

# Tobacco Addiction: Effect on Human Health

## Chapter 1

### Emotional Factors and Tobacco Consumption in Women: A Review

*Jennifer Lira-Mandujano<sup>1\*</sup>; Daniel Pech-Puebla<sup>1</sup>; Sara Eugenia Cruz-Morales<sup>1</sup>*

*<sup>1</sup>Faculty of Higher Studies –Iztacala, National Autonomous University of Mexico, México.*

*\*Correspondence to: Jennifer Lira-Mandujano, Faculty of Higher Studies –Iztacala, National Autonomous University of Mexico México.*

*Email: [liramjenn@comunidad.unam.mx](mailto:liramjenn@comunidad.unam.mx)*

---

#### Abstract

According to different epidemiological studies, it has been observed that there is a strong association between the consumption of tobacco and different chronic degenerative diseases. Despite that different investigations have been carried out and different strategies have been designed and implemented both to prevent the initiation of tobacco consumption, and to execute effective interventions to stop smoking, it has been detected that the percentage of women who smoke has increased. Pharmacological treatments are not effective for women, and the factors associated with tobacco use are different in women than those in men.

Therefore, the objective of this review is to determine the emotional factors associated with tobacco use in women. A search was carried out in different databases to identify articles evaluating emotional factors associated with tobacco consumption in women; 22 articles were considered and categorized in depression, negative affect and menstrual cycle.

Awareness of the specific factors associated with the consumption of cigarettes in women will aid in the design of prevention strategies to avoid the initiation of cigarette consumption and interventions toward smoking cessation for women.

**KeyWords:** Women, Smoking, Emotional factors

## 1. Introduction

According to several epidemiological studies, there is a strong association between consumption of tobacco and different chronic degenerative diseases [1]. Various investigations have been carried out, and many strategies have been designed and implemented both to prevent the initiation of tobacco consumption and to implement effective interventions to stop smoking, nevertheless, the percentage of women who smoke has increased. Pharmacological treatments are not as effective for women as they are for men, and the factors associated with tobacco use are different in women than in men [2-3]. Awareness of the specific factors associated with the consumption of cigarettes in women will aid in the design of prevention strategies to avoid the initiation of cigarette consumption and interventions toward smoking cessation for women.

Tobacco consumption is considered a public health problem at the international level and as the first preventable cause of different diseases [4]. In 2015, according to the Global adult tobacco survey [5], 879 million of adults worldwide were smokers (721 million men and 158 million women). A significant aspect of tobacco consumption is the economic burden to the consumer, and to society considering the cost of medical care for related diseases, the absence from work, the disability expenses and the years of potential life lost due to premature death [6].

According to the World Health Organization [7] tobacco use, unlike the use of other drugs, is associated with chronic diseases with high risk of mortality such as different types of cancer, cardiovascular disease, and respiratory diseases, for example, chronic obstructive pulmonary disease (COPD) [8]. Tobacco use is a risk factor for six out of eight leading causes of mortality in the world: ischemic heart disease, cerebrovascular diseases, lower respiratory infections, chronic obstructive pulmonary disease, tuberculosis and cancer of the trachea, bronchi, and lungs [9].

As a result, tobacco consumption is the cause of death of more than 7 million people each year around the world [4]. Deaths attributed to tobacco in adults aged 30 or more represent 12% worldwide; regarding gender, the proportion of deaths worldwide associated to tobacco use are 16% for men and 7% for women [10].

To provide a direct solution to this public health problem, the World Health Organization [11] proposed the Framework Convention on Control of Tobacco (FCTC) to protect the world population from the consequences of consumption and smoke exposure. This agreement was translated into the policy and intervention plan of MPOWER to reverse the tobacco epidemic [9]. Some articles of the FCTC stress policies and strategies focused on delaying and preventing the initiation of tobacco use, as well as implementing strategies that reduce the prevalence of tobacco consumption.

The specific tobacco prevention strategies focused for women are justified by several aspects: a) according to epidemiological data on tobacco consumption in women, the prevalence of consumption has increased and the age of onset has decreased in this group; b) tobacco use has specific effects on women's health that confirm its link with cancer, cardiovascular and pulmonary diseases, and also its consequences on reproductive health, and on the risks of exposure to second-hand tobacco smoke, with the consequent economic cost that these diseases have for women and their families [8]; c) research assessing the effectiveness of interventions to stop smoking, generally shows very low rates of abstinence, specifically when using nicotine replacement therapies and non-nicotine pharmacological therapies, [2-3] and d) women are highly vulnerable to depression, anxiety and negative affect, so they use cigars to regulate these emotional states [13-14]. All the aspects mentioned above should be considered in the implementation of tobacco prevention strategies focused on girls and the design of cessation treatments aimed at women. Therefore, the objective of this paper is to determine the emotional factors associated with tobacco consumption in women to contribute to the design of prevention and intervention strategies for girls and women.

## **2. Method**

A search was carried out in the databases EBSCOHOST, MEDLINE, PsychoINFO, and PubMed with the keywords: depression, negative affect, smoking, women, abstinence, and tobacco consumption. Initially, 75 articles were identified; only 22 articles met the inclusion and exclusion criteria and were included in the present review.

### **Inclusion criteria:**

a) Assessment of gender differences regarding tobacco consumption, or that the sample included only women, b) that tobacco consumption was related to emotional factors in women, and c) that they were published between 2007 and 2017.

### **Exclusion criteria:**

A sample including women with alcohol dependence or use of illegal drugs, b) including pregnant women, c) the sample had a diagnosis of a chronic degenerative disease such as cancer, diabetes, COPD or heart disease.

## **3. Results**

We identified 22 studies (**Table 1**) that were organized into categories related to emotional factors and smoking behavior in women, specifically: 1) depression and tobacco consumption, 2) negative affect and smoking and 3) menstrual cycle, tobacco consumption, and abstinence.

