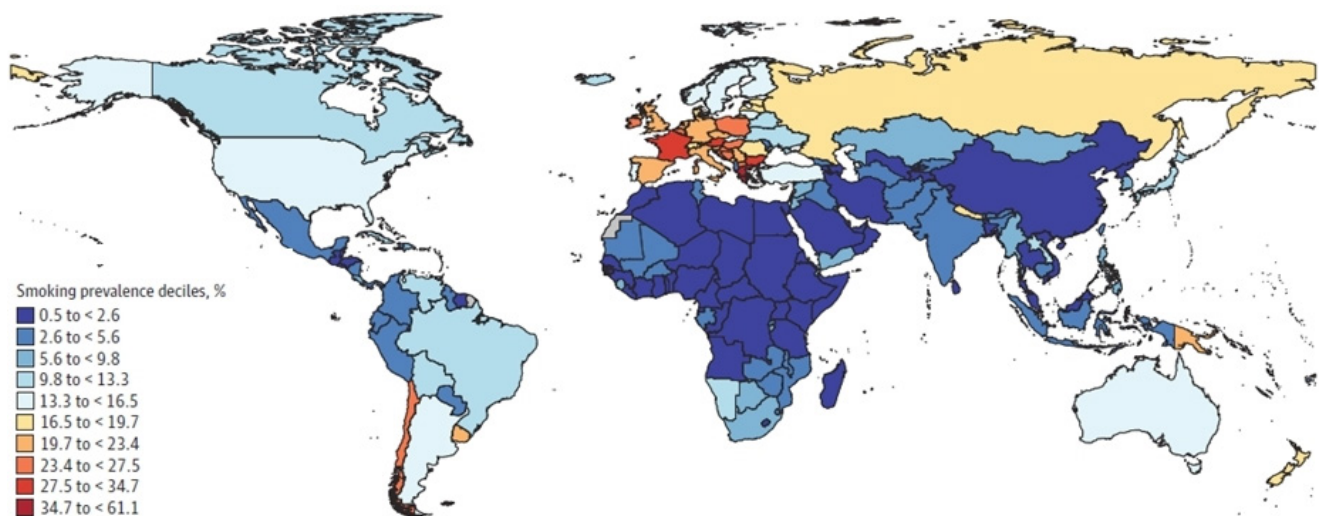


Figure 2. Prevalence of daily smoking among women worldwide in 2012 [6] adapted from Ng et al., 2014

