

Craving and nicotine withdrawal in a Spanish smoking cessation sample

Craving y abstinencia de la nicotina en fumadores españoles en un tratamiento para dejar de fumar

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Resumen

El craving y el síndrome de abstinencia de la nicotina (SAN) forman parte del trastorno por consumo del tabaco en el DSM-5. Ambos aparecen tras dejar de fumar o tras una reducción brusca del consumo de tabaco, y están relacionados con los resultados de dejar de fumar a corto y largo plazo. El objetivo del presente estudio fue analizar la relación del craving y del síndrome de abstinencia con dejar de fumar al final del tratamiento y con la recaída a los 3 meses de seguimiento en una muestra de fumadores españoles. La muestra estaba formada por 342 fumadores (37,7% hombres; 62,3% mujeres) que recibieron tratamiento cognitivo-conductual para dejar de fumar. La evaluación del craving y del síndrome de abstinencia se realizó a través de la escala Minnesota Nicotine Withdrawal Scale. Los abstinentes al final del tratamiento, comparados con los no abstinentes, mostraron un síndrome de abstinencia y un craving significativamente menor al finalizar el tratamiento. Además, los abstinentes tenían puntuaciones menores en dependencia de la nicotina antes del tratamiento. Entre los abstinentes, el craving descendió significativamente desde los valores presentados antes de dejar de fumar, mientras que en los participantes que no dejaron de fumar los valores de craving permanecieron en los mismos niveles. La dependencia de la nicotina elevada fue el predictor de fumar al final del tratamiento, mientras que el síndrome de abstinencia de la nicotina elevado fue predictor de la recaída a los 3 meses. Los resultados apoyan el papel robusto del craving y del SAN en dejar de fumar y en la recaída, aunque difieren en sus patrones de cambio a lo largo del tiempo.

Palabras Clave: craving, abstinencia, recaída, España, dejar de fumar.

Abstract

Craving and nicotine withdrawal syndrome (NWS) are components of the tobacco use disorder in DSM-5. They both appear after smoking cessation or an abrupt reduction in tobacco use, and they are associated with both short and long-term smoking-cessation outcomes. The aim of the present study was to examine the association of craving and withdrawal with smoking cessation at the end of the treatment and relapse at 3 months follow-up in a Spanish sample of smokers. The sample comprised 342 smokers (37.7% men; 62.3% women) receiving a cognitive-behavioral treatment for smoking cessation. The assessments of craving and withdrawal were conducted using the Minnesota Nicotine Withdrawal Scale. Abstainers at the end of the treatment, compared to non abstainers, showed significantly lower post-treatment withdrawal, and post-treatment craving. Furthermore, they had lower scores in pre-treatment nicotine dependence. Among abstainers, craving decreased significantly from pre-cessation levels, while in those participants who did not quit smoking it remained on the same levels. High nicotine dependence was a predictor of smoking at the end of the treatment, whereas high nicotine withdrawal predicted relapse at 3 months. Findings support the robust role of craving and NWS in smoking cessation and relapse, although they differ in their specific patterns of change over time.

Key Words: craving, withdrawal, relapse, Spain, smoking cessation.

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Nicotine withdrawal syndrome (NWS) is considered an important component of tobacco dependence (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Hughes, Higgins, & Hatsukami, 1990). It includes subjective, cognitive, and physiological symptoms that appear when giving up smoking, which make it more difficult to maintain abstinence (Shiffman, West, & Gilbert, 2004) and it plays an important role in relapse (Piasecki, Jorenby, Smith, Fiore, & Baker, 2003b). In the recent published DSM-5 (American Psychiatric Association [APA], 2013), the signs or symptoms of NWS are irritability, frustration or anger, anxiety, difficulty concentrating, increased appetite, restlessness, depressed mood, and insomnia.

