Anxiety, depression and methods of stress coping in patients with nicotine dependence syndrome

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Summary

Background: Nicotinism is the most common addiction in Poland. Nicotine dependence is the cause of numerous behavioral diseases, including ischemic heart disease, neoplasms and chronic obstructive pulmonary disease. A question arises whether a tendency to anxiety and depressive reactions, as well as the strategies of coping with stressful situations, is involved in the clinical presentation of this addiction.

Material/Methods: The study was conducted in a group of 88 nicotine addicts without serious systemic comorbidities and in 84 healthy subjects. All the participants were assessed with Beck Depression Inventory (BDI), Spielberger State-Trait Anxiety Inventory (STAI) and the Coping Inventory for Stressful Situations (CISS).

Results: The mean intensity of anxiety as a trait and anxiety as a state, as well as its level, were found to differ between the groups (Sten 6.28 ± 1.52 and 4.86 ± 1.05, p=0,0000 for the trait, and 6.09 ± 1.25 and 4.92 ± 1.29, p=0.0000, for the state, respectively). Similarly, depression was demonstrated to be more intensive in nicotine addicts than in healthy subjects (12.76 points ±4.77 *vs.* 10.76 ± 4.83, p=0.007). Among the 5 scales assessed by CISS, smokers demonstrated higher prevalence of emotion-oriented coping than controls (standard 9 6.27 ± 1.70 in smokers *vs.* 5.67 ± 1.57, p=0.019) and involvement in distracting activities (5.84 ± 1.48 *vs.* 5.28 ± 1.46, p=0.014).

Conclusions: The obtained results indicate that anxiety and depression, as well as differences in coping with stress situations, distinguish nicotine addicts from non-smokers.

key words: **nicotine dependence, anxiety, depression, stress coping**

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BACKGROUND

Nicotine dependence syndrome is the most common mental and behavioral disorder in the Polish population. A thorough epidemiological study concerning the prevalence of nicotinism was conducted by Niżankowska et al. in the Małopolska region in 2005 [1]. The study was a part of the international BOLD study on the prevalence of chronic obstructive pulmonary disease (COPD). The studied population of 603 consisted of 29.1% of smokers (36.1% of men and 21.9% of women), 38.6% of subjects who had never smoked (men 21.0%, women 56.5%), and 32.3% of ex-smokers (men 42.9%, women 21.5%) [1]. Health hazards associated with tobacco smoking constitute a crucial problem for the Polish health care system because of the high prevalence of the addiction. The consequences most important from the epidemiological point of view include: 1) atherosclerosis and its complications (ischemic heart disease with myocardial infarction and stroke), 2) neoplasms, including cancers of the lung and larynx [3], and 3) COPD [1]. The methods of treatment (pharmacological and non-pharmacological) of nicotine dependence are the crucial but underestimated problem from the point of view of prevention of behavioral diseases. Elimination of smoking would increase the life expectancy of a marked percentage of the population by reducing the number of premature deaths due to complications of active nicotinism and passive exposure to tobacco smoke.

Nicotinism develops as a result of the interaction of mental [4] and biological [5,6] factors, as well as social learning by interiorization of deviated social standards. Mental and behavioral disorders such as depression, anxiety, schizophrenia and personality problems are known to correlate with higher prevalence of smoking than that observed in the healthy population [6–8]. The subjects affected by such disorders demonstrate motivation deficits. From the neurophysiological point of view, such deficits are associated with dopamine deficiency in the mesolimbic pathway [5,8,9]. Nicotine, as an agonist of alpha-4 beta-2 nicotine receptor, induces dopamine secretion in the mesolimbic pathway and improves the patients' motivation [5,7–11]. Subjects with high levels of anxiety and depressive tendencies (depression) can be a potential high risk group susceptible to the development of nicotine dependence [12].

The association between exposure to mental stress (perceived as the interaction between the environment and the individual) and anxiety/depression is unclear [13,14]. Smokers report that in their own, subjective opinion, exposure to stress motivates them to light a cigarette. They explain their dependence as a reaction to stress. On the other hand, this has not been confirmed by epidemiological studies [15]. It is possible that stress coping strategies, rather than exposure to stress, play an important role in the pathogenesis of nicotinism [16,17].