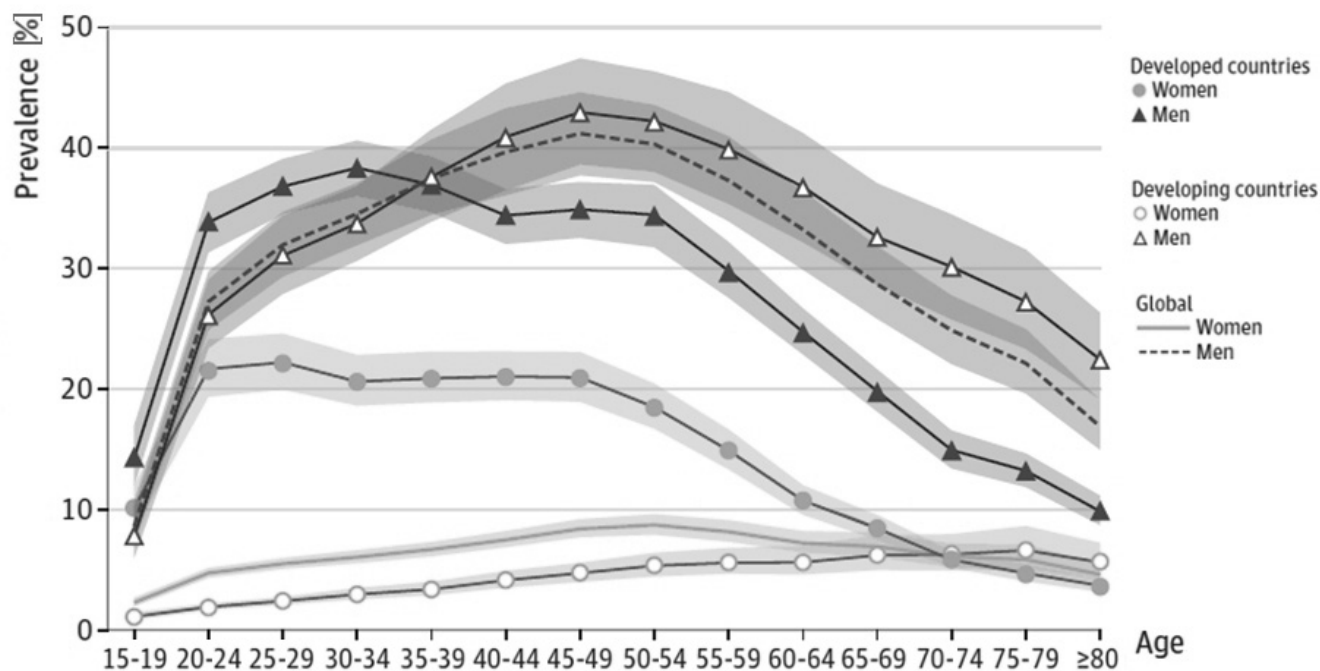


Figure 3. Number of cigarettes smoked daily with regard to women's and men's age (adapted from Ng et al., 2014)

decreased in recent years for 10%, more and more young Poles take up smoking. 22% of Poles aged 18-20 years admit to smoking regularly, and 15% to smoking occasionally. There has been a slight decreasing trend in the percentage of male smokers, but not female smokers [7]. 27% of adult Poles (33.5% of men, 21% of women) and 29% of adult Ukrainians (50% of men and 11.2% of women) are addicted smokers [3], i.e. about 20 million citizens of both states. It is disturbing that 8.5% of Polish smokers claim that smoking does not affect their health [3]. According to Doll et al. [9] non-smokers live ten years longer than smokers, and it is estimated that smoking a cigarette shorten's one's life for 11 minutes [9, 10, 11].

The WHO asserts that tobacco is a legally available product which causes negative consequences for both active and passive smokers. Tobacco is widely available due to its low price and little knowledge of the health consequences of its long-term use. There is a need for a coherent policy of smoking control worldwide [12]. On March 21, 2003 the World Health Organization adopted the Framework Convention on Tobacco Control [13]. This first ever international treaty on public health has been adopted by 169 countries and is legally binding in 124 countries populated by about 2.3 billion people. Poland signed the treaty on June 14, 2004, ratified it on September 15, 2009, and it is bound by

its provisions since the ratification. The Convention was signed by all EU member states. The Convention signatories, witnessing the increasing losses incurred by „the tobacco epidemic” decided to minimize them by gradually implementing a number of measures. In December 2012 the European Parliament approved the EU Tobacco Products Directive which stipulates that health warnings should cover 65% of the front and back surface of the unit packet. The Directive also regulates the production of flavored cigarettes and slim cigarettes with a diameter of less than 7.5 mm. From 2016 the production of cigarettes with flavoring additives will be prohibited, with the exception of menthol cigarettes subject to a four-year transition period until 2020. The directive is opposed by Poland which is one of the world's biggest tobacco producers, and the second largest tobacco producer in the European Union.

Smoking as a major social and health problem in 20-30-year-old women

Smoking is becoming more and more popular among girls and young women. The extensive marketing of light cigarettes has, in fact, contributed to an increase in smoking addiction in this particular age group of the general population [14]. A significant number of young smokers are students of medicine [15]. Research shows that Polish students of health-related majors [16]

smoke light cigarettes significantly less often than their counterparts from France, Britain or the United States [17, 18]. This tendency may be caused by a popular conviction that light cigarettes are far less hazardous to health than regular “full-flavored” cigarettes [18, 19]. The impact of advertising of young people’s choices of cigarette brands is also highly significant. A study in Poland conducted by Siemieńska et al. in 2006 revealed that the majority of young smokers (students) negate any potential influence of ads on their choice of a cigarette brand [16]. The attitude to smoking of representatives of women’s professional groups associated with health, which – it may appear – should be setting the non-smoking trend, is crucial. Unfortunately the percentage of smokers among young female students is still very high. According to a 2006 survey, 40% of Polish female university students admitted smoking addiction [20]. These results were then authenticated by a survey from 2012, in which 41% of full-time female students admitted to smoking cigarettes. This figure did not change significantly for six years, and the negative consequences of smoking are now obvious. Results of studies on the consequences of smoking are published systematically [21].