### 3.1. The Depression in Women and Tobacco

**Table 1:** Main characteristics of each study that met the inclusion and exclusion criteria.

Other	Objective	participants	Design	Results
<b>1. The depression in women and tobacco.</b>				
Larsen, Otten, & Engels (2009)	Examine the impact of concerns about weight and diet in adolescents with depression and the association with tobacco use. To assess the differences between men and women.	2,051 adolescents (1056 men y 995 women) average age of 13.8 years.	No experimental. Transversal.	Positive correlation between depression symptoms and smoking for boys and girls ( $p < 0.10$ ). Dieting was significantly associated with smoking only in women ( $p < 0.001$ ).
Morell, Cohen, & McChargue (2010).	Investigate the relationship between vulnerability to depression and smoking behavior. Assess if gender and expectancies about nicotine's ability to reduce negative affect have a moderator effect in this relationship.	1,214 university students (60% women).	No experimental. Transversal.	Those who had depression history were more vulnerable to smoking (OR=1.8, 95% CI= 1.3-2.4, y OR=2.1 95% CI= 1.5-2.8, respectively). Gender was a moderator between depression history and smoking.
Schleicher, Harris, Catley, & Nazir (2009)	Investigate the expectancy about nicotine's ability to regulate negative affect as a potential mediator of depression (history of depression and depressive symptoms).	315 university students.	No experimental. Transversal.	Depressive symptoms predicted the number of cigarettes smoked in the last month ( $B=3.42$ , $DS=1.26$ ; $\beta=0.15$ , $t=2.71$ , $p=0.007$ ) and the expectations of regulation of the negative affect ( $B=0.07$ , $DS=0.02$ ; $\beta=0.19$ , $t=3.43$ , $p=0.001$ ).
Husky, Mazure, Paliwal, & McKee (2008)	Determine whether the smoking behavior was associated with having major depression or having had depression at some point in life and if this association was stronger in women.	Epidemiological survey of 43,093 people.	No experimental. Transversal. Epidemiological review.	The association between the smoking behavior and major depression was mediated by gender ( $X^2=14.36$ , $p < 0.03$ ). Compared with men, women with prior smoking were at significantly higher risk of current and past depression (OR: 1.53 vs 1.36; 1.72 vs 1.36), also for current occasional (OR: 1.92 vs 1.39; 1.90 vs 1.30) and daily smoking (OR: 2.52 vs 1.95; 1.84 vs 1.48).

Other	Objective	participants	Design	Results
Wewers, Salsberry, Ferketich, Ahijevych, Hood, & Paskett (2012)	Examine the association between social, emotional, demographic factors, and the status of consumption among women.	570 women Never smokers (52%). Ex-smokers (20.5%) Current smokers (27.5%).	No experimental. Transversal.	Women with low socioeconomic status had a higher probability of smoking (OR: 3.05, 95% CI 1.74-5.34); the factors associated with current tobacco consumption were age 18-50 years (OR: 2.30, 95% CI 1.22-4.33), between 18-30 years (OR: 3.29, 95% IC 1.72-5.34), depression (OR: 1.99, 95% IC 1.31-3.05) and age of first pregnancy <20 (OR: 1.74, 95% IC 1.14-2.66). Low socioeconomic level and the combined depressive symptoms were most strongly associated with smoking.
Luk & Tsoh (2010)	Study if gender modulated the association between smoking and depression.	1,393 people (43.8% women). Never smokers (39.3%) Ex-smokers (7.3%) Current smokers (53.4%).	No experimental. Cross-sectional.	Women smoking currently (M=12.84, SD=0.59) had a higher level of depression compared to ex-smokers (M=8.64, SD=0.99, p<0.001) and never smokers (M=9.33, SD=0.24, p<0.001). Men smoking currently (M=11.18, SD=0.22) had more depressive symptoms compared with ex-smokers (M=9.01, SD=0.62, p=0.001). Between current smokers, women (M=13.34, SD=0.53) had more severe depression than men (M=11.24, SD=0.22).
Weinberger, Pilver, Desai, Mazure, & McKee (2013)	Examine changes in tobacco consumption over 3 years in an adult population with and without dysthymia and depression.	11,973 ex-smokers and smokers who consumed daily (46% women).	No experimental. Longitudinal. Data retrieved from two epidemiological studies.	Participants with current dysthymia were 113% (p<0.01) more likely and participants with minor depression were 53% (p<0.05) more likely to continue to smoke. Compared with those without diagnosis, the probabilities of continuing smoking were higher in daily smokers with current dysthymia (OR = 2.13, 95% IC = 1.23, 3.70) or depression (OR = 1.53, 95% IC = 1.07, 2.18).
<b>2. Negative affect and smoking in women</b>				
Audrain-McGovern et al. (2014)	Evaluate the gender differences in adolescents regarding the role of positive and negative affect in the development and consumption of tobacco.	1,357 high school students.	Cohort longitudinal study.	The negative affect at baseline was positively and significantly related to the progression of consumption in men (b=0.038, Z=2.874, p=0.004) and women (b=0.025, Z=3.609, p<0.0001), but the difference in gender was not significant (X <sup>2</sup> (1) =0.82, p=0.37). For each SD in the negative affect (SD=4.40) the probabilities of the progression of consumption were 15% (OR: 1.15, 95% CI 1.06-1.26) greater.

Other	Objective	participants	Design	Results
Leventhal et al. (2007)	Evaluate gender differences during abstinence and whether there are changes in the negative affect during this period.	203 adult smokers (50.2% women).	Experimental.	Women consistently reported increased negative affect during abstinence (anxiety (T1: $t=3.14$ , $p<0.01$ ), sadness (T1: $t=2.30$ , $p<0.05$ ), irritability (T1: $t=2.21$ , $p<0.05$ ; T2: $t=2.58$ , $p<0.05$ ) and impatience (T1: $t=2.20$ , $p<0.05$ ; T2: $t=3.42$ , $p<0.05$ ), distress and the desire to smoke to alleviate distress caused by the abstinence (T1: $t=3.16$ , $p<0.01$ ; T2: $t=2.44$ , $p<0.05$ ), and more withdrawal symptoms such as concentration difficulties and unpleasant physical symptoms (headaches [T1: $t=2.07$ , $p<0.05$ ; T2: $t=2.57$ , $p<0.05$ ], autonomic symptoms and drowsiness [T1: $t=2.65$ , $p<0.01$ ]).
Perkins et al. (2013)	Investigate differences in craving and negative affect according to gender.	Two Studies: Study 1: 105 adult smokers (63 male y 42 women). Study 2: 164 adult smokers (86 male y 78 women).	Experimental. Transversal.	Craving during abstinence and condition of induction of negative affect were higher in women than in men ( $F(1, 160) = 4.02$ , $p=0.047$ ).
Pang, & Leventhal (2013)	Assess whether there were differences between genders in the negative affect related to smoking abstinence and the time to start smoking in a task analogous to smoking cessation.	199 people (68 women y 131 men).	Experimental. Counter balanced.	During abstinence, women showed an increase in negative affect ( $\beta= -0.17$ , $p<0.01$ ) as well as in several states of negative affect (fear ( $\beta= -0.18$ , $p<0.01$ ), anxiety ( $\beta= -0.20$ , $p<0.01$ ), depression ( $\beta= -0.15$ , $p<0.05$ ) and confusion ( $\beta= -0.14$ , $p<0.05$ ).
Pang et al. (2015)	Study the relationship between gender and negative smoking reinforcement expectancies	Sample 1: 278 people not looking for treatment. Sample 2: 494 people looking for treatment.	No experimental. Transversal.	In both groups, seeking treatment and not seeking treatment, women reported stronger NR smoking expectancies than men (sample 1 $\beta$ [95% CI] = $-0.22$ [ $-0.33$ , $-0.10$ ], $p<0.001$ ; sample 2 $\beta$ [95% CI] = $-0.18$ [ $-0.27$ , $-0.09$ ]; $p<0.001$ ).
Xu et al. (2008)	Determine if negative reinforcement increases the risk of relapse in women and men abstinence smokers.	26 women smokers. 38 male smokers.	Experimental.	Women smokers in the 13-hour abstinence condition had more severe symptoms of negative mood (tension-anxiety ( $F(1, 60) = 7.47$ , $p=0.008$ ) and psychological symptoms ( $F(1, 59) = 6.89$ , $p=0.011$ ) and enjoyed greater relief than men.