Identification of the mental correlates of developing nicotine dependence is very important from both the practical and the social points of view. Knowledge of the mental factors determining the development of the syndrome may contribute to emergence of more effective methods of prevention and treatment, including selection of an optimal psychotherapeutic intervention method [18]. Identification of

stress coping styles in smokers could result in application of appropriate psychotherapy and relaxation techniques, and selection of an appropriate therapeutic strategy.

The aim of this study was to assess the styles of coping with stress and the intensity of anxiety and depression in young adults diagnosed with nicotine dependence syndrome.

MATERIAL AND METHODS

The study was conducted in a group of 88 subjects (50 males, 38 females) with nicotine dependence, aged from 30 to 50 years. The number of the patients exceeded the estimated minimum sample size. The sociodemographic and clinical data describing the group are presented in Table 1. Subjects had been qualified from among approximately 100 patients treated in the outpatient department. Patients with bronchial asthma, chronic obstructive pulmonary disease, malignant tumors, systemic collagenoses, hyperthyroidism or history of myocardial infarction were excluded. The exclusion criteria did not include arterial hypertension, metabolic syndrome and chronic bronchitis. Nicotine dependence was diagnosed according to ICD-10 [19]. All the patients were assessed using the Fagerström Test for Nicotine Dependence (FTND) [4] and quantification of pack-years smoked. The mean number of pack-years smoked in the group of smokers was 17.3±6.1. The number of pack-years correlated with the patients' age (r=0.45, p=0.000012). Only the subjects who scored 5 and more according to the questionnaire were qualified for the study. This criterion was applied to obtain a definite differentiation between the groups and to eliminate occasional smokers as well as subjects smoking at hazardous level but demonstrating no addiction. Ex-smokers and subjects with history of repeated attempts to quit or reducing periodically the number of cigarettes smoked were also excluded. The patients' mean age was 40.9±5.8 (40.1±5.9 for men, 41.8±5.9 for women). The control group consisted of 84 healthy subjects aged from 30 to 50 years who had never smoked (48 males and 36 females), recruited from among clinical outpatient department and primary care department patients. The mean age in this group was 40.7±6.4 (41.2±6.2l for men, 39.97±6.8 for women). The difference in age between the groups did not reach statistical significance (t=0.198, p=0.84). The difference in ages between men and women in both groups was not significant. All the subjects were assessed with the Beck Depression Inventory (BDI) version proposed by Pużyński and Wciórka [20]. They were asked to assess their well-being during the last week. The results were expressed as the number of points scored. Anxiety as a trait and anxiety as a state were measured by means of the Spielberger State-Trait Anxiety Inventory (STAI) in the Polish adaptation developed by Wrześniewski et al. and published by the Psychological Tests Laboratory of the Polish Society of Psychology [21]. The obtained raw data were converted to Sten values according to the normalization tables developed for the Polish version of the test. Stress coping strategies were measured according to the Coping Inventory for Stressful Situations (CISS) in Polish version developed by Strelau et al. and published by the Psychological Tests Laboratory of the Polish Society of Psychology [22]. The test assesses strategies of coping with difficult situations (task-oriented coping, emotion-oriented coping and avoidance coping). The obtained raw data were converted into standard

Table 1. Sociodemographic and clinical characteristics of the subjects.

	Smokers, total	Smokers, males	Smokers, females	Non-smokers, total	Non-smokers, males	Non-smokers, females
Number	88	50	38	84	48	36
Mean age (years)	40.9 ±5.8	40.1±5.9	41.8±5.9	40.9 ±5.8	40.1±5.9	41.8±5.9
Number of pack-years smoked	17.3±6.1	17.6±6.5	17.01±5.9	Not applicable	Not applicable	Not applicable
Subjects with arterial hypertension	38	24	14	37	22	15
Subjects with abdominal obesity	25	13	12	24	16	8

9 according to the normalization tables developed for the Polish version of the test.