The chemical compounds in tobacco smoke have a number of adverse effects on the human body. Nicotine affects the circulatory system by increasing heart rate, stroke volume, and cardiac output, and thus leading to higher oxygen uptake and arterial blood pressure [22]. Nicotine is delivered to the body not only by smoking cigarettes but also in the course of nicotine replacement therapy (NRT) in medication and dietary supplements. Nicotine is an organic chemical compound found in the roots and leaves of cultivated tobacco and in low levels in some other plants of the nightshade family (e.g. tomatoes) [23, 24]. It is a colorless substance which turns brown when air-exposed [24]. It is a strong agonist of N-acetylcholine receptors affecting acetylcholinergic receptors (nAChR), in particular, the $\alpha 4\beta 2$ receptors [25]. Nicotine binds with the nAChR of the ganglia of the autonomic nervous system and the central nervous system, affecting the function of the sympathetic and parasympathetic branches and the adrenal medulla [26]. The central nervous system is affected in a complex manner by more than 20 neurotransmitters, and nicotine promotes the release of three of them: dopamine, serotonin, and noradrenaline [27, 28]. Smoking cigarettes elevates the level of dopamine in the brain, which is characteristic of multiple addictive substances. The rise of dopamine concentration in the mesolimbic pathway affects one’s good mood, suppresses appetite,

and reduces anxiety [29, 30]. Nicotine is a highly toxic substance. A single intravenous dosage is lethal as it paralyzes the central and peripheral nervous systems, attacking mainly the respiratory chest muscles. It enhances the secretion of vasopressin, angiotensin II, and endothelin-1, increasing the risk of thrombophilia [31]. About 70-80% of nicotine is converted in the liver into cotinine [24].

Through the central nervous system nicotine influences indirectly the adrenal medulla and vegetative ganglia, and directly the blood vessels. A characteristic intensifying symptom in smokers is a decrease of capillary and arterial blood flow and reduced blood supply to some organs. This may lead to myocardial infarction and diseases of peripheral blood vessels, e.g. obliterative atheromatosis of lower limb arteries [32].

The respiratory system is particularly vulnerable to tobacco smoke, which increases respiratory epithelial permeability and impairs the function of the ciliary apparatus. It starts as a mild inflammation of the bronchial mucosa, manifested by morning cough and coughing up some sputum. Next, chronic bronchiolitis and obstruction of distal airways develop, which are manifested by lower tolerance to physical exercise, periodic shortness of breath, and fits of coughing [32]. Smoking is in 85-90% of cases inextricably linked to the development of chronic obstructive pulmonary disease (COPD) [33]. It is also responsible for lesions in the digestive track. Nicotine inhibits pancreatic excretion, reduces the blood flow in the alimentary system, and inhibits intestinal peristalsis leading to indigestion. Clinical studies show that smokers suffer more frequently from gastric and duodenal gastric disease, mouth and throat cancer, and large bowel cancer [32]. Despite the common awareness of the harmfulness of smoking the percentage of young women smoking is still high. Quitting is particularly difficult for people who started smoking before the age of 18 years. However, many smokers realize that smoking cessation can bring good results. College years are very significant for the development of healthy attitudes, therefore through systematic preventive activities and properly directed educational activities the percentage of young female student smokers should decrease [34, 35].

Therapeutic methods of smoking cessation

It is estimated that among more than one billion people addicted to nicotine in the world, about 70% are determined to kick the habit with the aid of one of available smoking quitting methods such as medication, behavioral therapy, self-control or group support.

One of the reasons for the limited effectiveness of the available smoking cessation methods is the fact that the causes of tobacco addiction are still not adequately explained [36]. Another adverse factor affecting tobacco addiction is the ever *faster lifestyle* with increasing stress and too little time for relaxation, healthy eating and regular physical activity.

Significant differences in nicotine dependence are observed between men and women [37]. While men tend to smoke to pass the time and to relax, for women smoking is a way to calm down. These two different motivations indicate that tobacco cessation therapy should be different for each sex. Women find it more difficult to quit smoking, and their psyche encompasses specific anxieties related to nicotine-addiction and fear of gaining weight after smoking cessation. In women, unlike in men, the psychological grounds for nicotine addiction are more significant than the somatic grounds. Thus in men, a more effective method of smoking cessation are nicotine patches, whereas in women it is behavioral therapy. What is interesting, Caleyachetty et al. [38] revealed that experiencing financial difficulties has little impact on making quit attempts.

The increase of the excise tax on cigarettes in Poland and thus higher prices of cigarettes are unrelated to the number of smoking quit attempts. In fact, the high price of a pack of cigarettes does not discourage smokers from smoking.