Other	Objective	participants	Design	Results
Weinberger, & McKee (2012)	Investigate the gender role of smoking behavior after an implicit induction of negative affect using music.	90 adult smokers. Condition 1: Induction of negative mood. Condition 2: Induction of positive mood. Condition 3: Neutral mood condition.	Experimental Transversal.	In the condition of negative mood induction, women started smoking faster than men ( $t(25) = 2.26, p < 0.05$ ). There were no differences by gender in the number of cigarettes smoked or in the craving for smoking between mood conditions (women's mean = 1.49, DS=0.84; men's mean = 1.53, DS=0.63).
Saladin et al. (2012)	Evaluate whether the difference between genders was related to differential craving and stress reactivity to smoking and negative affect/stress related cues.	37 women and 53 men with tobacco consumption.	Experimental. Transversal.	Participants showed increased craving and skin conductance in response to smoking signals compared to neutral signals ( $p < 0.001$ ) and increased subjective stress in response to negative affect/stress signals against neutral/relaxation signals (all $p$ 's less than 0.001). Women showed greater craving, stress and activation, lower valence ratings (greater negative emotion) in response to negative affect/stress signals (all $F$ 's lower than 0.70 and all $p$ 's less than 0.01).
<b>3. Menstrual cycle, tobacco and abstinence.</b>				
Saladin et al. (2015)	Examined whether the phases of the menstrual cycle (follicular or luteal) could explain the difference in reactivity to stress signals between male and female smokers.	55 men. 22 women in follicular phase. 15 women in luteal phase.	Experimental. Cross-sectional.	Compared to men, women in the luteal phase experienced greater craving after being presented with stressful cues, and women in the follicular phase experienced greater stress, activation, and lower valence (greater negative emotion), all $F$ 's ( $2, 85/86$ ) $\geq 3.9$ , all $p$ 's $\leq 0.02$ .
Pang, Andrabi, & Leventhal. (2017)	Study whether premenstrual syndrome (PMS) was associated with tobacco dependence and the factors that could impact success of cessation attempts.	157 female smokers.	No experimental. Transversal.	PMS was associated with greater dependence on tobacco, with withdrawal symptoms during the most recent attempt to quit smoking ( $Bs = 0.19-0.28, p < 0.05$ ), and with the number of attempts to quit smoking. SPM was associated with high probabilities of having used electronic cigarettes during the last cessation attempt (OR: 1.54, 95% IC 1.06-2.24).

Other	Objective	participants	Design	Results
Allen, Allen, Lunos, & Pomerleau (2010)	Describe the association between withdrawal symptoms during an attempt to stop smoking, and investigate the impact of these symptoms on the success of cessation of tobacco use and its relationship with the premenstrual period	202 participants. Luteal phase: 96 women. Follicular phase: 106 women.	Experimental. Longitudinal.	Participants on the follicular phase group smoked, on average, fewer cigars per day than in those on the luteal phase group (17.5 + 6.5 vs 15.8 + 4.7, $p=0.033$ , respectively). Participants in phase L had greater symptoms during the first six days of the abstinence attempt in: water retention (5.55 + 0.27 vs 4.63 + 0.28, $p=0.017$ ), pain (5.13 + 0.23 vs 4.31 + 0.23, $p=0.011$ ), total score on the premenstrual scale (19.21 + 0.73 vs 17.17 + 0.75, $p=0.047$ ), and on appetite/weight gain (2.02 + 0.10 vs 1.36 + 0.10, $p<0.001$ ). In phase F, those who had higher levels of anger and craving during the first six days of the abstinence attempt were more likely to relapse after 14 days of smoking (OR: 2.00, 95% CI= 1.09-3.68, $p=0.026$ ; OR: 2.63, 95% CI= 1.33-5.21, $p=0.006$ , respectively).
Sakai, & Ohashi (2013)	Examine changes in tobacco consumption in luteal and follicular phases and the association between smoking, craving, depression and symptoms associated with menstrual phases.	29 women smokers.	No experimental. Longitudinal.	Significant differences were found in the number of cigarettes between menstrual phases ( $F(2,84)=3.178$ , $p=0.007$ ); the group on the luteal phase consumed more cigars ( $p=0.028$ ). Craving, depression and symptoms associated with the menstrual period differed significantly among the two phases evaluated ( $F(2,84)=13.681$ , $p<0.001$ ; $F(2,84)=5.154$ , $p<0.001$ ; $F(2,84)=17.532$ , $p<0.001$ , respectively).