Mean values, variances, standard deviations, statistical significance of differences and correlation coefficients were calculated using a licensed „Statistica" software package.

RESULTS

The intensity of anxiety as a trait was higher among smokers than in non-smokers (6.28±1.52 and 4.86±1.05 respectively, p=0.0000). Similarly, the intensity of anxiety as a state was higher in the group of smokers (6.09±1.25 and 4.92±1.29, p=0.0000). The differences in depression intensity measured with BDI between nicotine addicts and non-smokers were also found to be statistically significant (12.76±4.77 vs. 10.76±4.83, p=0.007). The intensity of depression correlated in smokers with the intensity of anxiety as a trait and anxiety as a state (for the trait r=0.71, p=0.000 and for the state r=0.96, p=0.0000, respectively). Among healthy subjects, the intensity of anxiety as a trait and anxiety as a state correlated with the intensity of depression (for the trait r=0.59, p=0.0002 and for the state r=0.66, p=0.0001). As many as 40 subjects in the group of smokers scored more than 13 points in BDI, which indicates signs of depression – mild, or more than mild. Among non-smokers, 23 subjects scored above 13 points. The distribution of occurrence of depression signs in the assessed subjects was found to differ between the groups (chi-square=15.33, p=0.0009). Anxiety in smokers correlated with the patients' age (r=0.28, p=0.01 for the trait, r=0.38, p=0.002 for the state). Depression intensity also correlated with age in subjects addicted to nicotine (r=0.42, p=0.00006). The intensity of anxiety as a trait and anxiety as a state, as well as the level of depression, did not correlate with the number of pack-years smoked. In the group of non-smokers, the intensity of anxiety as a trait correlated with the subjects' age (r=0.25, p=0.02), whereas the correlation between the intensity of anxiety as a state and age did not reach statistical significance (r=0.09, p=0.32). The intensity of depression did not correlate with the subjects' age (r=0.18, p=0.81).

The results obtained with CISS demonstrated that smokers and non-smokers did not differ as far as the values concerning task-oriented coping were concerned (5.27±1.7 in smokers vs. 5.27±1.75, p=0.59). However, a difference was observed with respect to emotion-oriented coping (6.27±1.70

in smoking addicts vs. 5.67±1.57, p=0.019). No differences were demonstrated for the prevalence of avoidance coping (5.39±1.52 vs. 5.67±1.57, respectively, p=0.22). There was a difference between smokers and healthy controls with respect to involvement in distracting activities (5.84±1.48 vs. 5.28±1.46, p=0.014). The social diversion results did not differ between the groups (5.25±0.50 vs. 5,52±1.93, p=0.305). No statistically significant correlations between the number of pack-years smoked, intensity of anxiety or depression and the results obtained with CISS were observed. No such correlations were found in the group of healthy controls.

DISCUSSION

Higher levels of depression and anxiety in nicotine-addicted subjects indicate a comorbidity of nicotinism with depression and anxiety disorders. Such comorbidity can be explained, on the one hand, by the fact that neuroticity can be a risk factor for development of nicotine addiction [23]. However, on the other hand, nicotine can exert an anxiogenic effect mediated by the alpha4- beta2 nicotine receptor, which has been demonstrated repeatedly using various research models [5,24]. In 2010, a study carried out in a group of 5692 patients unequivocally indicated a correlation between anxiety disorder and nicotine dependence [25]. Anxiety and depression constitute the components of the Neuroticity superfactor in the personality concept based on the Big Five personality dimensions [23]. Anxiety and depression are not orthogonal to each other; therefore, the correlation between the intensity of anxiety and the intensity of depression in both studied groups confirms the lexical hypothesis and justifies the joint inclusion of both these constructs within the neuroticity dimension [26]. More frequent than just accidental anxiety and depression, comorbidity has also been demonstrated indirectly [27]. The occurrence of nicotinism among patients with mood disorders is a commonly recognized clinical phenomenon [28]. Our studies have demonstrated a higher proportion of subjects with signs of depression among smokers. However, the signs of depression obtained on the basis of the Beck Depression Inventory cannot be treated as equivalent to the diagnosis of mood disorder (depression) established clinically on the basis of ICD-10 criteria. The scores exceeding 13 points obtained with BDI do not indicate clinical symptoms of depression as a disorder [29]. However, they do indicate a tendency to respond with mood deterioration prevalent among smokers. Nicotine, by activating the alpha-4- beta-2 nicotine

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Pietras T et al – Anxiety, depression and methods of stress coping in patients...