Craving is considered a criterion for the diagnostic of tobacco use disorder in DSM-5 (APA, 2013). However, previously, craving was not considered as a formal criterion of nicotine dependence or NWS in DSM-IV (APA, 1994), nevertheless it was included by different researchers in the scales that assess this syndrome (Etter & Hughes, 2006; West & Hajek, 2004). Craving was not included in the DSM-IV as a symptom of withdrawal because of its inconsistent association with tobacco abstinence (Hughes, Higgins, & Bickel, 1994). Compared to other withdrawal features, craving seems to have a distinctive time course (Gilbert et al., 1998; Hughes, 1992; Shiffman et al., 1997).

Accordingly, it has been considered craving as a subjective experience of a desire or intense need for substance use (APA, 2013), as an important symptom of tobacco dependence (Baker, Breslau, Covey, & Shiffman, 2012; Tiffany, Warthen, & Goedecker, 2009), and there is evidence that it plays a causal role in smoking relapse (Baker et al., 2004; Shiffman, Paty, Gnys, Kassel, & Hickcox, 1996).

The inability to cope with NWS and craving when quitting smoking appears to account for the failure of many cessation attempts (Ferguson, Shiffman, & Gwaltney, 2006). In addition, several studies indicate that the pattern, duration, and severity of NWS and craving experienced by smokers who are abstinent during the first day or the first weeks after quitting are significant predictors of relapse in smokers (Allen, Bade, Hatsukami, & Center, 2008; Hughes, 2007; Piasecki et al., 2003b; Shiffman et al., 1997). For example, Allen et al. (2008) found that higher levels of NWS and craving were associated with relapse. Piasecki et al. (2003b) reported that subjects who relapse reported more severe NWS during smoking abstinence than did non relapsers.

The purpose of the current study was to assess the generalizability of these constructs by analyzing the relationship of craving and NWS with smoking cessation at the end of the treatment, and with relapse at 3 months follow-up, in a sample of Spanish smokers who received a cognitive behavioral smoking cessation intervention. Compared to the United States, where much of the previous research occurred, Spain has a higher prevalence of smoking (24% vs

19%; CDC, 2012; Ministerio de Sanidad, 2013), and Spanish smokers, on average, are less nicotine-dependent (de Leon, Becoña, Gurpegui, Gonzalez-Pinto, & Diaz, 2002). Given these differences, along with more general cultural differences, confirmation of the role of nicotine dependence and NWS upon smoking cessation in this population would strengthen the construct validity of addiction models that emphasize these factors, including DSM-5.

Methods

Participants

The study sample consisted of male and female Spanish smokers ($N = 342$) who requested smoking cessation treatment at the Smoking Cessation Unit of the Faculty of Psychology at the University of Santiago de Compostela (Spain). Recruitment of the smokers was carried out by advertisements in the media (radio, press and local television), through other smokers who had previously sought treatment, or through referral from general practitioners. Selection of participants used the following inclusion criteria: at least 18 years of age; desire to participate in the treatment program; smoking ≥ 10 cigarettes per day; and having completed the questionnaires in the pretreatment assessment. Exclusion criteria were: a diagnosis of a severe mental illness (bipolar disorder and/or psychotic disorder); concurrent dependence on other substances (cocaine, cannabis, and/or heroin); having participated in the same or similar treatment over the previous year; having received another type of effective smoking cessation treatment (nicotine replacement therapy, bupropion, varenicline) in the past year; suffering from a severe physical pathology that would require immediate medical intervention (e.g., recent myocardial infarction, pneumothorax); smoking tobacco other than cigarettes (e.g., cigars); refusing to be video-recorded during the sessions; and failing to attend the first treatment session.

From an initial sample of 412 smokers, 70 were excluded based on exclusion criteria, with the final sample comprising 342 smokers (37.7% men and 62.3% women) with a mean age of 41.58 years ($SD = 10.87$).

Measures

All participants completed the Smoking Habit questionnaire (Becoña, 1994), which obtains information on sociodemographic variables (e.g., gender, age) and aspects related to smoking and smoking history (e.g., number of cigarettes smoked per day, number of years smoking).