Other	Objective	participants	Design	Results
Allen et al. (2014)	Investigate the difference in symptomatology during acute smoking abstinence with respect to the follicular and luteal menstrual phases. Identify the association between depressive symptoms and symptomatology in acute abstinence and examine if the menstrual phases work as a modifying effect between depressive symptoms and the symptoms in acute tobacco withdrawal.	147 women smokers.	No experimental. Longitudinal.	<p>During acute abstinence, there was a greater average of abstinence as well as perceived stress in the luteal phase (<math>9.1 + 0.4</math> vs <math>8.0 + 0.4</math>, <math>p=0.0090</math>; <math>23.2 + 0.6</math> vs <math>20.9 + 0.6</math>, <math>p=0.0006</math>, respectively).</p> <p>Two of the premenstrual symptoms (pain and water retention) and the total premenstrual symptoms increased in the luteal phase while decreasing in the follicular phase <math>p&lt;0.001</math>. The affection was higher in the luteal phase during acute abstinence (<math>p=0.0353</math>). The menstrual phase was identified as a moderating effect, given that, in the follicular phase but not in the luteal phase, the sub-scale of premenstrual pain was positively associated with depressive symptoms and premenstrual pain (<math>B (SE) = 0.07(0.02)</math> vs <math>B (SE) = -0.02(0.03)</math>, <math>p=0.0126</math>, respectively), in addition to the association between affection. Negative and depressive symptoms were higher in the follicular phase (<math>B (SE) = 0.27 (0.04)</math> vs <math>B (SE) = 0.14 (0.05)</math>, <math>p=0.0021</math>, respectively).</p>
Allen et al. (2015)	Assess if the menstrual phase influences the subjective response of nicotine during acute smoking abstinence.	140 participants. Follicular-Luteal group: 72. Luteal-Follicular group: 68.	No experimental. Longitudinal.	Phase L was associated with an increase in the "stimulated" item of the Visual Analog Scale (VAS), compared to phase F ( $14.4 + 2.3$ vs $7.2 + 2.2$ , $p = 0.01$ , respectively). Phase L was associated with a greater reduction in the item "urgency of smoking", compared to phase F ( $-21.1 + 2.5$ vs $-13.6 + 2.3$ , $p = 0.02$ , respectively).
Carlson, Allen, Allen, & al' Absi (2017)	Compare the level of cortisol and mood between the different phases of the menstrual cycle during acute smoking abstinence.	125 women smokers.	No experimental. Longitudinal.	<p>There were no significant differences between the menstrual phases with respect to the cortisol values (follicular mean=6.78; luteal cortisol=6.68).</p> <p>Negative affect was greater in D3 compared to D0 (<math>B=0.05+0.02</math>, <math>p=0.444</math>), during the follicular phase there was an increase in craving from D0 to D1, while this decreased in the luteal phase (<math>+0.31</math> vs <math>-0.15</math>, <math>B=0.46+0.19</math>, <math>p=0.162</math>).</p>

This category comprised seven investigations; in six of them we reviewed whether depression was related to tobacco use in adolescents, young adults, and adults in the context of cross-sectional studies, and the seventh investigation was a longitudinal study.

Larsen, Otten and Engels [15] examined the impact of concerns about weight and diet in adolescents with depression and its association with tobacco use, in addition to assessing the differences between men and women. The sample included 2051 adolescents of the Netherlands (1056 men and 995 women of 13.8 years of age on average). Depressive symptoms, concern about weight, the status of smoking behavior, and alcohol use were assessed, and body mass index was obtained using weight and height measurements. They found a positive correlation between symptoms of depression and similar smoking behavior for boys and girls ( $p > 0.10$ ). Also, dieting was significantly associated with depressive symptoms in girls ( $p < 0.001$ ). Depressive symptoms were significantly associated with smoking at some point in life, both in boys and girls. In general, it was found that depressive symptoms related to similar smoking behavior both in boys and in girls.

In a research analyzing university population, Morrell, Cohen, and McChargue [16], investigated the relationship between vulnerability to depression and smoking behavior, as well as the possible role of gender and expectations that nicotine would reduce negative affects as moderators and mediators of such relationship. The results showed that vulnerability to depression was a significant predictor of tobacco use in women, but not in men; that the vulnerability to depression was significantly associated with the level of cigarette consumption, and that this relation was mediated, only in women, by the expectations of reducing negative affect. It was concluded that college women who are vulnerable to depression might be more likely to smoke to regulate their mood, under the belief that smoking can alleviate their negative mood.

Another study in university population by Schleicher, Harris, Catley, and Nazir [17], investigated the expectancy about nicotine's ability to regulate negative affect as a potential mediator of depression (history of depression and depressive symptoms) in 315 university students. The results obtained from the application of a survey showed that such expectancies mediated the positive relationship between depressive symptoms and level of tobacco consumption. These results aid in the design and implementation of effective prevention strategies and intervention plans for university students.

In a larger population specifically of women, Husky, Mazure, Paliwal, and McKee [18] conducted a study to determine if the smoking behavior was associated with having major depression or having had depression at some point in life and if this association was stronger in women. An epidemiological survey was applied to 42,565 people (24,291 women and 18,274 men) on major depression and smoking behavior. The results showed that being a current

smoker (daily and occasional) and being an ex-smoker significantly increased the probability of having major depression at the moment or having had depression at some point in life. This relation varied according to gender; specifically, women ex-smokers had a significantly higher risk of presenting or having presented depression when compared to men who were smokers (daily or occasional) or ex-smokers. The authors concluded that the association between smoking, at present or at some point in the past, and depression or having had depression is not limited to smokers with nicotine dependence, and that this association is stronger in women, which stresses the importance of considering depression in the design of interventions to stop smoking addressed to women.

Another research examined the relationship between social, emotional, demographic factors, and the status of consumption among women. 570 women answered a survey which included sociodemographic information, socioeconomic level, the age of first pregnancy, depression level and consumption status variables. The authors reported that women with low socioeconomic status had a higher probability of smoking compared to women of a high socioeconomic level; the factors associated with current tobacco consumption were age between 18 and 50 years, the severity of depression, and age of the first pregnancy. Also, the prevalence of consumption was 50% higher in women with four or more risk factors, compared with 10% of those who did not report risk factors. They reported that low socioeconomic level and the combined depressive symptoms were more associated with risk of tobacco consumption. The results can be used to develop and test social programs that could be applied along with the tobacco policies of the organizations, which focus mainly on reducing the prevalence of tobacco use in women population [19].

Luk and Tsoh [20] studied adult population in the United States to examine the moderating role of gender in the association between smoking status and depression. They analyzed the responses of 1,393 people (43.8% women) and found that women who reported being current smokers had a higher depression level compared to those who reported being ex-smokers and to those who had never smoked. Among men, it was observed that current smokers had more depressive symptoms when compared with ex-smokers only. When they compared the depression level by gender among current smokers, it was observed that women reported a higher level than men. Therefore, there was a strong association between smoking and the level of depression, which was modulated by gender. These results stress the importance of including strategies to address depression in the design of treatments to stop smoking in women.

Finally, Weinberger, Pilver, Desai, Mazure, and McKee [21] conducted a longitudinal study to examine changes in tobacco consumption over 3 years in an adult population representative of the United States with and without dysthymia and depression. The data of 11,973 ex-smokers and smokers who consumed daily (46% women) were analyzed. Results

showed that having dysthymia and having minor depression were associated with a higher probability of continuing smoking; current dysthymia and having presented it at some point in life were associated with a lower probability of maintaining abstinence from tobacco consumption.

### **3.2. Negative Affect and Smoking in Women**

We included eight studies that evaluated whether there are gender differences in negative affect and the relationship with tobacco consumption.