Humans differ in their ability to quit smoking. Half of these individual differences are heritable genetic influences [39]. It is agreed that nicotine dependent people who quit smoking abruptly have greater chances to kick the habit than people who gradually cut down on the number of cigarettes smoked a day [40]. The biggest incentive to smokers is the fact that smoking cessation brings all kinds of benefits – not only health-related – regardless of age. Quitting smoking even after the age of 60 seems to have a beneficial effect on both prolonging life and improving the quality of life. It is, however, undisputable that quitting smoking as early as possible will bring the best results. People who quit smoking before the age of 30 live almost as long as those who never smoked in their life. A few days after quitting smoking the human body begins to make up for the damage done by the toxic components in a cigarette. Blood circulation as well as pulmonary function become improved, while coughing and breathlessness gradually subside. With time the risks of circulatory and pulmonary diseases and lung cancer become reduced. There is an observable improvement in physical fitness, the breath becomes fresher, and the senses of smell

and taste become sharper. Finally, one's self-esteem is greatly improved [41].

Smoking cessation is a long and multi-stage process involving cognitive, motivational, emotional, volitional, and behavioral changes [42]. A few hours after quitting smoking sudden withdrawal symptoms may appear such as irritability (frustration, anger), anxiety neurosis, sleeplessness, feeling depressed, concentration problems, decreased heart rate, and increased appetite. Quitters experience an intensification of these symptoms after 1-4 days, but after 3-4 weeks the levels of these symptoms return to baseline. Increased appetite may even last longer than 6 months, and it may lead to greater body weight and a desperate craving for a cigarette [42].

Methods of tobacco addiction treatment

It seems that every addiction treatment method is effective, if it leads to the successful attainment of the assumed goal. Studies have confirmed the effectiveness of antismoking counseling, varenicline and bupropion, as well as nicotine-based medications. The efficiency of other methods such as acupuncture, aromatherapy, hypnotherapy, laser therapy, bioresonance therapy or homeopathy has not been scientifically confirmed with clinical tests [43, 44].

Nicotine replacement therapy (NRT)

NRT is a reinforcing nicotine addiction therapy based on a combination of psychotherapy and pharmacotherapy aimed at developing substitute patterns of behavior in smokers who want to reach for a cigarette. NRT is used for preventing craving for tobacco and sudden withdrawal effects by remedial administration of nicotine to the body. Tobacco addiction therapy may also use medications reducing tobacco craving symptoms and antidepressants affecting the central nervous system by increasing dopamine and noradrenaline levels in the brain. Like nicotine, they influence the reward system and thus help alleviate symptoms of abrupt withdrawal. Effective substances include nicotine-based drugs, bupropion hydrochloride and varenicline.

In the self-control method a smoker controls his or her dependence, for example, by changing various smoking rituals such as smoking while having a morning coffee. Self-control is about removing a link in the smoking habit chain. The most common physical and psychical factors conducive to smoking are certain routine activities which increase the craving to reach for a cigarette, e.g. drinking coffee, having a break, finishing a meal, drinking alcohol, being among smokers or meeting friends, in particular, in places associated with smoking (pubs, clubs) [4, 21].

Behavioral therapy

Behavioral tobacco dependence consists of performing routines related to taking nicotine in order to experience pleasure or avoid bad moods. The ritual of holding or lighting a cigarette increases tobacco dependence and hinders smoking cessation. Most often smokers take nicotine in specific situations (after a meal, in company of others, while drinking alcohol or coffee) developing a conditioned reflex of reaching for a cigarette in circumstances associated with smoking.

Group support involves elements of health education and group counseling aimed at overcoming smoking addiction. Group therapy allows for an exchange of experiences, observations and individual ways to cope with the urge to smoke in different situations. Quitters can benefit from others' experiences and support and work on the process of smoking cessation under the guidance of professional therapists [46].