For the assessment of nicotine dependence (ND) we used the *Fagerström Test for Nicotine Dependence* (FTND, Heather-ton, Kozlowski, Frecker, & Fagerstrom, 1991; Spanish version by Becoña & Vázquez, 1998).

To assess nicotine withdrawal, the Spanish version of the *Minnesota Nicotine Withdrawal Scale* (Hughes & Hatsukami, 1998) was used (see Table 1). This scale consists of eight

Table 1
Spanish version of the 'Minnesota Nicotine Withdrawal Scale'

	Nada	Escaso	Leve	Moderado	Severo
	0	1	2	3	4
1. Enfado/Irritabilidad/Frustración					
2. Ansiedad/Nerviosismo					
3. Dificultad de concentración					
4. Impaciencia/Intranquilidad					
5. Incremento del apetito, hambre, ganancia de peso					
6. Insomnio, problemas con el sueño, despertar a media noche					
7. Ánimo deprimido, tristeza					
8. Deseo o necesidad de fumar					

items (irritability, angry or frustrated; anxiety or tension; difficulty concentrating; restlessness or impatience; increased appetite, hungry or weight gain; depressed mood or sad; insomnia, sleep problems or awakening at night; and, desire or craving to smoke) measured with a Likert scale ranging from 0 (no symptoms) to 4 (severe symptoms). The sum of the items, minus the craving score which is assessed separately, was used to assess overall NWS. This scale has been found to have fair to good internal consistency with alpha ranging from .80 to .83 (Toll, O'Malley, McKee, Salovey, & Krishnan-Sarin, 2007). Craving was assessed as a single item on the scale, due to evidence suggesting that craving patterns are distinct from other symptoms of withdrawal (Hughes & Hatsukami, 1998), and scores were analyzed separately.

We used the Micro⁺ Smokerlyzer[®] (Bedfont Scientific Ltd, Sittingbourne, UK) to measure carbon monoxide (CO) in expired air, to corroborate self-reported abstinence at the end of the treatment and at 3-month follow-up (cut-off point of < 10 ppm to be considered a non-smoker) (West, Hajek, Stead, & Stapleton, 2005).

Procedure

At the initial assessment, we administered the measurements described above. *Minnesota Nicotine Withdrawal Scale* was administered again for the assessment of craving and NWS at the end of the treatment and at 3 months follow-up. All smokers gave their informed consent to participate in the research, and the Bioethics Committee of the University of Santiago de Compostela authorized the study.

The psychological treatment administered was the *Smoking Cessation Program* by Becoña (2007), a manualized cognitive-behavioral treatment that comprises 6 group-format sessions over six weeks (one session per week). The treatment was administered by psychologists trained in its application.

We considered that a participant relapsed when he or she had been abstinent for at least 24 hours at the end of the treatment, but reported any smoking during the 7 days prior to the date of the 3-month follow-up (Velicer, Prochaska, Rossi, & Snow, 1992).

Data analysis

Analyses were conducted using SPSS 20. Descriptive statistics were used to describe demographic and smoking history characteristics of the participants. Comparisons of clinical characteristics pre- and post-treatment and at 3-months follow-up were conducted using t-test. The effect size (ES) of significant results is reported in the tables ($d = 0.20-0.49$ small ES, $d = 0.50-0.79$ medium ES, and $d = 0.80$ and above large ES, Cohen, 1988).

For testing the change in craving and NWS over the three times points (pre, post-treatment and 3 months follow-up), among abstainers and relapsers at 3 months follow-up, mixed factor analyses of variance (ANOVAs) were conducted, with time as the repeated factor and smoking status at 3 months follow-up (abstainer-relapser) as the between-subjects factor. We used Bonferroni's post-hoc tests for verifying the existence of significant differences in the pairwise comparison.