Audrain-McGovern, Rodriguez, and Leventhal [22] performed a longitudinal study with adolescents to assess the gender differences in the role of positive and negative affect in the development and consumption of tobacco. For four years, every 6 months data was collected from 1357 high school students about cigarette smoking and positive and negative affect. The authors found that the positive affect obtained at baseline is negatively related to the progressive increase in tobacco use by women but not by men. The negative affect at baseline was positively and significantly related to the progression of consumption in men and women, but the difference in gender was not significant. They concluded that the impact of affect on the smoking behavior of adolescents varies between genders; specifically, low positive affect (low experience of positive feelings or emotions) for females and high negative affect (high experience of negative feelings or emotions) for both males and females increases the risk for smoking. These results have significant implications, both in the groundwork of proposals for future research related to affect, gender and consumption in adolescents, and in establishing the basis to present more innovative and effective consumption prevention models.

Other studies evaluated gender differences when smoking is suppressed, particularly if the negative affect increases in this period. Leventhal, Boyd, Moolchan, Waters, Lerman, and Pickworth [14] investigated whether there were gender differences during the withdrawal syndrome in self-reported measures related to affect, intense desire to smoke, in tasks of cognitive performance and physiological responses. Participants were 203 adults, with an average consumption of 15 cigarettes per day, who attended two sessions, the first after 12 hours of abstinence and the second after free consumption. Women consistently reported that during the abstinence period the negative affect (fear, anxiety, sadness, irritability, tension, impatience, and restlessness) increased, as well as distress and the desire to smoke to alleviate such distress caused by abstinence. Also, women reported more withdrawal symptoms such as problems concentrating and unpleasant physical symptoms (headaches, autonomic symptoms, and drowsiness). In contrast, both genders showed similar changes due to abstinence in positive affect, hunger, urge to smoke for pleasure, physiological measures and measures of cognitive performance. Therefore, it was concluded that gender differences, in particular concerning the withdrawal syndrome, could mediate the relationship between gender and smoking behavior,

as well as the ability to quit smoking.

Perkins, Karelitz, Giedgowd, and Conklin [23] conducted two studies to find out if there were differences in craving and negative affect according to gender. In the first study, two groups of adult male and female smokers were compared, one group had a period of abstinence throughout the night ( $> 12$  hours), and the other group had not. In the second study two groups were compared with male and female smokers, in one group an acute induction of negative mood was made through images and music, and in the second group, a neutral mood was inducted. The results of both studies were similar in showing that craving during abstinence and condition of induction of negative affect were higher in women than in men. Craving was strongly associated with negative affect in both studies. From these results, it is concluded that situations of negative mood and particularly abstinence during the night can increase the craving mainly in women. Moreover, they can help understand why women are more likely than men to relapse after an attempt to quit smoking.

In a third study, Pang and Leventhal [24] assessed whether there were differences between genders in withdrawal-related negative affect, time to start smoking on a lab analog smoking lapse task, as well as the relation between gender, withdrawal-related negative affect, and smoking lapse behavior. 199 participants attended two sessions (one with abstinence of 16 hours and the second session with free consumption) in a counterbalanced design. At the beginning of each session measures on withdrawal symptoms and mood states obtained, followed by a laboratory analog smoking lapse task, in which, the participants were monetarily reinforced for delaying smoking. The performance on such task works as a comparable model of smoking lapse behavior by measuring the ability to resist the temptation to smoke under conditions where abstinence is advantageous. The results showed that women, compared to men, showed more effects of abstinence and an increase in negative affect as well as in several particular states of negative affect (fear, anxiety, depression, confusion). These results suggest that the differences in sensitivity to the negative affect for abstinence could be the basis of patterns of tobacco consumption specific to gender.

Other studies have studied the role of negative reinforcement. Pang, Zvolensky, Schmidt, and Leventhal [25] examined the relationship between gender and negative smoking reinforcement expectancies in two independent samples with negative affect present. The first sample consisted of non-treatment seeking daily smokers; the second sample consisted of daily smokers seeking treatment to stop smoking. Measures on the level of dependence, smoking expectancies, symptoms of anxiety and depression were obtained from all the participants. It was found that women from both samples, those seeking treatment and those who were not, reported higher negative reinforcement smoking expectancies than men. The study concluded that women had stronger beliefs that smoking alleviates negative affect. Consequently, increasing the ability to cope with negative affect without smoking or changing the expectancies

of negative reinforcement might be essential to take into account in the treatment for cessation in women.

Also, empirical evidence indicates that female smokers suffer more withdrawal symptoms than male smokers when they try to quit smoking, but it is not clear whether women enjoy greater relief from withdrawal symptoms when they return to smoking. Considering this, Xu, Azizian, Monterosso, Domier, Brody, Fong, and London [26] conducted an investigation to determine if negative reinforcement increases the risk of relapse in smokers after a period of abstinence. The sample consisted of 26 women and 38 male smokers, whose mood scores, craving of cigarettes, and other signs of nicotine withdrawal were evaluated before and after smoking a cigarette in two conditions of abstinence; in one condition, participants had had one hour of abstinence, while in the second condition they had had more than 13 hours of abstinence. The results showed that women smokers in the 13-hour abstinence condition had more severe symptoms of negative mood than men and enjoyed greater relief from these symptoms than men after smoking a cigar of their preferred brand. The results may help explain why women are more likely to relapse when they try to quit smoking.

Two laboratory studies examined whether induced negative affect prompts the consumption of tobacco. Weinberger and McKee [27] investigated the gender role of smoking behavior after an implicit induction of negative affect using music. Participants were 90 adult smokers who completed a laboratory session during which they were randomly assigned to one of three conditions: 1) induction of negative mood, 2) induction of positive mood and 3) a neutral mood condition. The latency of smoking and the number of cigarettes smoked after remaining in the mood condition were obtained. The results showed that women started smoking faster than men at the end of the mood induction, specifically in the condition of negative mood induction. Also, it was observed that there were no differences between genders in the number of cigarettes smoked or in the craving for smoking between mood conditions. The authors concluded that there were gender differences in the relationship between negative affect and smoking behavior after a subtle mood manipulation. This study suggests that, in women, there might be a strong relationship between relief of negative affect and smoking, since smoking occurs in response to a subtle increase in negative affect.

Also, Saladin, Gray, Carpenter, LaRowe, DeSantis, and Upadhyaya [28], evaluated if the difference between genders is due to differential craving and stress reactivity to smoking- and negative affect/stress-related cues. In this study 37 women and 53 men with nicotine dependence were exposed to two types of active signals, each with an associated control signal: 1) in vivo smoking cues and in vivo neutral control cues, and 2) imagery-based negative affect/stress script and a neutral/relaxing control script. Before and after each signal/script, the participants answered instruments related to craving and affective reactions; heart rate and skin conductance were obtained. According to the results, participants presented an increased

craving and skin conductance in response to smoking signals compared to neutral signals as well as an increased subjective stress in response to negative affect/stress signals against neutral/relaxing signals. Regarding gender differences, women showed higher craving, stress and activation, and lower valence ratings (greater negative emotion) in response to negative affect/stress signals. While there were no significant differences in gender in response to smoking cues, women had higher activation scores.