Physical exercise and dance

A number of smoking cessation programs involve intensive physical activity [47, 48]. Physical exercise can provide a prospective quitter with extra strength and motivation to fight the habit, but not only. There is no one perfect method of changing one's behaviors towards smoking. Physical activity is a great alternative to smoking. Physical exercise at any age leads to an improvement in one's physical fitness and ability to work effectively [49, 50]. Smoking is often related to reduced fitness capabilities of the body [51, 52], which can be effectively restored thanks to physical exercise [53]. It is not a fast and smooth process; however, the achieved effects would discourage quitters from reaching for a cigarette as it would pose the risk of wasting the hard-won efforts to attain those effects. Exercise-induced stimulation of the circulatory, respiratory and hormonal systems as well as thermoregulation is important for removal of toxins accumulated in the body due to smoking. An exercise-induced better frame of mind helps everyone fight the habit. Very often quitters are afraid of gaining weight. The process of quitting smoking is stressful to the body. Smoking is often replaced by a different habit, e.g. compulsive eating. Physical exercise not only reduces psychophysical tension thanks to the stimulation of the production of endorphins and serotonin [54, 55], but is also related to intensified metabolism. Physical activity consumes the surplus energy and thus effectively curbs the undesired weight gain [56]. Certainly, it must be stressed that the problem of overweight is also age-related. At later stages of life it becomes more and more

difficult to maintain proper body weight. It is related to a naturally lower metabolism rate and physical activity level. Undertaking intensive physical activity should be linked to at least one more partial lifestyle change. Living an active life requires healthy nutrition and proper rest. Such lifestyle changes will enable us to derive great satisfaction from physical exercise, and will reduce the stress of daily life.

Among the most recommended forms of physical activity for smoking quitters are endurance exercises such as jogging, cycling, swimming, cross-country skiing, aerobics or Nordic walking. They are widely available and inexpensive. Endurance exercises can be performed for a minimum of 45-60 minutes, can effectively distract quitters from the urge to reach for a cigarette, and have a beneficial effect on the condition of the cardio-respiratory system weakened by smoking. An alternative to endurance training could be gym exercises, which not only improve physical health but also mental strength so necessary for effective smoking cessation [57].

Lifestyle does affect the outcome of tobacco addiction therapy. Quitters must take care of healthy eating habits, proper amount of sleep and regular exercise adjusted to the physical capabilities of one's own body and one's fitness level. According to Jaskólski [58] physical fitness is the ability to perform long-term, intense physical exercise involving large muscle groups, without any homeostasis disturbances, after completion of which all physiological indicators should return to baseline. The necessary determinant of human physical fitness is a properly chosen training load. In order to improve one's training level a diversification of training volume and intensity is necessary. Exercise intensity must be individually adjusted for anyone beginning aerobic training, while adaptative processes are necessary before taking up anaerobic training [59].

Using basic parameters: physiological (pre- and post-exercise HR), temporal (exercise duration), biochemical (blood lactate), the following exercise zones (in % HR_{max}) [60, 61, 62] can be distinguished:

- Low exercise intensity (50-60% HR_{max}) – exercises mainly based on aerobic energy metabolism, with a minimal impact on fitness improvement, i.e. mostly fitness maintenance exercises.
- Moderate exercise intensity (60-70% HR_{max}) – exercises mainly based on aerobic energy metabolism, with a positive impact on fat burning, lasting from 30 minutes to 3 hours with constant training loads. These exercises are recommended to people taking up physical activity.

- High exercise intensity (70-85% HR_{max}) – exercises characterized by mixed aerobic-anaerobic energy metabolism, with high intensity lasting above 30 minutes with constant training loads. They lead to a rapid fitness improvement and high fat burn level.
- Maximal exercise intensity (above 85% HR_{max}) – exercises based on anaerobic, (lactate) energy metabz. The exercises should not last over 120 seconds.

The best health results can be obtained with moderate exercises at 60-70% HR_{max}. Well-trained individuals may slightly increase the intensity of their exercises reaching the high intensity exercise zone of 70-85% HR_{max}.

Regular physical activity is a not an easy smoking cessation method, but it is an aid effective for stress reduction, body detoxification, fitness and health improvement, overweight prevention, development of consistency in action, distraction of attention in „moments of weakness” and using up the free time once occupied by smoking. Quitters should take up physical activity also to simultaneously maintain their proper body weight.

Different smoking quitting programs have been developed to minimize the consequences of smoking. It appears that a combination of cognitive skills, concentration training and regular physical exercise, i.e. shifting one's attention from smoking to physical exercise, can bring most significant results for smoking quitters [63, 64].

Although there are many different smoking cessation programs, none of them remains 100% effective. The search for the most perfect method still continues.

What this paper adds?

Different smoking quitting programs have been developed to minimize consequences of smoking. The present paper is an analysis of effectiveness of different methods or combinations of methods of overcoming nicotine addiction. It appears that a combination of cognitive skills, concentration training and regular physical exercise, i.e. shifting one's attention from smoking to physical exercise, can bring significant results for smoking quitters.