Additionally, the role of craving and NWS in predicting smoking at the end of the treatment and smoking relapse at 3 months follow-up was analyzed using stepwise logistic regression (forward conditional). According to this method, variables are selected in the order in which they maximize the statistically significant contribution to the model. The significance level for all analyses was set at 0.05.

Results

Sample characteristics

Participants in this study ($N = 342$) smoked a mean of 21.62 cigarettes per day ($SD = 8.16$, range: 10-40). FTND

mean as 5.28 ($SD = 2.12$), NWS mean was 7.18 ($SD = 6.21$), and craving mean was 2.92 ($SD = 1.02$).

Smoking status at the end of the treatment and its relationship with NWS and craving

We had data at the end of the treatment from 312 participants (91.23% of the initial sample). Of them, 201 (64.42%) were abstinent and 111 (35.58%) continued smoking. Among those who continued smoking a significant reduction in the number of cigarettes at the end of the treatment was produced ($M = 24.85$, $SD = 9.37$ pre-treatment, and $M = 7.93$, $SD = 6.74$, post-treatment; $t = 18.34$, $p < .001$).

Regarding variables assessed pre-treatment (ND, NWS and craving) significant differences were found at the end of the treatment for only ND; abstainers had lower ND than participants who continued smoking ($M = 4.84$, $SD = 2.09$ for abstainers, and $M = 5.88$, $SD = 1.97$, for smokers; $t = -4.30$, $p < .001$).

On NWS and craving post-treatment, significant differences were observed by final smoking status. Abstainers presented lower NWS ($M = 8.15$, $SD = 5.08$ for abstainers, and $M = 10.98$, $SD = 6.58$ for smokers; $t = -3.94$, $p < .001$), and lower craving ($M = 1.84$, $SD = 1.13$ for abstainers, and $M = 2.73$, $SD = 1.05$ for smokers; $t = -6.84$, $p < .001$), than smokers.

Smoking status at 3 months follow-up and its relationship with NWS and craving

Taking as a reference the number of participants who were abstinent at the end of the treatment ($n = 201$), we obtained complete data for 162 participants on NWS and craving pre-treatment, post-treatment and at 3 months follow-up. Of these 106 (65.43%) remained abstinent and 56 (34.57%) relapsed by 3 months follow-up.

At 3 months follow-up, we found significant differences on NWS and craving assessment between abstainers and relapsers. Those participants who relapsed at 3 months follow-up presented higher NWS ($M = 6.02$, $SD = 6.30$ for abstainers, and $M = 9.75$, $SD = 6.77$ for relapsers; $t = -3.46$, $p < .001$), and higher craving ($M = 0.81$, $SD = 1.05$ for abstainers, and $M = 2.66$, $SD = 1.08$ for relapsers; $t = -10.53$, $p < .001$), than participants who remained abstinent at 3 months follow-up.

Evolution of craving and NWS from the beginning to the end of treatment (n = 312)

Among end-of-treatment abstainers ($n = 201$), we observed that the pattern of change of craving was different than that of NWS. Craving in abstainers decreased until reaching values below pre-treatment levels (2.97 pre-treatment vs. 1.84 post-treatment; $t = -11.08$, $p < .001$). However, NWS increased (6.53 pre-treatment, vs. 8.15 post-treatment; $t = -3.64$; $p < .001$).

Among continuing smokers, craving remain stable (2.89 pre-treatment vs. 2.73 post-treatment; $t = 1.31$, n.s.), but NWS increased significantly (8.04 pre-treatment vs. 10.98 post-treatment; $t = -4.19$, $p < .001$).

Evolution of craving and NWS from treatment onset to the 3 months follow-up (n = 201)

As seen in Table 2 we found no differences between those who abstained versus relapsed at 3-months on either pre-treatment craving or NWS. At posttreatment, only NWS differed between the groups (7.34 for abstainers vs. 9.89 for relapsers). By 3 months follow-up, we observed significant differences between abstainers and relapsers on both variables. Those who relapsed had a higher craving and higher NWS than those who remained abstinent.