### **3.3. Menstrual Cycle, Tobacco and Abstinence**

Different investigations have been carried out to identify factors related to the low rates of abstinence obtained when women try to stop smoking. One possible explanation is that the menstrual cycle and negative symptoms play a crucial role when women try to quit smoking. Therefore, in this section, we included seven studies examining the impact of the menstrual cycle, emotional factors and withdrawal symptoms on success to stop smoking and on maintaining smoking behavior.

In a study conducted in a laboratory Saladin, Wray, Carpenter, McClure, LaRowe, Upadhyaya, and Gray [29] evaluated whether the phases of the menstrual cycle (follicular or luteal) in women could explain the difference between male and female smokers regarding reactivity to stress signals. The participants were men and women (18-40 years of age) who did not seek treatment and had smoked at least 10 cigarettes per day in the last 3 months. 22 women were in the follicular phase group, and 15 women in the luteal phase group: the male group consisted of 55 men. All the participants underwent an evaluation to assess the level of dependence to nicotine and then were administered a cue reactivity paradigm in which they assessed craving, stress, and emotional reactivity to stress. The results showed that there were no significant differences between women in the luteal phase and the follicular phase in any of the measurements obtained. Women in the luteal phase experienced greater craving after being presented with stressful cues, and women in the follicular phase experienced greater stress, activation, and lower valence (greater negative emotion), which means women perceived the stress cues as more emotionally aversive than men. These findings indicate that women might face greater obstacles to quit smoking (craving vs. greater emotional response) and that these could vary according to the phase of the menstrual cycle which also could impact the women's response towards stress signals. This possibility suggests the need for interventions to stop smoking that take into account aspects of gender and variables throughout the menstrual cycle.

Another study examined whether premenstrual syndrome (PMS) is associated with tobacco dependence and the factors that can reduce smoking cessation success. Females smokers (157) who did not seek treatment and who smoked 10 or more cigarettes per day participated in the study; in one session, investigators assessed the level of carbon monoxide,

alcohol in blood, premenstrual and depressive symptoms, tobacco dependence, history of tobacco consumption, as well as demographic, and characteristics of the menstrual cycle. They reported that PMS was associated with a) greater tobacco dependence, b) withdrawal symptoms during the most recent attempt to quit smoking, c) the number of attempts to quit smoking, and d) with higher probabilities of having used electronic cigarettes during the last cessation attempt. From these results, it can be concluded that the relation between PMS and cessation of tobacco use may have implications for treating smokers who experience severe PMS, moreover, given that women with severe PMS may be partially vulnerable and require special attention to combat withdrawal symptoms during cessation attempts [30].

Allen, Allen, Lunos, and Pomerleau [31] described the association between withdrawal symptoms during an attempt to stop smoking and investigated the impact of these symptoms on the success of smoking cessation, along with its relationship with the premenstrual period. The study involved 202 women aged between 18 and 40 years, randomly assigned to one of two conditions: 1) initiation of abstinence in the follicular phase (F) (four to six days after the onset of menstruation) and 2) initiation of abstinence in the luteal phase (L) (six to eight days after ovulation). All participants received individual sessions of behavioral counseling and self-help materials to stop smoking. Likewise, all participants answered the short premenstrual evaluation questionnaire (PAF), the Minnesota scale of nicotine withdrawal symptoms (MNWS), and the Questionnaire of Smoking Urges (QSU). They completed a cigarette consumption diary and a daily record of the menstrual cycle during the first six days of the initiation of tobacco abstinence. The results showed that the group on follicular phase, on average smoked fewer cigars per day than the group on luteal phase. Participants in phase L had more symptoms during the first six days of the abstinence attempt in the following areas: sub-scale of water retention, sub-scale of pain, total score on the premenstrual scale, as well as a reagent on appetite/weight gain. The results also showed that, regardless of the phase in which abstinence began, most of the withdrawal symptoms were associated with the cessation of consumption, except the appetite/weight gain reagents (at 14 and 30 days of abstinence), restlessness (to 14 days), and anger (to 30 days). No premenstrual symptoms were associated with the cessation of consumption. In the group of participants in phase F, those who had higher levels of anger and craving during the first six days of the abstinence attempt were more likely to relapse after 14 days of abstinence. The study concluded that women who tried to stop smoking during the luteal phase had significantly more severe menstrual symptoms, compared with those in the group of the follicular phase.

In a similar study, the authors examined changes in tobacco consumption during luteal and follicular phases, as well as the association between smoking, craving, depression, and symptoms associated with menstrual periods. The study involved 29 women between 20 and 29 years who had smoked, on average, 10 cigarettes daily during the last year. Their level



of nicotine dependence was assessed through the Fagerström questionnaire, and they were evaluated for menstrual phases. An electronic thermometer and device to measure breath CO concentrations were lent to the participants, who were then categorized according to phases: menstrual, follicular (the period between menstruation and ovulation), and luteal (the period between ovulation and menstruation). The participants reported their level of craving each day through a visual analog scale, their body temperature, symptoms of depression through the CES-D depression scale, and the symptoms associated with the period menstrual through the menstrual distress questionnaire (MDQ), and CO in expired air. The results showed that the group of the luteal period consumed significantly more cigarettes. Also, craving, depression, and symptoms associated with the menstrual period were higher in the menstrual and luteal periods. Furthermore, the number of cigarettes smoked and CO concentration significantly correlated with the levels of craving, depressiveness, and menstrual phase-associated symptoms in all phases except in the follicular phase. These associations were stronger in the luteal compared to the other two, while the association between craving and the number of smoked cigarettes was lower in the menstrual and follicular periods [32].

Allen, Allen, Tosun, Lunos, al'Absi, and Hatsukami [33] investigated the difference in symptomatology during acute smoking abstinence with respect to the follicular and luteal menstrual phases and examined if the menstrual phases have a modifying effect between the depressive symptoms and the symptoms in acute tobacco withdrawal. They studied 147 women aged between 18 and 40 years who have smoked at least 5 cigarettes per day during the last year. The participants underwent two testing weeks during their menstrual cycle with testing order randomly assigned (follicular vs. luteal). They attended a clinic daily to check their consumption status and to have administered the Minnesota Withdrawal Scale (MNWS), the brief Questionnaire of Smoking Urges (QSU-Brief), the Positive and Negative Affect Scale (PANAS), the Perceived Stress Scale (PSS) and the Shortened Premenstrual Assessment Form (PAF). The authors reported that during the period of acute abstinence, there was a higher average of abstinence and of perceived stress in the luteal phase when compared to the follicular phase. Furthermore, two of the premenstrual symptoms (pain and water retention) and the total premenstrual symptoms increased in the luteal phase and decreased in the follicular phase. Concerning affection during acute abstinence, the score was higher in the luteal phase than in the follicular phase. The menstrual phase was reported to have a moderating effect since the sub-scale of premenstrual pain was positively related to depressive symptoms and premenstrual pain in the follicular phase but not in the luteal phase. Also, the authors reported that there might be a stronger association between depressive symptoms with negative affect and premenstrual pain during the follicular phase compared to the luteal phase. Therefore, during smoking abstinence, there is a significant association between depressive symptoms and withdrawal symptoms versus menstrual phase and withdrawal symptoms.