References

1. Le Foll B, Goldberg SR. Nicotine as a typical drug of abuse in experimental animals and humans. *Psychopharmacology*. 2006; 184(3-4): 367-381.
2. Zeller A. Medical therapy for smoking cessation. *The Umsch*. 2010; 67(8): 419-425.
3. Gawriljuk K, Obermayer L, Burzyński K. Respect your Health – Euroschools 2012. Projekt Społeczny Uniwersytet Warszawski 2012, Streetfootballworld GmbH.
4. Woronowicz B. Uzależnienia. Geneza, terapia, powrót do zdrowia. Wyd. Eduk. Parpamedia. Media Rodzina. 2009; 410-422.
5. Florek E, Piekoszewski W. Alternatywna metoda zaprzestania palenia – od ograniczenia do zaprzestania. *Przeg Lek*. 2006; 63(10): 1108-1110.
6. Ng M, Freeman M, Fleming T, et al. Smoking prevalence and cigarette consumption in 187 Countries, 1980-2012. *J Am Med Association*. 2014; 311(2): 183-192.
7. Wronkowski Z, Zwierko M. Miejsce i znaczenie promocji zdrowia w zwalczaniu nowotworów złośliwych. W: Karski JB, Promocja zdrowia. Warszawa, Ignis. 1999: 108-119.
8. Global Adult Tobacco Survey (GATS) Poland and Ukraine 2010.
9. Doll R, Peto R, Wheatley K, Gray R, Sutherland I. Mortality in relation to smoking: 40 years' observations on male British doctors. *Br Med J*. 1994; 309(6959): 901-911.
10. Phillips AN, Wannamethee SG, Walker M, Thomson A, Davey Smith G. Life expectancy in men who have never smoked and those who have smoked continuously: 15 year follow up of large cohort of middle aged British men. *Br Med J*. 1996; 313: 907-908.
11. Shaw M, Mitchell R, Dorling D. Time for a smoke? One cigarette reduces your life by 11 minutes. *Br Med J*. 2000; 320(7226): 53.
12. World Health Organization. Report on the Global Tobacco Epidemic. The MPOWER package. 2008.
13. World Health Organization (WHO). WHO Study Group on Tobacco Product Regulation: Report on the Scientific Basis of Tobacco Product Regulation: Third Report of a WHO Study Group. World Health Organization. Geneva. 2009.
14. Połucka-Molińska M, Wojciechowska M. Kształtowanie się statusu materialnego rodzin palących. *Przeg Lek*. 2006; 63(10): 1086-1089.
15. Kowalska A, Rzeźnicki A, Drygas W. Postawy i zachowania dotyczące palenia tytoniu studentów pierwszego roku Wydziału Nauk o Zdrowiu. *Przeg Lek*. 2006; 63(10): 1041-1044.
16. Siemińska A, Jassem JM, Uherek M, Wilanowski T, Nowak R, Jassem E. Postawy wobec palenia tytoniu wśród studentów pierwszego roku medycyny. *Pol Pneumonol Allergol*. 2006; 74: 377-382.
17. Jossieran L, Raffin J, Dautzenberg B, Brucker G. Knowledge, opinions, and tobacco consumption in a French faculty of medicine. *Presse Medicale*. 2003; 32(40): 1883-1886.