With respect to NWS, the ANOVA indicated a significant effect of the time factor (pre, post and 3 months) and of the group factor (abstainers and relapsers), and a significant time x group interaction. Thus, among relapsers ($n = 56$), after the application of post hoc Bonferroni correction (see Figure 1), we found significant differences between NWS pre and post ($p < .001$) and NWS pre and 3 months follow-up ($p < .05$), but no differences between NWS post and 3 months follow-up. In abstainers ($n = 106$), no significant differences were found on NWS across the different time points.

With respect to craving, we found a significant time effect, a significant group effect, and a significant time x group interaction. Among relapsers (see Figure 2), a signifi-

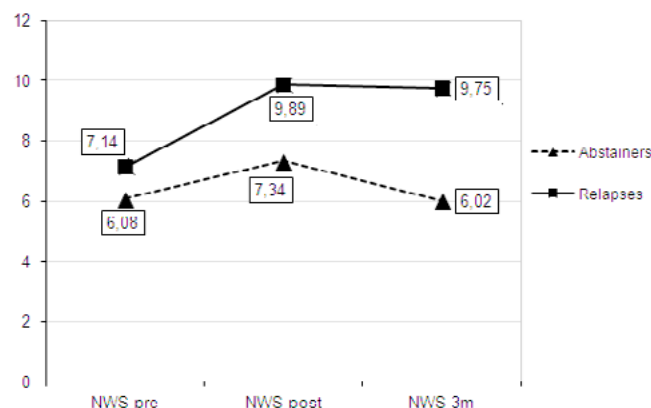


Figure 1. Nicotine withdrawal syndrome (NWS) over the three time points among relapsers and abstainers.

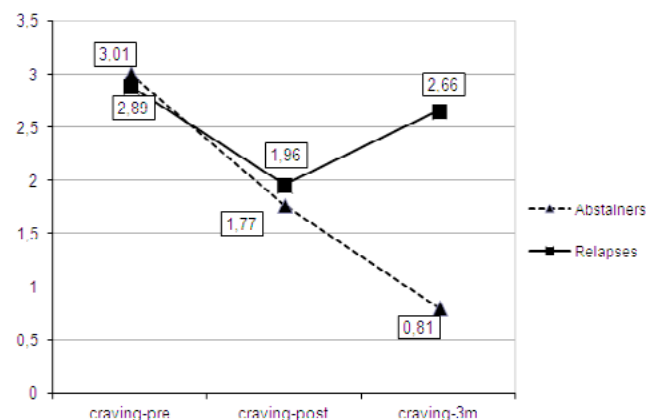


Figure 2. Craving over the three time points among relapsers and abstainers.

Table 2

Differences in craving and nicotine withdrawal syndrome (NWS) at three time points (pre-treatment, post-treatment, and 3 months follow-up) among abstainers and relapsers

3 months follow-up (n = 162)						
	Abstainers (n = 106; 65.43%)	Relapsers (n = 56; 34.57%)	t	95% CI		d
				Lower	Upper	
Pre-treatment assessment						
NWS, Mean (SD)	6.08 (5.41)	7.14 (5.49)	-1.19	-2.84	0.70	
Craving, Mean (SD)	3.01 (0.82)	2.89 (0.99)	0.76	-0.19	0.42	
Post-treatment assessment						
NWS, Mean (SD)	7.34 (4.89)	9.89 (5.52)	-3.02**	-4.22	-0.88	0.23
Craving, Mean (SD)	1.77 (1.12)	1.96 (1.04)	-1.06	-0.55	0.17	
3 month follow-up assessment						
NWS, Mean (SD)	6.02 (6.30)	9.75 (6.77)	-3.49***	-5.84	-1.62	0.27
Craving, Mean (SD)	0.81 (1.05)	2.66 (1.08)	-10.53***	-2.20	-1.50	0.64
NWS						
	Anova Time (pre, post, 3 months)	F (2,159) = 7.28***				
	Group (abstainer, relapses)	F (1,160) = 11.83***				
	Interaction (time x group)	F (2,159) = 3.14*				
Craving						
	Anova Time (pre, post, 3 months)	F (2,159) = 68.74***				
	Group (abstainer, relapses)	F (1,160) = 37.56***				
	Interaction (time x group)	F(2,159) = 43.27***				

Note. NWS = nicotine withdrawal syndrome.

