

Assessment of changes in nicotine dependence, motivation, and symptoms of anxiety and depression among smokers in the initial process of smoking reduction or cessation: a short-term follow-up study

Avaliação de mudanças na dependência da nicotina, motivação e sintomas de ansiedade e depressão em fumantes no processo inicial de redução ou cessação do tabagismo: estudo de seguimento de curto prazo

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Abstract

Introduction: The first days of a quit attempt represent an important challenge to long-term abstinence, especially because of the changes that take place over this period.

Objective: To examine whether smokers who have recently changed their smoking behavior show changes in the intensity of nicotine dependence, motivational stage, or symptoms of anxiety and depression relative to smokers without recent changes in smoking behavior.

Methods: Smokers attending a support group for smoking cessation in Porto Alegre, southern Brazil, were invited to participate. The program consisted of four weekly sessions. Smokers answered questionnaires covering intensity of nicotine dependence, stage of motivation, and symptoms of anxiety and depression at baseline and in the fourth week. Urine was collected at both time points, tested for cotinine concentration, and used to determine the final status of smokers.

Results: Of the 54 smokers included in the study, 20 (37%) stopped smoking or decreased tobacco use. Both smokers who stopped or reduced tobacco use and those who did not change their behavior presented a decrease in nicotine dependence scores ($p = 0.001$). Conversely, only the smokers who changed behavior presented an increase in scores in the maintenance stage ($p < 0.001$).

Conclusion: When modifying tobacco use, smokers face a difficult process, marked by several changes. A better understanding of these changes and their implications for treatment are discussed.

Keywords: Smoking cessation, tobacco use disorder, motivation, anxiety, depression.

Resumo

Introdução: Os primeiros dias de uma tentativa de parar de fumar representam um desafio importante para a abstinência a longo prazo, especialmente por causa das mudanças que ocorrem nesse período.

Objetivo: Examinar se fumantes que mudaram recentemente seu hábito de fumar mostram mudanças na intensidade da dependência à nicotina, no estágio motivacional ou nos sintomas de ansiedade e depressão em comparação com fumantes sem mudanças recentes em seu hábito de fumar.

Métodos: Fumantes participando de um grupo de apoio para a cessação do tabagismo em Porto Alegre, sul do Brasil, foram convidados a participar do estudo. O programa consistia de quatro sessões semanais. Os fumantes responderam a questionários que avaliaram a intensidade da dependência à nicotina, o estágio motivacional e sintomas de ansiedade e depressão no início do programa e na 4ª semana. Amostras de urina foram coletadas nos dois momentos para avaliar a concentração de cotinina para determinar o status final dos fumantes.

Resultados: Dos 54 fumantes incluídos no estudo, 20 (37%) pararam de fumar ou reduziram o uso de tabaco. Tanto os fumantes que pararam ou reduziram o uso de tabaco quanto aqueles que não mudaram seu hábito apresentaram diminuição nos escores de dependência à nicotina ($p = 0,001$). Por outro lado, apenas os fumantes que mudaram seu hábito apresentaram aumento nos escores do estágio de manutenção ($p < 0,001$).

Conclusão: Ao modificar o uso de tabaco, os fumantes enfrentam um processo difícil, marcado por várias mudanças. Um melhor entendimento dessas mudanças e suas implicações para o tratamento são discutidas.

Descritores: Abandono do hábito de fumar, transtorno por uso de tabaco, motivação, ansiedade, depressão.

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Introduction

Tobacco smoking is the leading cause of preventable death worldwide, whereas quitting smoking is an effective way to prevent many diseases and premature mortality.¹ An increasingly large body of information about the harms of smoking and a greater availability of treatment programs has led to a growing effort among smokers to quit, however more than 95% of smoking cessation efforts fail within a year.² Moreover, even though more than 70% of smokers report that they are interested in quitting, most continue smoking.³ One factor that may hinder smoking cessation is the presence of depression symptoms and anxiety. The positive reinforcing effects of nicotine may improve mood, cognition, and anxiety. Abstinence, in turn, may exacerbate these symptoms. Despite the higher prevalence of anxiety and depression in smokers, studies conducted with Brazilian populations have been unsuccessful to demonstrate the association between these symptoms and failure to stop smoking.^{4,5}

