Mood, mood regulation expectancies and frontal systems functioning in current smokers versus never-smokers in China and Australia

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Published in:
Addictive Behaviors

DOI:
10.1016/j.addbeh.2013.07.002

Mood, Mood Regulation Expectancies and Frontal Systems Functioning in Current Smokers, Long-Term Abstinent Ex-Smokers and Never-Smokers

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Abstract

Indices of mood, mood regulation expectancies and everyday executive functioning were examined in 38 current smokers who have smoked for at least one year, 19 ex-smokers who had previously smoked for at least one year but who had not smoked for at least one year prior to present, and 59 never-smokers who reported they had never smoked tobacco. All participants completed the following measures online: Depression Anxiety Stress Scales (DASS-21), the Negative Mood Regulation (NMR) expectancies scale, the Frontal Systems Behavior Scale (FrSBe), the Fagerström Test for Nicotine Dependence (FTND) and the Alcohol Use Disorders Identification Test (AUDIT). Multivariate analyses of covariance (MANCOVA) followed by Tukey post hoc tests revealed significant differences such that current smokers indicated worse functioning than ex-smokers and never-smokers on DASS, NMR, and FrSBe. Results most plausibly reflect a return to pre-smoking baseline brain function in long-term abstinent ex-smokers, although the possibility that they were able to quit smoking due to inherently better mood and executive function compared to current smokers cannot be excluded.

Keywords: smoking; nicotine; addiction; self-regulation; quitting smoking

Tobacco smoking remains the leading preventable cause of death worldwide (World Health Organization [WHO], 2011), thus successful implementation of strategies that promote quitting smoking is of crucial importance to public health. In Australia, heavy taxation of tobacco products, smoke-free environment legislation, bans on tobacco advertising, and gruesome ads depicting horrific health consequences of smoking are some of the approaches taken by anti-smoking campaigns, and such approaches have substantially reduced smoking prevalence over recent decades (AIHW, 2011). In Australia approximately 40% of smokers attempt to quit each year, though only about half of those who attempt to quit are reportedly successful at maintaining abstinence from smoking for a one-month period (Cooper, Borland, & Yong, 2011). Negative affect appears to adversely impact quit attempts, such that smokers reporting high levels of negative affect are less likely to succeed (Anda et al., 1999; Kassel, Stroud, & Paronis, 2003; Shiffman et al., 1997; Spielberger, Foreyt, Reheiser, & Poston, 1998). In general smoking appears to be significantly associated with negative affective states such as depression, anxiety and stress as well as deficient ability to self-regulate negative moods (e.g., Fergusson, Goodwin, & Horwood, 2003; Kassel et al., 2003; Lyvers, Thorberg, Dobie, Huang & Reginald, 2008; McChargue, Cohen & Cook, 2004a,b; Patton et al., 1996, 1998; Pedersen & von Soest, 2009). Recent data from two large Australian national household surveys indicated that current smokers reported higher levels of psychological distress than their ex-smoker and non-smoker peers (Leung, Gartner, Dobson, Lucke, & Hall, 2011). Similarly a large-scale population survey in Norway (Mykletun, Overland, Aarø, Liabø & Stewart, 2008) revealed that anxiety and depression were more prevalent in current smokers than in ex-smokers or in people who had never smoked.

Indices of frontal lobe dysfunction have also been associated with chronic smoking, raising the possibility that deficient frontal lobe functioning may underlie mood difficulties in

smokers. Spinella (2003) found that current smokers reported more signs of frontal lobe dysfunction than non-smokers on all three subscales of the Frontal Systems Behaviour Scale (FrSBe; Grace & Malloy, 2001), and brain imaging studies have found signs of structural deficiencies of prefrontal cortex in chronic smokers (Brody et al., 2004; Zhang et al., 2011). Performance on a well-known neuropsychological test of frontal lobe related executive function, as well as a psychophysiological index of attention related to prefrontal cortex function, were both found to be deficient in nicotine-deprived current smokers compared to never-smokers or smokers who had just smoked a cigarette (Lyvers, Maltzman & Miyata, 1994; Lyvers & Miyata, 1993). As the ability to regulate one's own negative mood states by non-pharmacological means appears to be dependent on frontal lobe functioning (Lyvers, Thorberg, Ellul, Turner & Bahr, 2010), disruption of frontal systems may underlie mood problems in chronic smokers.