* p < .05; ** p < .01; ***p < .001.

Table 3

Logistic regression analysis output as predictors of smoking status at the end of treatment (n = 312) and at 3 months follow-up (n = 162)

	B ^a	Wald	p value	OR	OR (95% CI)
End of the treatment					
ND, FTND (≥ 6) pre-treatment	0.828	11.772	.001	2.28	1.42-3.67
Constant	-0.986	33.289	.001	0.37	
3 months of follow-up					
NWS-post	0.094	8.258	.004	1.09	1.03-1.02
Constant	-1.445	18.555	.001	0.23	

Note. CI = confidence interval; FTND = Fagerström Test for Nicotine Dependence; ND = nicotine dependence; OR = odds ratio.

^a The groups were coded into the model as Smokers = 1 and Abstainers = 0.

cant decrease was observed in craving from pre to post-treatment, followed by a significant increase by 3 month. However, pre-treatment and at 3 months craving did not differ. In contrast, among abstainers, we found progressive decline in craving between the 3 time points with all differences statistically significant at $p < .001$.

Predictors of smoking status at the end of the treatment and relapse at 3 months follow-up

For analysing predictors of smoking status at the end of the treatment, binary logistic regression was conducted using those 312 participants with end-of-treatment data, as the criterion variable smoking or abstinent and the predictor variables ND, NWS-pre, and craving-pre. We found that ND was significantly associated with smoking at the end of the treatment. Having high ND ($OR = 2.28$) was associated with a significantly increased likelihood of smoking at the end of the treatment (see Table 3).

We also examined predictors of relapse at 3 months follow-up, using a binary logistic regression analysis using the 162 participants with follow-up data out of the 201 who had reached abstinence at the end of the treatment. Adopting as the criterion variable smoking or abstinent, and as predictor variables ND, craving-pre, NWS-pre, craving-post, and NWS-post, we found that NWS post was associated with a higher risk of relapse. That is, higher NWS at the end of the treatment was associated with a significantly increased likelihood of smoking 3 months later ($OR = 1.09$; see Table 3).

Discussion

Role of NWS, craving, and ND on the treatment outcome

We found that those participants who did not quit smoking at the end of the treatment presented a higher post-treatment NWS and craving for cigarettes than those participants who achieved abstinence. This same result has been found in previous studies (e.g., Ferguson et al., 2006; Tiffany et al., 2009) in which high scores in NWS and craving were associated with failures when quitting smoking. We also observed that high pre-treatment ND predicted failure to quit smoking by the end of the treatment. These results are consistent with the robust role of ND in the maintenance of smoking behavior (Benowitz, 2010) and the predictive power of ND (Ferguson et al., 2003). These results support the statement that both NWS and craving, as well as nicotine dependence in general, are related to treatment outcome. Indeed, these results are consistent with previous studies that established craving and NWS as symptoms of dependence and predictors of smoking cessation success (Hughes et al., 1990; Tiffany et al., 2009), consistent with DSM-5 criteria. Moreover, these relationships between craving, ND, and smoking cessation outcomes are consistent with Robinson et al. (2011) who found that more dependent smokers also experienced

greater craving, and Baker et al. (2012), who considered craving as a NWS symptom and as the symptom most associated with tobacco dependence.

With respect to the concurrent relationship between craving and NWS with smoking at 3 months follow-up, those participants who had relapsed presented with significantly higher NWS and craving than those who remained abstinent. This is contrary to many smokers' expectations that craving and withdrawal symptoms will decrease if they return to smoking. However, these uncomfortable effects in fact appear more likely to decline if they remain abstinent.