In order for a smoker to quit, nicotine dependence needs to be counterbalanced by a high degree of motivation to stop smoking. Because smoking cessation may be a very difficult goal for those unable or unwilling to quit smoking, a reduction in cigarette consumption can be an initial step towards changing behavior and achieving complete abstinence.⁶⁻⁸ Smoking reduction may increase the chance of future cessation because it reduces dependence, discontinues conditioning, and increases self-efficacy.^{8,9} Thus, reduced tobacco use signals that the smoker is motivated to change, and should therefore be considered a positive outcome.⁷

About two-thirds of the smokers trying to quit fail in the first week. This rate is similar for both treated¹⁰ and untreated smokers.^{2,11} The first days post-quit day seem to be the most difficult ones, because, in addition to learning a new behavior, smokers have to cope with withdrawal symptoms and cognitive and emotional difficulties.¹² Notwithstanding, resisting smoking in the first moments after quitting is essential, as these symptoms tend to remain stable.¹³ Smokers who manage to remain abstinent and survive the first days without tobacco are more likely to succeed in the long term^{11,14} and less likely to have lapses or to relapse,¹⁰ probably because they feel encouraged and motivated.^{2,10} Conversely, it is very common, in the treatment setting, to have patients that stop attending therapeutic group activities or consultations because they have failed to quit smoking or have relapsed.¹⁵

In view of the above, most attempts to quit smoking fail prematurely, and our understanding of this process remains inaccurate. In this sense, a better understanding of the behavioral changes taking place

in the first days of a quit attempt is key to predicting early success and helping smokers who present more difficulties as early as possible. Moreover, achieving and maintaining tobacco abstinence may be compromised by biopsychosocial risk factors.^{16,17} Finally, the relationship between these changes and biochemical markers of exposure to tobacco, currently underestimated, may provide additional information on the changes taking place during the process of stopping or reducing smoking and determining abstinence or relapse.

Therefore, the objective of this study was to examine whether smokers attending a support group for smoking cessation and showing recent changes in their smoking behavior (quitting or reducing consumption) also show changes in measures such as intensity of nicotine dependence, motivational stage, and anxiety and depression symptoms, when compared to smokers that did not change their smoking habits.

Methods

Procedures

This short-term cohort study was conducted in a free-of-charge program for smoking cessation between July 2007 and November 2009. The program consisted of four weekly group meetings involving 8 to 12 participants and led by health professionals trained in cognitive-behavioral and motivational interviewing methods. Each session lasted for about 2 hours and was structured so as to provide information about the consequences of cigarette smoking, methods for quitting, stages of change, benefits of cessation, tobacco withdrawal symptoms, coping strategies, and relapse prevention. In each session, the participants received written materials structured according to the American Cancer Society¹⁸ and the Brazilian National Cancer Institute.¹⁹

At the beginning of the first session, participants were asked to sign an informed consent form. Subsequently, they answered a self-administered questionnaire covering sociodemographic characteristics, smoking history, nicotine dependence, motivational stages, and anxiety and depression symptoms. The second session focused on planning the quitting attempt and provided information on withdrawal signs and symptoms, risk situations, coping strategies, and relaxation exercises. In this session, the quit day for each participant was set. In the third session, difficulties faced during the attempt to stop smoking were approached, and strategies to maintain abstinence were reinforced. The last session focused on relapse prevention and reinforcement of skills and strategies for those who did not achieve abstinence.

In the last session, participants filled out the same instruments used in the first session and were asked to inform whether they had stopped smoking, decreased tobacco use, or continued smoking the same amount of cigarettes. In addition to the questionnaires, urine samples were collected in the first and fourth sessions of the program and tested for cotinine. The Research Ethics Committee of Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA) approved the study protocol (protocol no. 219/07).

Subjects

Participants were male and female smokers aged at least 18 years living in Porto Alegre, southern Brazil. Smokers were recruited from the community by newspaper and radio advertisements of a study comprising a support group for smoking cessation. By telephone, smokers received a description of how the group sessions would be conducted; participation in a group session was scheduled if the smoker chose to participate. Groups were offered at different times, including outside office hours, and participants could choose what time worked best. The individuals included were current cigarette smokers, or smokers who had stopped within the last week, and who showed up on the scheduled date. Smokers under 18 years of age or those who reported current illicit drug use, nicotine replacement therapy, bupropion treatment, presence of debilitating conditions that could interfere with group participation, as well as those who provided incomplete data on the questionnaires, preventing data analysis, were excluded from the sample.