18. Borland R, Yong H, King B, Cummings M, Fong G, Elton-Marshall T, Hammond D, McNeill A. Use of and beliefs about light cigarettes in four countries: Findings from the International Tobacco Control Policy Evaluation Survey. *Nicotine Tob Res.* 2004; 6: 311-321.
19. Hamilton WL, di Stefano Norton G, Ouellette TK, Rhodes WM, Kling R, Connolly GN. Smokers' responses to advertisements for regular and light cigarettes and potential reduced-exposure tobacco products. *Nicotine Tob Res.* 2004; 6: 353-362.
20. Molski M, Barłóg A, Waligóra A, Dzikiewicz M, Ciołek K, Zaborowska K. Palenie tytoniu jako problem młodzieży studiującej. Badania przeprowadzone wśród studentów WSZPZiU w Poznaniu. W: Wpływ używek na zdrowie i urodę. Sesja Naukowa WSZPZiU, Poznań 2006; 51-64.
21. Naumann F. Pal zdrowo! Jak zmniejszyć szkodliwe skutki nałogu. MUZA SA, Warszawa. 2001.
22. Haley NJ, Hoffmann D. Analysis for nicotine and cotinine in hair to determine cigarette smokers' status. *Clin Chem.* 1985; 31(10): 1598-1600.
23. Benowitz NL, Hukkanen J, Jacob P. Nicotine chemistry, metabolism, kinetics and biomarkers. *Handb Exp Pharmacol.* 2009; 192: 29-60.
24. Hukkanen J, Jacob P. III, Benowitz NL. Metabolism and disposition kinetics of nicotine. *Pharmacol Rev.* 2005; 57: 79-115.
25. Szymańska JA, Frydrych B, Bruchajzer E. Nikotyna. Dokumentacja dopuszczalnych wielkości narażenia zawodowego. *Podst Met Oceny Środ Pracy.* 2007; 2(52): 121-154.
26. Tapper AR, McKinney SL, Nashmi R et al. Nicotine activation of alpha4* receptors: sufficient for reward, tolerance, and sensitization. *Science.* 2004; 306: 1029-1032.
27. Szajerska G, Kwiatkowska D. Metabolizm nikotyny – mechanizm i kliniczne efekty toksycznego działania. *Post Higieny Med Dośw.* 1997; 51(1): 23-38.
28. Wonnacott S, Sidphura N, Balfour DJK. Nicotine: from molecular mechanisms to behaviour. *Curr Opin Pharmacol.* 2005; 5: 35-59.
29. Di Chiara G. Role of dopamine in the behavioural actions of nicotine related to addiction. *Eur J Pharmacol.* 2000; 393: 295-314.
30. Dani JA, De Biasi M. Cellular mechanisms of nicotine addiction. *Pharmacol Biochem Behav J.* 2001; 70: 439-446.
31. Naruszewicz M. Wpływ palenia tytoniu na hemostatyczne czynniki ryzyka chorób sercowo-naczyniowych. Pamiętaj o sercu – Narodowy Program Profilaktyki i Leczenia Chorób Układu Sercowo-Naczyniowego. POLKARD. 2007.
32. Grady D, Ernster V. Does cigarette smoking make you ugly and old? *Am J Epidemiol.* 1992; 135(8): 839-842.
33. Kałucka S. Występowanie POChP w rodzinie osoby palącej papierosy. *Przeg Lek.* 2006; 63(10): 848-851.
34. Kowalska A, Rzeźnicki A, Drygas W. Postawy i zachowania dotyczące palenia tytoniu studentów pierwszego roku Wydziału Nauk o Zdrowiu. *Przeg Lek.* 2006; 63(10): 1041-1044.
35. Zysnarska M, Biskupska M, Połucka-Molińska M. Studenci położnictwa a nikotynizm. *Przeg Lek.* 2006; 63(10): 1045-1047.
36. Darlow S, Lobel M. Smoking behaviour and motivational flexibility in light and heavy smokers. *Addict Behav.* 2012; 37(5): 668-673.
37. Torchalla I, Okoli CTC, Hemsing N, Greaves L. Gender differences in smoking behaviour and cessation. *J Smoking Cess.* 2011; 6: 9-16.
38. Caleyachetty A, Lewis S, McNeill A, Leonardi-Bee J. Struggling to make ends meet: exploring pathways to understand why smokers in financial difficulties are less likely to quit successfully. *Eur J Publ Health.* 2012; 22(Suppl 1): 41-48.
39. Hall FS, Markou A, Levin ED, Uhl GR. Mouse models for studying genetic influences on factors determining smoking cessation success in humans. *Annals NY Acad Sci.* 2012; 1248(1): 39-70.
40. West R, Sohal T. „Catastrophic” pathways for smoking cessation. *Cochrane Review.* [W] The Cochrane Library, Oxford, Issue 1. 1999.
41. Zatoński W. Prof. Witold Zatoński radzi jak rzucić palenie. Centrum Onkologii-Instytut w Warszawie. 1999.
42. Zatoński W, Górecka D, Opolski G, Pużyński S, Radziwiłł K, Ziętek M. Konsensus dotyczący rozpoznawania i leczenia zespołu uzależnienia od tytoniu. *Med Prakt.* 2006; 7.
43. Borland R, Yong H, King B, Cummings M, Fong G, Elton-Marshall T, Hammond D, McNeill A. Use of and beliefs about light cigarettes in four countries: Findings from the International Tobacco Control Policy Evaluation Survey. *Nicotine Tob Res.* 2004; 6: 311-321.
44. Motyl A. Jak rzucić palenie? <http://www.medicover.pl/FileOpenCache/23095-poradnik-palenie.pdf>. 2010.
45. Woronowicz B. Uzależnienia. Geneza, terapia, powrót do zdrowia. Wydawnictwo Edukacyjne Parpamedia. Media Rodzina. 2009; 410-422.
46. Woynarowska B. Edukacja Zdrowotna, podręcznik akademicki. Wydawnictwo Naukowe PWN. Warszawa. 2012.
47. Marcus BH, Albrecht AE, Niaura RS, Abrams DB, Thompson PD. Usefulness of physical exercise for maintaining smoking cessation in women. *Am J Cardiol.* 1991; 68(4): 406-407.