There is mixed evidence that nicotine can have acute anxiolytic, antidepressant and/or cognitive enhancing effects, and thus may be used by smokers to alleviate negative moods and inattention symptoms; however it is unclear to what extent such effects represent alleviation of nicotine withdrawal or other manifestations of nicotine dependence rather than a net benefit for the smoker (Morissette et al., 2007; Parrott, 2004, 2005, 2006; Volkow & Li, 2004). Shahab and West (2012) reported the findings from a large U.K. sample such that self-reported happiness was similar in never-smokers and in ex-smokers who had quit for more than a year, with lower happiness levels reported by current smokers and by ex-smokers who had only recently quit. Such evidence suggests that smoking may worsen mood whereas smoking cessation may lead to eventual improvements in mood. Parrott (2004, 2005, 2006) proposed that mood fluctuations due to nicotine dependence may be the primary cause of higher self-reported negative affect in current or recently abstinent smokers compared to nonsmokers. Nicotine dependence may thus resemble other drug addictions in being

characterized by frequent negative mood and executive dysfunction symptoms that reflect "hedonic homeostatic dysregulation" resulting from alteration of anterior brain dopamine systems by frequent drug use (Koob & Le Moal, 1997). Anxiety, depression and stress reportedly decrease after quitting smoking even when taking into account life events (Boden, Fergusson & Horwood, 2010; Chassin, Presson, Sherman & Kim, 2002; Cohen & Lichtenstein, 1990; West & Hajek, 1997). Such decreases in negative affect occur following the immediate post-quitting period (Parrott, 2005), suggesting that their cause is subsidence of nicotine dependence and return to pre-smoking brain functioning.

As discussed above, various studies have found associations between negative affect and smoking and between signs of executive dysfunction and smoking; however no study to date has examined both negative affect and executive function in smokers compared to long-term ex-smokers and never-smokers. The ability to self-regulate one's negative mood states is highly dependent on the functioning of the frontal lobe executive control systems of the brain (Lyvers et al., 2010), systems that may be adversely affected by nicotine dependence (Spinella, 2003) but which are likely to return to normal functioning following extended nicotine abstinence (Parrott, 2004, 2005, 2006). The present study thus examined mood and everyday executive function in current smokers, long-term abstinent ex-smokers and never-smokers, using self-report measures that had shown highly significant differences between smokers and nonsmokers in previous research (e.g., Lyvers et al., 2008, 2009; Spinella, 2003): the Depression Anxiety Stress Scales (DASS-21; Lovibond & Lovibond, 2002), the Negative Mood Regulation (NMR) expectancies scale (Catanzaro & Mearns, 1990), and the Frontal Systems Behavior Scale (FrSBe; Grace & Malloy, 2001) with Apathy, Disinhibition and Executive Dysfunction subscales designed to detect deficits associated with anterior cingulate, orbitofrontal and dorsolateral prefrontal cortex dysfunction, respectively. Alcohol use was assessed using the Alcohol Use Disorders Identification Test (AUDIT; Babor et al., 1992) as

chronic smoking is often reported to be associated with heavier drinking (Biederman et al., 2005; Grucza & Bierut, 2006), and level of nicotine dependence in smokers was assessed via the Fagerström Test for Nicotine Dependence (FTND; Fagerström, 1978; Heatherton et al., 1991). We expected to find that compared to never-smokers, current smokers would show elevated signs of "hedonic homeostatic dysregulation" (Koob & LeMoal, 1997) due to nicotine-induced alteration of frontal brain circuits that regulate mood and cognition, whereas long-term abstinent ex-smokers would be similar to never-smokers based on the assumption that long-term abstinence eventuates in return to normal functioning of the mesocortical dopamine system innervating prefrontal cortex (Lyvers, 2000). Thus in comparison to never-smokers and ex-smokers, current smokers were expected to report more signs of dysfunction on the three subscales of the FrSBe as well as impaired self-regulation of negative moods as assessed by the NMR scale, higher levels of depression, anxiety and stress as measured by the DASS-21, and heavier drinking as measured by the AUDIT. Long-term abstinent ex-smokers and never-smokers were not expected to differ on these measures.

Method

Participants

After deletion of two multivariate outliers the final sample of 116 participants included 38 current smokers who reported smoking for at least one year prior to participation; 19 ex-smokers, defined as those who previously had smoked for at least one year but who had not smoked at all for at least one year prior to participation; and 59 never-smokers, defined as those who reported never having smoked tobacco. Participants were recruited in three ways; 30 were recruited within Australia via eSearch, an online survey company, and were paid US$3.50 to complete the survey online. Given that the U.S. dollar was weaker than the Australian dollar at the time of the study, the eSearch incentive may have been too small to recruit enough participants, thus another 40 participants were recruited via an

advertisement in the local newspaper for a $30 monetary incentive; they also completed the survey online using another online survey program, Survey Monkey. The remaining 48 participants were recruited via a poster and sign-up sheet at Bond University offering a credit point in an undergraduate psychology subject as an incentive for participation; they too completed the survey online using Survey Monkey. All three recruitment methods asked for individuals who fit into one of the following categories to participate as research subjects in a study of the trait correlates of smoking: current smokers who have smoked for at least one year, ex-smokers who had smoked for at least one year in the past but who had been abstinent from smoking for at least one year prior to the present time, and those who have never smoked tobacco. The final sample included 43 men and 73 women aged 19-58 years (M = 27.36, SD = 9.40).