A total of 183 smokers attended the first session. After application of our inclusion and exclusion criteria, 163 smokers were enrolled in the study. Only two

smokers had quit smoking before starting the support group, and they were not more than 7 days abstinent. Only 54 smokers (33.1%) completed the four sessions of the study. Figure 1 shows the patient selection process and dropout rates.

Measures

Nicotine dependence. The intensity of nicotine dependence was measured using the Fagerström Test for Nicotine Dependence (FTND),^{20,21} which comprises six questions related to smoking. Summing the results of all questions provided a total score ranging from 0 to 10 points, with higher scores indicating higher nicotine dependence.

Motivational stage. The motivational stage was measured by the University of Rhode Island Change Assessment Scale (URICA)^{22,23} and the Contemplation Ladder.^{24,25} URICA assesses the degree to which participants are willing to change their smoking behavior by asking whether they agree or disagree with certain presented statements. Responses are rated using a Likert scale. Based on the answers, one can evaluate scores for the stages of precontemplation, contemplation, action, and maintenance, as well as calculate a total score by adding the mean scores obtained for contemplation, action, and maintenance, and subtracting the mean score of the precontemplation subscale. The Contemplation Ladder, used in a brief form, presented five statements, and participants had to indicate the statement that best characterized their thinking in relation to smoking at the time. According to the statement chosen, a score ranging from 0 to 10 was assigned to each response, with higher scores indicating higher motivation.

Anxiety symptoms. The Beck Anxiety Inventory (BAI) comprises 21 items describing various symptoms

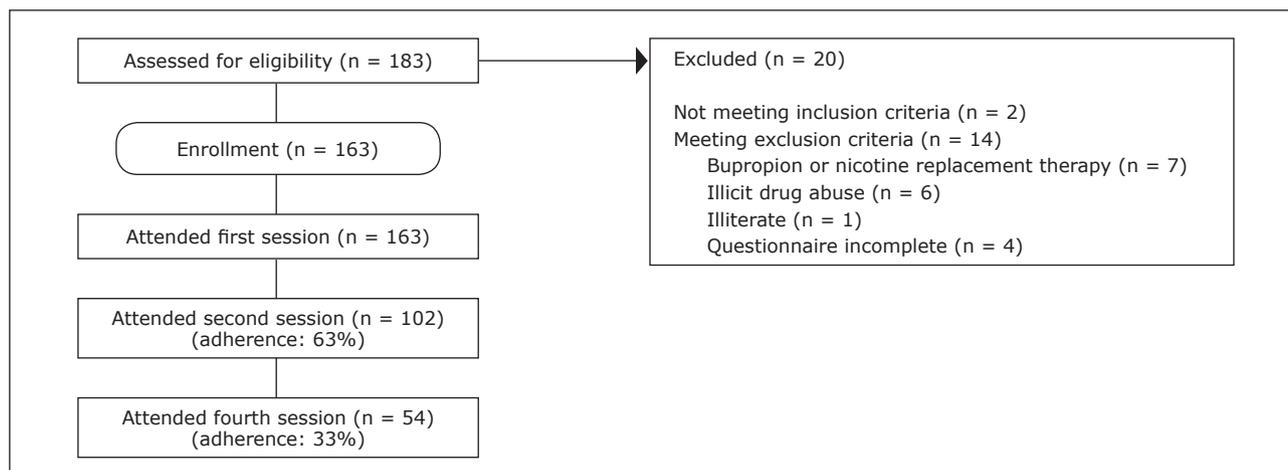


Figure 1 – Flowchart describing the selection of smokers and showing dropout rates in different sessions of the smoking cessation support group

of anxiety. Subjects marked the level of intensity of each symptom using a range of 0 to 3. The final score is obtained by summing all the items and matching that sum to a standardized severity level, as follows: minimum (0 to 11 points), mild (12 to 19), moderate (20 to 35), or severe (36 to 63).^{26,27}

Depression symptoms. Symptoms of depression were assessed using the Beck Depression Inventory (BDI), a measure comprising 21 items and four response options for each item, ranging from 0 to 3, corresponding to increasing intensity of depression. The total score is obtained by summing individual scores and is used to classify between levels of depression, i.e., minimum (0 to 10 points), mild (11 to 19), moderate (20 to 30), or severe (31 to 63).^{27,28}