With respect to predicting relapse among smoker who achieved end-of-treatment abstinence, we observed that high post-treatment NWS was associated with a greater risk of relapse at 3 months. Therefore, as Piasecki et al. (2003b) and Shiffman et al. (2004) had pointed out, the NWS that a smoker suffers when quitting appears to play an important role in the maintenance of abstinence versus relapse. This suggests that greater emphasis on controlling NWS, via pharmacotherapy, education, and coping skills training, may be advisable in general, and particularly for those smokers who present with high NWS during treatment.

Evolution of craving and NWS

We found different patterns of change in these two variables, among both abstainers and continuing smokers between pre- and post-treatment. Consistent with other studies, we found that among abstainers craving decreased whereas NWS increased (Etter, 2005; Gilber et al., 1998; Hughes, 1992; Shiffman et al., 1997) finding different patterns of change in craving and NWS among abstaining smokers. The increase in NWS is a normal fact giving that they have quit smoking and, although the treatment is based on a gradual cessation, any reduction in nicotine intake carries on the presence of NWS regardless of a higher or lower intensity. Thus, it is necessary to work during the treatment with the aim of decreasing NWS as far as possible to avoid relapse due to the discomfort generated by these symptoms. An important aspect that should be included in the treatment is craving decrease. One of the most frequent expectations among smokers is that if they give up smoking, craving or the desire for the consumption is going to be very intense.

Among continuing smokers, we also found an increase NWS, but no change in craving. The increase in NWS among continuing smokers may reflect the reduction in smoking (and, therefore, likely nicotine intake) that most of the smokers experienced during treatment.

With respect to the change in craving and NWS from the onset of the treatment until the 3 months follow-up, our results showed that craving decreased significantly among abstainers. On the other hand, in those who relapse, an increase in craving in the 3 months follow-up was found. A similar result was reported by Schlam, Piper, Cook, Fiore, and Baker (2012), in which craving continued

decreasing in the group of abstainers compared to those who continue smoking at one year follow-up. The finding of craving increases among relapsers is consistent with studies showing that relapses often occur in the presence of an intense craving (Shiffman et al., 1997). Regarding NWS, only abstainers showed a decline by 3 months. The continuing NWS among relapsers may reflect their continued attempts to control their smoking, rather than simply immediately resuming their pretreatment patterns of use. It would be very interesting to analyze in future studies if this result is due to the characteristics of this type of treatment for smoking cessation in which the smoker learns different strategies to control their smoking behavior or whether NWS remains high when relapsing regardless of the method used.

Limitations

The study has several limitations. First, we must take care with generalizing the results obtained from this treatment study, with specific inclusion and exclusion criteria, to the general population of smokers. Moreover, it would be interesting to analyze the evolution of craving and NWS in smokers who gave up smoking without attending a specific treatment and see if there are differences with those who used specific procedures. On the other hand, that this specific sample of Spanish smokers in treatment produced results consistent with previous research with very different samples supports the robustness and generalizability of the roles of craving and nicotine withdrawal. Second, the size of the sample of relapsers was modest, which may have limited our power to detect effects. Finally, our findings are based on retrospective, self-reports. However, we employed a widely-accepted and reliable instrument for the assessment of NWS (Shiffman et al., 2004).

Conclusions

In summary, evidence indicates that craving decreases as the time without smoking increases, but that relapse is associated with craving increase. In the case of NWS, a slight increase happens when giving up smoking and it decreases as length of abstinence increases, whereas it remains high among relapsers. Moreover, we found that at the end of the treatment, NWS is higher in persons who later relapse than among those who do not, although the levels of craving are similar between the groups.

In conclusion, our findings among a Spanish sample of smokers provide further support for the robust role of craving and NWS in smoking cessation and relapse.

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Conflict of interest

None declared.

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