Based on the previous study [33], another analysis assessed if the menstrual phase influences the subjective response to nicotine during acute smoking abstinence. The analyzed sample consisted of 140 women with an average age of 29.7 years, and consumption of 12.6 cigarettes per day. 72 participants were assigned to the Follicular-Luteal group (F-L) and 68 to the Luteal-Follicular group (L-F). Both groups went through four days of biochemically-verified smoking abstinence and then completed experimental sessions in which a nicotine nasal spray was administered, along with a series of subjective assessments. Two significant differences were found in the subjective response to nicotine between menstrual phase after the first dose of nicotine nasal spray. The results showed that, after the first dose of the nasal spray of nicotine, when compared to phase F, the luteal phase (L) was associated with an increase in the “stimulated” item of the Visual Analog Scale (VAS) (as an indicator of acute abstinence response), and with a more significant decrease in the item “urgency of smoking” (as an indicator of abstinence relief). However, most of the associations explored were not significant, providing very little evidence about the sensitivity to nicotine concerning menstrual phases after 4 days of abstinence. Contrary to what was expected, the subjective response to nicotine might not vary with respect to the menstrual phase, which highlights a need for more exhaustive research to confirm these findings and to explore how non-nicotinic enhancers may vary regarding menstrual phases [34].

One last study intended to compare the level of cortisol and mood between the different phases of the menstrual cycle during acute smoking abstinence. Carlson, Allen, Allen and al’Absi [35] analyzed the data of 125 smoker women who, during the acute abstinence from smoking, underwent salivary cortisol level evaluations and answered a mood self-report, through the Subjective State Scale (SSS). These measurements were collected 5 times on the day before abstinence (D0), the first (D1), and third (D3) days of abstinence. No significant differences between the menstrual phases regarding the cortisol values were reported. Negative affect was greater in D3 compared to D0. Craving was reported to increase from D0 to D1 during the follicular phase, and to decrease during the luteal phase. They concluded that the menstrual phase might influence craving during acute withdrawal but that it did not seem to affect the level of salivary cortisol. Future investigations should consider the assessment of other possible mechanisms responsible for the differences in the influence of menstrual cycles on the consequences of smoking cessation.

#### **4. Conclusions**

The purpose of this work was to determine emotional factors associated with tobacco consumption in women, which would allow the design of more successful prevention and intervention strategies for girls and women. Based on the review of the current literature on emotional factors related to tobacco consumption and abstinence, it is concluded that, on the one hand, emotional factors, like depressive symptoms, vulnerability to depression, and negative

affect, have a significant impact on the start and maintenance of tobacco consumption. On the other hand, the menstrual cycle influences the probability of success or failure of smoking cessation depending on the phase of the cycle.

The relevance of this work is based on three main aspects:

1. In recent years, the percentage of women who use tobacco has increased, although the overall smoking population has decreased. Current studies have established that the prevalence of consumption in women has increased because once this group starts consuming, develops higher rates of dependence [36-38].

2. The health consequences in women are more severe than those associated with tobacco use in men.

3. The rates of abstinence obtained over time after completing a treatment to stop smoking are very low.

Therefore, it is crucial to point out some essential guidelines to take into account when designing and evaluating tobacco prevention strategies for women, as well as for early detection and intervention for women who want to quit smoking:

It is imperative that these strategies take into account the age group to which they are addressed along with the interests and problems intrinsic to each stage of development. For example, in designing prevention strategies, it would be important to have different approaches if these strategies are directed to girls or adolescents; moreover, in early detection strategies, distinguishing between different population, adolescents or young adults (university), would imply a different level of studies thus different communication needs.

It is imperative to identify the factors associated with the initiation, progression, and maintenance of tobacco consumption. According to the present review: the symptoms of depression, worry about weight, low positive affect and high negative affect in adolescents increase the risk of initiation and progression of tobacco use [15,22]. Furthermore, it is essential to work with adolescents in the development of coping skills such as emotional self-control, since it has been showed that, in university women, a determining factor related to the maintenance of tobacco consumption is depressive symptoms and the expectation that tobacco consumption will alleviate such negative affect [17]. Coping skills and emotional interventions also need to be taken into account when working with adult women given that depression is the most important factor associated with tobacco use in this population [20-21].

Several studies have reported that when women try to quit smoking they present more severe withdrawal symptoms than men, such as higher craving, increase in negative affect, and greater concentration impairments [19, 23, 26-28]. Additionally, the different phases of the

menstrual cycle have effects on what women experience, specifically, the luteal phase is more likely to promote a higher consumption of cigarettes or greater withdrawal symptoms during abstinence periods, as well as more severe premenstrual symptoms, depressive symptoms and negative affect [29, 21-33]. Therefore, to quit smoking during the luteal phase of the menstrual cycle increases the probability of relapse.

Specifically, in the design of a smoking cessation intervention aimed at women, it is suggested to include cognitive behavioral techniques based on empirical evidence to stop smoking and to manage symptoms of depression, negative affect and anxiety. Therefore, some techniques that would aid in such interventions would be self-control techniques, stress inoculation, activation control techniques, problem-solving skills, self-instruction training and emotional regulation.

## 5. Acknowledgments

This work was developed with the support of the “Programa de Apoyo a Proyectos de Investigación e Innovación Tecnológica (PAPIIT)”, which is part of the “Dirección General de Asuntos del Personal Académico (DGAPA- UNAM)”. UNAM-PAPIIT -IA304016 RA304016.