Smoking status. When filling out the questionnaire in the fourth session, smokers classified themselves as having quit, reduced tobacco intake, or maintained intake based on recent smoking habits. To confirm self-reported smoking status, cotinine urine concentration was assessed at the pharmacology laboratory of the Basic Health Sciences Department of UFCSPA using the colorimetric technique as described by Peach et al.²⁹ This method was chosen because it shows good sensitivity and specificity in distinguishing between smokers and non-smokers. Moreover, the method is sensitive to changes in smoking behavior, as it measures the concentrations of cotinine and other nicotine metabolites.^{30,31} Cotinine has a half-life of approximately 20 hours,³² and it derives solely from the metabolism of tobacco.³³ Even though more specific and sensitive methods are available, they are also more expensive, time-consuming, and often unavailable in clinical biochemistry laboratories in developing countries.³⁰

Statistical analysis

Baseline data were analyzed considering all enrolled smokers. Conversely, the analysis of changes in smoking behavior included only retained smokers, i.e., those who attended all four sessions of the support group.

For the analysis of retained smokers, groups were created based on self-reported smoking habits, confirmed by cotinine concentrations in urine samples. As a result, smokers were divided into two groups: 1) smokers who kept smoking (similar cotinine urinary concentrations in the first and fourth sessions); and 2) smokers who completely quit smoking, or at least reduced tobacco intake (confirmed by a 40% or greater reduction in cotinine concentrations from the first to the fourth session). Because an expressive reduction in smoking can cause changes in many biopsychosocial factors, it was deemed appropriate to combine quitters

and reducers in the same group. Within each group, results were divided into baseline (first session) and final (fourth session) measures. The Kruskal-Wallis test or one-way analysis of variance (ANOVA) followed by Tukey's test were used to assess differences in the variables between our four resulting groups.

Association tests were performed using the chi-square test, and correlation tests were performed using Pearson's or Spearman's correlation coefficients. Missing data were excluded analysis by analysis. Statistical analyses were performed using the PASW Statistics version 18. Differences were considered significant when $p < 0.05$.

Results

Table 1 shows the characteristics of the smokers included in the study, as well as characteristics of retained smokers, divided according to change in smoking habit reported and confirmed by urinary cotinine levels (smoking or abstinence/reduction) in the fourth week. The majority of enrolled smokers were female, married, with incomplete or complete high school (8 to 11 years of study), were employed or had some type of income. They also reported having one or more than one tobacco-related disease, being non-drinkers, and having attempted to quit smoking previously. These characteristics did not differ between retained or non-retained smokers (except for age) or between abstinent/reduced smokers and non-quitting retained smokers. As usual, they started to smoke during adolescence. The level of depression was similar between non-retained and retained smokers (median = 12 [8-21] and 10 [7-17], respectively; $p = 0.116$), but anxiety levels were higher in non-retained smokers than in retained ones (median 13 [6-24] and 8 [4-13], respectively; $p = 0.004$).

Intensity of nicotine dependence was positively correlated with baseline urinary cotinine concentrations ($r = 0.364$; $p < 0.001$). Cotinine levels rose in association with responses indicating greater nicotine dependence on FTND. Four questions of the FTND were able to predict differences in the biochemical marker (Table 2); time to first cigarette and number of cigarettes per day were the ones that best predicted urinary cotinine concentration.

Testing at the fourth week of follow-up revealed a correlation between baseline urinary cotinine concentrations and the difference between final and baseline concentrations ($r = -0.555$, $p < 0.001$, Figure 2). The greatest changes in cotinine concentrations between the two tests were observed in smokers who had higher baseline concentrations.

Statistical analysis showed that only FTND and maintenance stage (URICA scale) scores differed after

attendance of the four sessions of the smoking cessation program ($p = 0.001$ and $p < 0.001$, respectively) (Table 3). Correlating these scores with differences in urinary cotinine concentrations revealed similar changes in both parameters, regardless of whether or not the smokers had changed their tobacco consumption habits (Figure 3).

The study also evaluated the authenticity of self-reported smoking status. Cotinine urinary concentrations showed that 61% (28/46) of the smokers reporting changes in their smoking habits had not actually reduced consumption, and that 25% (2/8) of the smokers denying changes showed a decrease in cotinine concentrations.