CR

receptor, induces dopamine secretion within the mesolimbic pathway, which improves the patients' motivation, gives the feeling of pleasure and improves the mood [5,24,30]. A similar mechanism is responsible for the higher prevalence of nicotinism among schizophrenic patients and in personality disorders. Such individuals, due to impaired function of dopaminergic mesocortical pathways, develop motivation deficits and anhedonia [5,31]. Nicotine, by stimulating the mesolimbic pathway, improves motivation and reduces cognitive function deficits. The tendency to respond with anxiety and mood deterioration in the course of nicotinism probably prompts the individuals (in case of appropriate stimulation by the social environment) to reach for cigarettes as a substitute means of reward. Nicotine improves the mood, but, paradoxically, can also have an anxiogenic effect. An ineffective mechanism of coping with neuroticity using an addictive substance such as nicotine is developed [32]. Verification of this thesis requires measurement of neuroticity, which, however, was not an objective of our study. The correlation of the intensity of depression and anxiety with age in the group of smokers may suggest an association of nicotinism with the onset of clinically undiagnosed mood or anxiety disorders, as the percentage of subjects with a history of at least 1 episode of depressive mood or anxiety increases with age [33]. The general health and condition deteriorates with age, which can influence the proportion of subjects with mood disorders. However, individuals with serious systemic diseases were excluded from our study. Our hypothesis is even more probable because, among health controls, intensity of depression did not correlate with age, and the number of subjects who scored 13 or more points according to the Beck Depression Inventory was significantly lower. Recent publications emphasize more frequent occurrence of depression in smokers and deterioration of their quality of life [34]. Attention has also been focused on dysfunction of cholinergic neurons in depression (cholinergic depression hypothesis) and complex depression and nicotinism comorbidity [35]. In 2010, an extraordinary finding that passive exposure to tobacco smoke is associated with increased risk of depression was reported [36]. Smoking has also been demonstrated to be a predictive factor for suicidal ideations in the course of depression in bipolar affective disorder [36,37].

The results obtained in smokers with respect to the stress coping styles – emotion-oriented coping – demonstrate the similarity of this group to the group of alcoholics, who, according to the normalization tables of the Polish CISS version, had significantly higher mean results than the control groups. Similar results, although not so high as in the case of alcoholics, were obtained for aggressive soldiers and prisoners [22]. The greater involvement of smokers than healthy controls in distracting activities is difficult to explain in the context of other analyzed variables. Tobacco smoking and reaching for a cigarette can be by themselves a form of distracting activity for a specific personality profile [38]. However, the smokers' stress coping strategies cannot be correlated with anxiety and depression in a simple way. We failed to demonstrate correlations between the severity of anxiety and depression and the prevalence of specific stress coping strategies [39,40]. There may be a factor contributing to the development of addiction that is potentially independent from the components of the neuroticity dimension.

CONCLUSIONS

On the basis of the obtained results it can be concluded that:

1. Depression, anxiety as a trait, and anxiety as a state are more severe in subjects with nicotine dependence than in healthy individuals.

2. Smokers demonstrate, in comparison with the control group, higher prevalence of emotion-oriented coping style and distracting themselves with other activities.