48. Ussher MH, Taylor AH, West R, McEwen A. Does exercise aid smoking cessation? A systematic review. *Addiction*. 2000; 95(2): 199-208.
49. Fabre C, Massé-Biron J, Ahmaidi S, Adam B, Préfaut C. Effectiveness of individualized aerobic training at the ventilatory threshold in the elderly. *J Gerontol Series A: Biol Sci Med Sci*. 1997; 52(5): 260-266.
50. Ahmaidi S, Masse-Biron J, Adam B, Choquet D, Freville M, Libert JP, Prefaut C. Effects of interval training at the ventilatory threshold on clinical and cardiorespiratory responses in elderly humans. *Eur J Appl Physiol Occup Physiol*. 1998; 78(2): 170-176.
51. Hirsch GL, Sue DY, Wasserman K, Robinson TE, Hansen JE. Immediate effects of cigarette smoking on cardiorespiratory responses to exercise. *J Appl Physiol*. 1985; 58(6): 1975-1981.
52. Sidney S, Sternfeld B, Gidding SS, Jacobs DR Jr, Bild DE, Oberman A, Haskell WL, Crow RS, Gardin JM. Cigarette smoking and submaximal exercise test duration in a biracial population of young adults: the CARDIA study. *Med Sci Sports Exe*. 1993; 25(8): 911-916.
53. Albrecht AE, Marcus BH, Roberts M, Forman DE, Parisi AF. Effect of smoking cessation on exercise performance in female smokers participating in exercise training. *Am J Cardiol*. 1998; 82(8): 950-955.
54. Goldfarb AH, Jamurtas AZ, Kamimori GH, Hegde S, Otterstetter R, Brown DA. Gender effect on beta-endorphin response to exercise. *Med Sci Sports Ex*. 1998; 30(12): 1672-1676.
55. Craft LL, Perna FM. The benefits of exercise for the clinically depressed. *Primary Care Companion to the Journal of Clinical Psychiatry*. 2004; 6(3): 104-111.
56. Kawachi I, Troisi RJ, Rotnitzky AG, Coakley EH, Colditz GA. Can physical activity minimize weight gain in women after smoking cessation? *Am J Publ Health*. 1996; 86(7): 999-1004.
57. Ciccolo JT, Dunsiger SI, et al. Resistance training as an aid to standard smoking cessation treatment: a pilot study. *Nicotine Tob Res*. 2011; 13(8): 756-760.
58. Jaskólski A. *Podstawy fizjologii wysiłku fizycznego z zarysem fizjologii człowieka*. AWF. Wrocław. 2006.
59. Przybylski W, Szwarz A. *Piłka nożna – trening część II*. AWF. Gdańsk. 1998.
60. Bednarski L, Koźmin A. *Piłka nożna: podręcznik dla studentów i nauczycieli*. AWF. Kraków. 2004.
61. Olex-Zarychta D. *Fitness teoretyczne i metodyczne podstawy prowadzenia zajęć*. Fundacja Akademii Wychowania Fizycznego. Katowice. 2005.
62. Fortuna M. *Podstawy kształtowania i kontroli zdolności wysiłkowej tlenowej i beztlenowej*. Kolegium Karkonoskie w Jeleniej Górze (Państwowa Wyższa Szkoła Zawodowa). Wydawnictwo ALEX. Jelenia Góra. 2008.
63. Gronek P. *ABC sztuki koncentracji w sporcie – kinezjotrapping*. UNIBOX. Poznań. 2012.
64. Raupach T, Hoogsteder PH, Onno van Schayck CP. Nicotine vaccines to assist with smoking cessation: current status of research. *Drugs*. 2012; 72(4): e1-16.