Table 1 – Demographic characteristics of the smokers included in the study, n (%)

	Enrolled smokers			p	Retained smokers		
	Total* (n = 163)	Retained† (n = 54)	Non-retained† (n = 109)		Smoking† (n = 34)	Abstinence/ reduction† (n = 20)	p
Gender							
Female	105 (64.4)	35 (33.3)	70 (66.7)	1.000	24 (68.6)	11 (31.4)	0.376
Male	58 (35.6)	19 (32.8)	39 (67.2)		10 (56.6)	9 (47.4)	
Marital status							
Single	35 (21.5)	8 (22.9)	27 (77.1)	0.291	5 (62.5)	3 (37.5)	0.989
Married/living with a partner	81 (49.7)	31 (38.3)	50 (61.7)		19 (61.3)	12 (39.7)	
Divorced	33 (20.2)	9 (27.3)	24 (72.7)		6 (66.7)	3 (33.3)	
Widowed	14 (8.6)	6 (42.9)	8 (57.1)		4 (66.7)	2 (33.3)	
Education (4 missing)							
≤ 8 years	41 (25.1)	15 (36.6)	26 (63.4)	0.633	9 (60.0)	6 (40.0)	0.762
8-11 years	62 (38.0)	17 (27.4)	45 (72.6)		11 (64.7)	6 (35.3)	
> 11 years	46 (28.2)	18 (39.1)	28 (61.9)		12 (66.7)	6 (32.3)	
Occupation (17 missing)							
Paid work	101 (61.7)	30 (29.7)	71 (71.3)	0.544	16 (53.3)	14 (47.7)	0.175
Pensioner	20 (12.7)	9 (45.0)	11 (55.0)		6 (66.7)	3 (33.3)	
Housewife	16 (9.8)	5 (31.3)	11 (68.8)		5 (100.0)	0 (0.0)	
Others	9 (5.5)	2 (22.2)	7 (77.8)		2 (100.0)	0 (0.0)	
Health conditions	114 (69.9)	39 (34.2)	75 (65.8)	0.719	24 (61.5)	15 (38.5)	1.000
Drinking (3 missing)	70 (42.9)	25 (35.7)	45 (64.3)	0.616	13 (52.0)	12 (48.0)	0.161
Quit attempt (3 missing)	127 (79.4)	38 (29.9)	89 (70.1)	0.211	24 (63.2)	14 (36.8)	0.754
Age (mean ± SD)	49.2±11.4	47.6±12.2‡	52.4±8.6	0.004	53.7±9.1	50.7±7.6	0.226

SD = standard deviation.

* Percentages refer to the column.

† Percentages refer to the total value (row).

‡ $p < 0.01$.

Table 2 – Urinary cotinine concentrations divided according to FTND responses (n = 163)

FTND question	Cotinine concentration		p
1. How soon after you wake up do you smoke your first cigarette?†	Within 30 minutes: 16.5±1.1 µg/mL	After 31 minutes or more: 10.3±0.9 µg/mL	< 0.001
2. Do you find it difficult to refrain from smoking in places where it is forbidden, etc.?*	Yes: 18.9±2.2 µg/mL	No: 12.9±0.8 µg/mL	0.014
3. Which cigarette would you hate most to give up?	The first one in the morning: 14.7±1.1 µg/mL	All others: 14.9±1.4 µg/mL	0.907
4. How many cigarettes/day do you smoke?†	11 or more: 15.6±1.0 µg/mL	10 or less: 9.3±1.6 µg/mL	0.009
5. Do you smoke more frequently during the first hours after waking than during the rest of the day?	Yes: 15.5±1.1 µg/mL	No: 14.1±1.2 µg/mL	0.412
6. Do you smoke if you are so ill that you are in bed most of the day?*	Yes: 15.9±1.1 µg/mL	No: 12.0±1.4 µg/mL	0.038

FTND = Fagerström Test for Nicotine Dependence.

Cotinine concentrations expressed as mean ± standard error of mean.

* $p < 0.05$.

† $p < 0.01$.