REFERENCES:

1. Nizankowska-Mogilnicka E, Mejza F, Buist AS et al: Prevalence of COPD and tobacco smoking in Malopolska region – results from the BOLD study in Poland. Pol Arch Med Wewn, 2007; 117: 402–10

2. Waśkiewicz A, Piotrowski W, Sygnowska E et al: Quality of nutrition and health knowledge in subjects with diagnosed cardio-vascular diseases in the Polish population – National Multicentre Health Survey (WOBASZ). Kardiol Pol, 2008; 66: 507–13

3. Didkowska J: Epidemiologia i etiopatogeneza nowotworów płuca. In: Jassem J, Krzakowski M. (ed.), Nowotwory płuca i opłucnej. Via Medica, Gdańsk, 2009; 1–18 [in Polish]

4. Meneses-Gaya IC, Zuardi AW, Loureiro SR, Crippa JA: Psychometric properties of the Fagerström Test for Nicotine Dependence. J Bras Pneumol, 2009; 35: 73–82

5. Stahl SM: Stah'l essential psychopharmacology. Neuroscientific basis and practical applications. Cambridge University Press, New York, 2008

6. Rajikin MH, Latif ES, Mar MR et al: Deleterious effects of nicotine on the ultrastructure of oocytes: role of gamma-tocotrienol. Med Sci Monit, 2009; 15(12): BR378–83

7. Ziedonis D, Hitsman B, Beckham JC et al: Tobacco use and cessation in psychiatric disorders: National Institute of Mental Health report. Nicotine Tob Res, 2008; 10: 1691–715

8. Benowitz NL: Pharmacology of nicotine: addiction, smoking-induced disease, and therapeutics. Annu Rev Pharmacol Toxicol, 2009; 49: 57–71

9. Quaak M, van Schayck CP, Knaapen AM, van Schooten FJ: Genetic variation as a predictor of smoking cessation success. A promising preventive and intervention tool for chronic respiratory diseases? Eur Respir J, 2009; 33: 468–80

10. Prendergast MA, Harris BR, Mayer S et al: Nicotine exposure reduces N-methyl-D-aspartate toxicity in the hippocampus: relation to distribution of the alpha7 nicotinic acetylcholine receptor subunit. Med Sci Monit, 2001; 7: 1153–60

11. Stefano GB, Bianchi E, Guarna M et al: Nicotine, alcohol and cocaine coupling to reward processes via endogenous morphine signaling: the dopamine-morphine hypothesis. Med Sci Monit, 2007; 13(6): RA91–102

12. McKenzie M, Olsson CA, Jorm AF et al: Association of adolescent symptoms of depression and anxiety with daily smoking and nicotine dependence in young adulthood: findings from a 10-year longitudinal study. Addiction, 2010; 105: 1652–59

13. Avdibegovic E, Delic A, Hadzibeganovic K, Selimbasic Z: Somatic diseases in patients with posttraumatic stress disorder. Med Arh, 2010; 64: 154–57

14. Goh C, Agius M: The stress-vulnerability model how does stress impact on mental illness at the level of the brain and what are the consequences? Psychiatr Danub, 2010; 22: 198–202

15. Balk E, Lynskey MT, Agrawal A: The association between DSM-IV nicotine dependence and stressful life events in the National Epidemiologic Survey on Alcohol and Related Conditions. Am J Drug Alcohol Abuse, 2009; 35: 85–90

16. Araujo RB, Oliveira Mda S, Pedroso RS, Castro Mda G: Coping strategies for craving management in nicotine dependent patients. Rev Bras Psiquiatr, 2009; 31: 89–94

17. Pfaff KA, El-Masri MM, Fox-Wasylyshyn SM: Comparing the psychological stress between non-smoking patients and smoking patients who experience abrupt smoking cessation during hospitalization for acute myocardial infarction: a pilot study. Can J Cardiovasc Nurs, 2009; 19: 26–32

18. Colgan Y, Turnbull DA, Mikocka-Walus AA, Delfabbro P: Determinants of resilience to cigarette smoking among young Australians at risk: an exploratory study. Tob Induc Dis, 2010; 8: 7

19. Klasyfikacja zaburzeń psychicznych i zaburzeń zachowania w ICD-10. Badawcze kryteria diagnostyczne. Kraków-Warszawa: Uniw Wyd Med,,Vesalius", Instytut Psychiatrii i Neurologii; Kraków-Warszawa, 1998 [in Polish]