## 6. References

1. US. Department of Health and Human Services . The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. 2014.
2. Pang RD, Zvolensky JM, Schmidt BN, Leventhal MA. Gender Differences in Negative Reinforcement Smoking Expectancies. *Nicotine Tob Res.* 2015; 17: 750-754.
3. Schnoll AR, Patterson F, Lerman C. Treating Tobacco Dependence in Women. *J Womens Health.* 2007; 16: 1211-1218.
4. World Health Organization. Who report on the global tobacco epidemic. Monitoring tobacco use and prevention policies. 2017.
5. Asma S, Mackay J, Song SY, Zhao L, Morton J, Palipudi KM, et al. The GATS Atlas: Global adult tobacco survey. Atlanta, GA.: CDC Foundation.
6. Reynales-Shigematsu LM. Costos de atención médica de las enfermedades atribuibles al consumo de tabaco en América: revisión de la literatura. *Salud Pública Mex.* 2006; 48: S190-S200.
7. WHO. World No Tobacco Day : Tobacco breaks hearts – choose health, not tobacco. Geneva: World Health Organization; 2018.
8. U. S. Department of Health and Human Services. The Health Consequences of smoking- 50 years of progress. Atlanta, G. A. : U. S. Department of Health and Human Services, National Center for chronic Disease Prevention and Health Promotion, Office on smoking and Health. 2014.
9. World Health Organization. MPOWER. A policy package to reverse the tobacco epidemic. 2008.
10. World Health Organization. WHO global report. Mortality attributable to tobacco. 2012.

11. World Health Organization. The WHO framework convention on tobacco control an accelerator for sustainable development. 2003.
12. Regueira G, Suárez-Lugo N, Jakimczuk S. Estrategias para el control del tabaco con perspectiva de género en América Latina. *Salud Pública Mex.* 2010;52: s315- s320.
13. Eissenberg T. Measuring the emergence of tobacco dependence: contribution of negative reinforcement models. *Addiction.* 2004; 99: 5-29.
14. Leventhal MA, Boyd S, Moolchan TE, Waters JA, Lerman C, Pickworth W. Gender Differences in Acute Tobacco Withdrawal: Effects on Subjective, Cognitive, and Physiological Measures. *Exp Clin Psychopharm.* 2007;15: 21–36.
15. Larsen JK, Otten R, Engels R. Adolescent depressive symptoms and smoking behavior: the gender-specific role of weight concern and dieting. *J Psychosom Res.* 2009; 66: 305-308.
16. Morrell REH, Cohen ML, McChargue ED. Depression vulnerability predicts cigarette smoking among college students: Gender and negative reinforcement expectancies as contributing factors. *Addict Behav.* 2010; 35: 607–611.
17. Schleicher HE, Harris KJ, Catley D, Nazir N. The role of depression and negative affect regulation expectancies in tobacco smoking among college students. *J Am Coll Health.* 2009;57: 507-512.
18. Husky MM, Mazure CM, Paliwal P, Mckee SA. Gender differences in the comorbidity of smoking behavior and major depression. *Drug Alcohol Depend.* 2008; 93: 176-179.
19. Wewers ME, Salsberry PJ, Ferketich AK, Ahijevych KL, Hood NE, Paskett ED. Risk Factors for Smoking in Rural Women. *J Womens Health.* 2012;21: 548-556.
20. Luk JW, Tsoh JY. Moderation of gender on smoking and depression in Chinese Americans. *Addict Behav.* 2010; 35: 1040-1043.
21. Weinberger AH, Pilver CE, Desai RA, Mazure CM, McKee SA. The relationship of dysthymia, minor depression, and gender to changes in smoking for current and former smokers: Longitudinal evaluation in the U.S. population. *Drug Alcohol Depend.* 2013;127:170-176.
22. Audrain-McGovern J, Rodriguez D, Leventhal AM. Gender differences in the relationship between affect and adolescent smoking uptake. *Addiction.* 2014; 110: 519-529.
23. Perkins AK, Karelitz LJ, Giedgowd EG, Conklin AC. Negative mood effects on craving to smoke in women versus men. *Addict Behav.* 2013;38: 1527-1531.
24. Pang RD, Leventhal MA. Sex Differences in Negative Affect and Lapse Behavior During Acute Tobacco Abstinence: A Laboratory Study. *Exp Clin Psychopharmacol.* 2013;21: 269–276.
25. Pang RD, Zvolensky JM, Schmidt BN, Leventhal MA. Gender Differences in Negative Reinforcement Smoking Expectancies. *Nicotine Tob Res.* 2015; 17: 750-754.
26. Xu J, Azizian A, Monterosso J, Domier CP, Brody AL, Fong TW, et al. Gender effects on mood and cigarette craving during early abstinence and resumption of smoking. *Nicotine Tob Res.* 2008; 10: 1653-1661.
27. Weinberger AH, McKee SA. Gender Differences in smoking following an implicit mood induction mood induction. *Nicotine Tob Res.* 2012; 14: 621-5.
28. Saladin ME, Gray KM, Carpenter MJ, La Rowe SD, De Santis SM, Upadhyaya HP. Gender Differences in craving and cue Reactivity to smoking and negative affect/ stress cues. *Am J Addict.* 2012;21: 210-20.
29. Saladin ME, Wray JM, Carpenter MJ, McClure EA, La Rowe SD, Upadhyaya HP, Gray KM. Menstrual Cycle Phase Effects in the Gender Dimorphic Stress Cue Reactivity of Smokers. *Nicotine Tob Res.* 2015;17: 607-11.

30. Pang RD, Andrabi N, Leventhal AM. Premenstrual Symptoms and Factor Implicated in Smoking Cessation Among Woman Smokers. *Exp Clin Psychopharm*. 2017;25: 235-241.
31. Allen AM, Allen SS, Lunos S, Pomerleau S Severity of withdrawal symptomatology in follicular versus luteal quitters: The combined effects of menstrual phase and withdrawal on smoking cessation outcome. *Addict Behav*. 2010; 35: 549-552.
32. Sakai H, Ohashi K. Association of menstrual phase with smoking behavior, mood and menstrual phase-associated symptoms among Young Japanese women smokers. *BMC Womens Health*. 2013; 13: 10.
33. Allen SS, Allen AM, Tosun N, Lunos S, al' Absi M, Hatsukami D. Smoking- and menstrual-related symptomatology during short-term smoking abstinence by menstrual phase and depressive symptoms. *Addict Behav*. 2014; 39: 901-906.
34. Allen AM, Lunos S, Heishman SJ, al' Absi M, Hatsukami D, Allen SS. Subjective response to nicotine by menstrual phase. *Addict Behav*. 2015; 43: 50-53.
35. Carlson SC, Allen AM, Allen SS, al' Absi M. Differences in Mood and Cortisol by Menstrual Phase During Acute Smoking Abstinence: A Within-Subject Comparison. *Exp Clin Psychopharmacol*. 2017; 25: 338-345.
36. United Nations Office on Drugs and Crime [UNODC]. Guidelines on drug prevention and treatment for girls and women. Vienna: United Nations Office on Drugs and Crime. 2016.
37. World Health Organization. Gender, Women, and the Tobacco Epidemic. Geneva: WHO. 2010.
38. Junta Internacional de Fiscalización de Estupefacientes. Informe 2017. 2018.