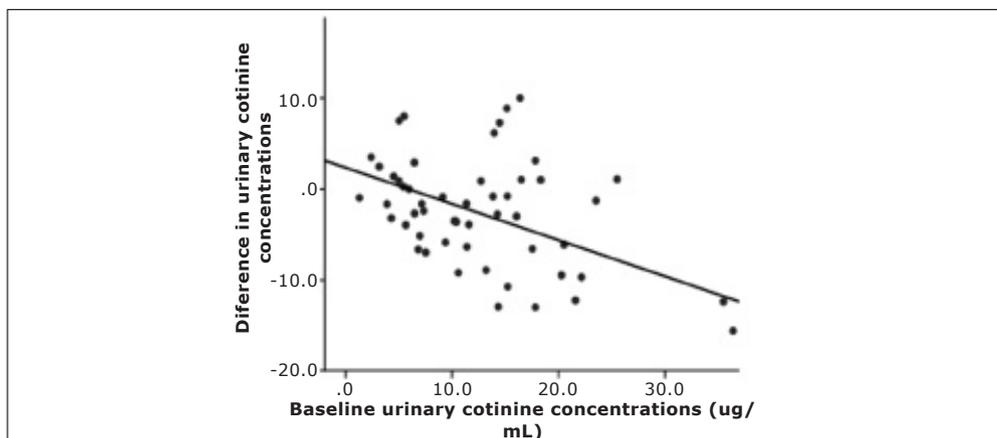


Figure 2 – Relationship between baseline urinary cotinine concentrations and the difference between final and baseline urinary cotinine concentrations in retained smokers (n = 54; r = -0.550, p < 0.001)

Table 3 – Scores obtained for nicotine dependence, motivation, and comorbidity scales in the different groups of smokers

	Baseline		Final		Significance [†]
	Smoking (n = 34)	Abstinence/reduction (n = 20)	Smoking (n = 34)	Abstinence/reduction (n = 20)	
FDNT*	5 (4-7) ^{c,d}	4.5 (4-7) ^d	3 (1-5.25) ^a	1.5 (0-5) ^{a,b}	H = 16.14, p = 0.001
URICA-PC	12.6±3.4	10.8±3.2	11.5±3.3	11.7±5.0	F _(3,102) = 1.185, p = 0.319
URICA-C	29.9±2.6	29.9±3.1	29.4±3.1	30.3±4.0	F _(3,102) = 0.379, p = 0.768
URICA-A	28.4±3.1	28.0±4.6	28.2±3.0	29.4±4.3	F _(3,102) = 0.628, p = 0.599
URICA-M*	24.4±4.6 ^b	19.8±6.1 ^{a,c,d}	26.0±4.1 ^b	25.0±5.7 ^b	F _(3,102) = 6.892, p < 0.001
URICA - Total	10.0±1.4	9.6±1.4	10.3±1.2	10.4±1.9	F _(3,102) = 1.540, p = 0.209
Contemplation Ladder	8.9±2.0	8.3±1.9	9.2±1.6	9.1±1.6	H = 4.748, p = 0.191
BAI	9 (5-15)	7 (4-12)	7.5 (4-16)	5 (1.5-12.5)	H = 1.674, p = 0.643
BDI	12 (8-17)	8 (5-17)	10 (7-15)	5 (4-15)	H = 7.011, p = 0.072

BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; FTND = Fagerström Test for Nicotine Dependence; URICA = University of Rhode Island Change Assessment Scale (PC = precontemplation; C = contemplation; A = action; M = maintenance).

Values expressed as mean ± standard deviation or median (25th-75th percentiles).

Superscript letters are used to indicate differences between groups: ^a p < 0.05 compared to group baseline smoking; ^b p < 0.05 compared to group baseline abstinence/reduced smoking; ^c p < 0.05 compared to group final smoking; ^d p < 0.05 compared to group final abstinence/reduced smoking.

* p < 0.05. [†] Letters H and F refer to the statistical test performed in each case: H = Kruskal-Wallis; F = one-way ANOVA.