20. Wciórka J, Pużyński S: Narzędzia oceny stanu psychicznego. In: Rybakowski J, Pużyński S., Wciórka J. (eds.), Psychiatria. Tom I. Podstawy psychiatrii. Wydawnictwo Medyczne Urban & Partner, Wrocław, 2010; 413–76 [in Polish]

21. Wrześniewski K, Sosnowski T, Matusik D: Inwentarz Stanu i Cechy Lęku STAI. Polska Adaptacja STAI. Podręcznik, Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego, Warszawa, 2002 [in Polish]

22. Strelau J, Jaworowska A, Wrześniewski K, Szczepaniak P: Kwestionariusz Radzenia Sobie w Sytuacjach Stresowych CISS, Podręcznik. Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego, Warszawa, 2007 [in Polish]

23. Siuta J: Inwentarz osobowości NEO-PI-R Paula T. Costy Jr i Roberta McCrea. Adaptacja Polska. Podręcznik. Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego, Warszawa, 2006 [in Polish]

24. Plaza-Zabala A, Martín-García E, de Lecea L et al: Hypocretins regulate the anxiogenic-like effects of nicotine and induce reinstatement of nicotine-seeking behavior. J Neurosci, 2010; 30: 2300–10

25. Noftle EE, Fleeson W: Age differences in big five behavior averages and variabilities across the adult life span: moving beyond retrospective, global summary accounts of personality. Psychol Aging, 2010; 25: 95–107

26. Costa PT Jr: Clinical use of the five-factor model: an introduction. J Personal Ass, 1991; 57: 393–98

27. Zhu B, Zhao Z, Ye W et al: The cost of comorbid depression and pain for individuals diagnosed with generalized anxiety disorder. J Nerv Ment Dis, 2009; 197: 136–39

28. Piper ME, Smith SS, Schlam TR et al: Psychiatric disorders in smokers seeking treatment for tobacco dependence: relations with tobacco dependence and cessation. J Consult Clin Psychol, 2010; 78: 13–23

29. Shafer AB: Meta-analysis of the factor structures of four depression questionnaires: Beck, CES-D, Hamilton, and Zung. J Clin Psychol, 2006; 62: 123–46

30. Grieder TE, Sellings LH, Vargas-Perez H et al: Dopaminergic signaling mediates the motivational response underlying the opponent process to chronic but not acute nicotine. Neuropsychopharmacology, 2010; 35: 943–54

31. Winterer G: Why do patients with schizophrenia smoke? Curr Opin Psychiatry, 2010; 23: 112–19

32. Carmody TP, Vieten C, Astin JA: Negative affect, emotional acceptance, and smoking cessation. J Psychoactive Drugs, 2007; 39: 499–508

33. Gabriel A, Violato C: The development of a knowledge test of depression and its treatment for patients suffering from non-psychotic depression: a psychometric assessment. BMC Psychiatry, 2009; 9: 56

34. de Castro MR, Matsuo T, Nunes SO: Clinical characteristics and quality of life of smokers at a referral center for smoking cessation. J Bras Pneumol, 2010; 36: 67–74

35. Mineur YS, Picciotto MR: Biological basis for the co-morbidity between smoking and mood disorders. J Dual Diagn, 2009; 5: 122–30

36. Bandiera FC, Arheart KL, Caban-Martinez AJ et al: Secondhand smoke exposure and depressive symptoms. Psychosom Med, 2010; 72: 68–72

37. Botega NJ, de Azevedo RC, Mauro ML et al: Factors associated with suicide ideation among medically and surgically hospitalized patients. Gen Hosp Psychiatry, 2010; 32: 396–400

38. Ostacher MJ, Lebeau RT, Perlis RH et al: Cigarette smoking is associated with suicidality in bipolar disorder. Bipolar Disord, 2009; 11: 766–71

39. DiFranza J, Ursprung WW, Lauzon B et al: A systematic review of the Diagnostic and Statistical Manual diagnostic criteria for nicotine dependence. Addict Behav, 2010; 35: 373–82

40. Brown RA, Lejuez CW, Strong DR et al: A prospective examination of distress tolerance and early smoking lapse in adult self-quitters. Nicotine Tob Res, 2009; 11: 493–502