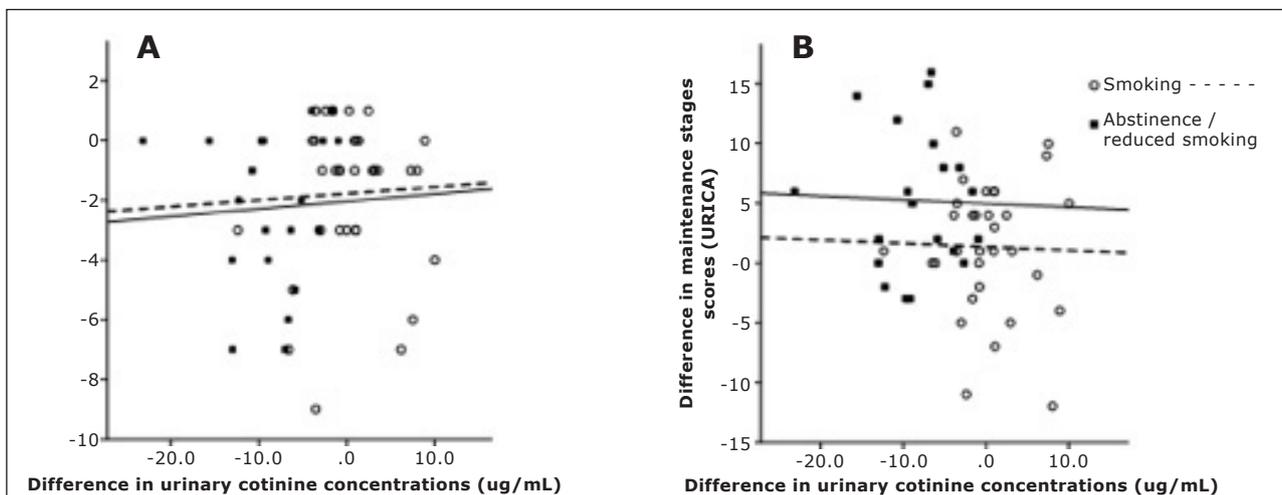


Figure 3 – Relationship between differences in urinary cotinine concentrations and A) differences in the intensity of nicotine dependence in smokers according to their situation (n = 54; r = 0.041, p = 0.82 [smoking]; r = 0.052, p = 0.827 [abstinence/reduction]); B) differences in maintenance stage scores in smokers according to their situation (n = 54; r = -0.026, p = 0.889 [smoking]; r = -0.028, p = 0.906 [abstinence/reduction])

The concordance of self-reported smoking status and urinary cotinine concentrations had a kappa index of 0.60, indicating only moderate agreement ($p = 0.445$). As a result, only 24 of the 54 retained smokers were able to correctly identify their final smoking status. The comparison between smokers' self-reports and biochemical markers yielded an accuracy of 44% for self-report data.

Discussion

The first days of an attempt to quit smoking represent an important challenge for long-term abstinence. This study found that more than 60% of the smokers are unable to achieve their goal of changing tobacco consumption patterns, even when they had fully attended a smoking cessation program. Worst of all, only 12% of those who attended the first program meeting were able to effectively stop or reduce smoking, either because they did not attend the whole program or because they did not remain abstinent. Better news is that, for smokers who were able to at least reduce the amount of tobacco smoked daily, the intensity of nicotine dependence decreased and scores of motivational maintenance increased.

In the FTND scale, time to the first cigarette of the day and number of cigarettes smoked per day seemed to provide the best information for assessing intensity of nicotine dependence; data originating from these questions added appreciably to the prediction of biochemical levels of cotinine. In fact, some questionnaires use only these two questions to measure nicotine dependence, but the other questions contained in the FTND may serve to improve our understanding of smokers' behaviors.²¹ Nicotine dependence is frequently pointed out as a powerful predictor of the failure to achieve abstinence. Smokers who do not quit usually have higher levels of nicotine dependence.³⁴⁻³⁶ In the same way, smokers who reach cessation are supposedly those who are less nicotine dependent. Nevertheless, our results do not corroborate these statements.

Evidently, FTND scores decreased with the smokers' attempts to reduce or quit smoking, indicating that they had changed something in their behavior and had consequently reduced their physical dependence. Unexpectedly, however, the smokers who maintained their usual consumption (as confirmed biochemically) also showed a decrease in their FTND scores. We also observed many smokers who claimed reduction or cessation of the habit, however not confirmed by urinary cotinine levels. Smokers who engaged in the program to quit smoking initiated the process of change by demonstrating their desire to quit smoking; however, they had not yet changed their behavior. One may think that the smokers saw themselves changing their habit (i.e., feeling abstinent or less dependent on tobacco), but their behavior

did not correspond to these expectations. Moreover, it is known that the dose of nicotine absorbed depends on the depth and frequency of puffs, and that smokers learn to titrate nicotine levels to manipulate plasma concentrations according to their needs.³⁷ Thus, a slight decrease in the number of cigarettes smoked may not reflect a real decrease in nicotine exposure; this would explain the maintenance of urinary cotinine concentrations. Similar misclassification rates among self-reported tobacco users have been shown in different populations.³⁸⁻⁴¹ The low accuracy of self-reported measures and the contradiction between such measures and biochemical measures underscore the great difficulty involved in quitting smoking, even when tobacco users are aware of the harmful effects of tobacco and of the need to change the habit. Finally, smokers may underreport smoking not to disappoint the health professional and to be socially accepted.

Even though cotinine tests are not 100% accurate, they serve well to indicate changes in tobacco exposure. The more prominent decrease in cotinine concentrations among smokers with higher baseline levels is an empirically logical result, as higher initial concentrations allow for greater reductions.

Data obtained with the URICA scale and the Contemplation Ladder showed that motivational scores remained stable regardless of whether the patient quit smoking. The exception to this was the maintenance stage of the URICA, whose scores increased for smokers who reduced or quit smoking. This increase demonstrates their commitment to remaining abstinent or smoking less. The association between advanced motivational stages and smoking reduction or cessation has been identified in previous studies,^{42,43} but not in our sample. Smokers who did not change their tobacco consumption presented higher baseline maintenance stage scores when compared to smokers who reduced tobacco consumption or quit, which suggests that even highly motivated smokers may not be fully ready to stop smoking. Similarly, Boardman et al.⁴⁴ showed that smokers who did not manage to quit presented high levels of motivation and self-efficacy due to the hope of quitting in the next attempt.

In this study, anxiety symptoms did not show a relationship with the cessation/reduction process. Our result diverges from others found in the literature that report higher numbers of anxiety symptoms in more dependent smokers, especially women, and a decreased anxiety among individuals who remain abstinent.^{16,45} This could be related to limitations of the study, including the small sample size and the short period of analysis. Moreover, another study by our group found that higher anxiety levels were associated with a lower probability of the smoker keeping the treatment.⁴⁶ Here it is important to consider that we included in this analysis only

smokers who remained in the support group for 4 weeks, which may explain the lower anxiety levels observed. Zvolensky et al.⁴⁷ pointed out that anxiety symptoms per se do not influence the chance of early smoking relapse, except in smokers with anxiety disorders.

Investigation of depression symptoms and other variables related to the treatment showed a lower intensity of depression among the smokers who joined the treatment vs. those smokers who did not join the program. This means that high levels of depression may hinder treatment adherence⁴⁸ and affect the process of smoking cessation in those who seek interventions to change their habit, heightening the probability of failure or relapse.⁴⁹ Nicotine is known to act on neural circuits associated with affect regulation,⁵⁰ and individuals will smoke to relieve feelings of sadness or negative affect, effectively using nicotine as a remedy for depression symptoms.⁵¹ As a result, quitting is more difficult for those who are depressed, who would have to learn a new skill to cope with sadness symptoms. Our results, however, did not uncover any differences among the groups in the periods analyzed, probably because the smokers who remained in treatment had low levels of depression symptoms to begin with.

Despite the recognized efficacy of group therapy for smoking cessation, adherence to group programs is a barrier to tobacco control; 23% of the participants leave treatment within the first month, and around 45% leave it within 2 months.^{48,52} In our study, adherence to the support group was even lower, with only 33.1% of the individuals attending all the meetings over 1 month. Poor adherence is also a problem in group treatment of other addictions; for example, only around 20% of alcoholics in Brazil continue attending Alcoholics Anonymous meetings after 6 months of follow-up.⁵³ Comparing the approaches used here with studies conducted in other countries may be disappointing, mainly due to intrinsic characteristics of support groups in Brazil. Usually, recruitment is carried out reactively, and the participation of patients is not subject to any kind of incentive, especially financial ones.

The results of the present study should be considered with care. First, the small sample size, combined with the large number of dropouts, limits generalization of the findings. Also, we did not include a diagnostic assessment of past or present psychopathology or a more fine-grained analysis of the personal characteristics of patients, which may have interfered with smoking cessation. Also, the study included subjects who enrolled in a clinical setting, and therefore not be representative of all smokers.

Smoking cessation is a dynamic process. The early period of cessation typifies a moment of personal challenge, as behaving in a new way requires effort and not overcoming withdrawal signs and symptoms may preclude immediate success. This work showed

that smokers who reduced or quit smoking, as well as those who did not change their habits, diminished the intensity of nicotine dependence, whereas only the ones who changed their habits raised their scores on the maintenance stage of the URICA scale. Whether the patients who did not reduce or quit tobacco smoking learned to report lower levels of dependence is a factor deserving further investigation. Greater knowledge about the motivation, dependence and comorbidity related to smoking will allow professionals to be better prepared to treat smokers, with more effective treatment plans and interference strategies tailored to these characteristics.

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