Materials

Demographic Questionnaire. Participants were asked questions concerning their age, gender, nationality, country of residence, level of education, proficiency and confidence with English, smoker status (current smoker, ex-smoker or never-smoker) and illicit drug use.

Fagerström Test for Nicotine Dependence (FTND). The FTND (Fagerström, 1978; Heatherton et al., 1991) is a six-item self-report measure of nicotine dependence. The FTND yields a total score ranging from 0-10. Scores between 7 and 10 are indicative of a high level of nicotine dependence; scores of 4 to 6 indicate moderate dependence, and scores less than 4 indicate low to no dependence. A number of studies have demonstrated that the FTND has good internal consistency and validity (Colby, Tiffany, Shiffman & Niaura, 2000) and test-retest reliability (Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994).

Negative Mood Regulation (NMR) Scale. The NMR scale (Catanzaro & Mearns, (1990) is a 30-item questionnaire assessing beliefs about one's ability to regulate or alleviate a negative mood state through their own efforts. The questions follow the stem, "When I'm

upset, I believe that…" and ask respondents to indicate on a five point Likert-type scale the degree to which they agree/disagree with the statements. High scores on the NMR scale are indicative of strong beliefs in one's ability to regulate or alleviate negative moods without pharmacological assistance. The NMR scale has good psychometric properties (Cohen, McChargue & Morrell, 2007; Hasking, Lyvers & Carlopio, 2011) and has demonstrated discriminant validity from the Beck Depression Inventory, the Internal External Locus of Control Scale, and the Social Desirability Scale (Catanzaro & Mearns, 1990). The NMR scale typically shows negative correlations with indices of anxiety and depression (Catanzaro & Greenwood, 1994; Kassel, Jackson & Unrod, 2000; Kirsch, Mearns & Catanzaro, 1990) and with the FrSBe (Lyvers et al., 2010) in line with theoretical expectations.

Depression Anxiety Stress Scales (DASS-21). The DASS-21(Lovibond & Lovibond, 2002) is a 21-item short form of the DASS-42. The DASS-21 has three scales designed to assess depression, anxiety and stress with seven questions for each mood state. Responses to each item are indicated on a four-point severity scale from 0 (*Did not apply to me at all*) to 3 (*Applied to me very much, or most of the time*). Depression scale items include "I couldn't seem to experience any positive feeling at all"; a sample Anxiety scale item is "I experienced trembling" and a sample Stress scale item is "I found it hard to wind down." The DASS-21 has demonstrated good psychometric properties (Antony, Bieling, Cox, Enns, & Swinson, 1998), with construct validity established in a non-clinical population (Henry & Crawford, 2005). The DASS-21 has been normed in Australia along with other widely-used self-report mood scales including the Beck Anxiety Inventory, the Beck Depression Inventory and the Carroll Rating Scale for Depression (see Crawford, Cayley, Lovibond, Wilson, & Hartley, 2011, for a review).

Frontal Systems Behaviour Scale (FrSBe). The FrSBe (Grace & Malloy, 2001) is a self-report questionnaire developed to assess three cognitive and behavioral domains of

everyday frontal lobe functioning in adults aged 18 to 95 years: Apathy (anterior cingulate dysfunction), Disinhibition (orbitofrontal dysfunction) and Executive Dysfunction (dorsolateral prefrontal dysfunction). The FrSBe contains 46 items scored on a five point Likert scale (*almost never* to *almost always*). Scores provided an indication of the degree of dysfunction within the three domains, in addition to yielding an overall frontal lobe dysfunction score. The standard FrSBe Self-Rating form asks for pre- and post-injury ratings; however the present study only asked for current ratings, consistent with previous studies of non-brain-injured individuals (e.g., Lyvers et al., 2012; Spinella, 2003). The FrSBe has a clear three factor structure (Stout, Ready, Grace, Malloy, & Paulsen, 2003) and the corresponding subscales show good validity and reliability (Lane-Brown & Tate, 2009; Velligan, Ritch, Sui, DiCocco, & Huntzinger, 2002).

Alcohol Use Disorders Identification Test (AUDIT). The AUDIT (Babor et al., 1992) is a widely used 10-item questionnaire designed to identify and screen for risky or problematic alcohol consumption. The AUDIT yields a total score indicating the degree of alcohol-related risk. Scores between 0 and 7 indicate Low Risk alcohol consumption; scores between 8 and 15 are classified as Hazardous alcohol consumption; and scores of 16 or greater indicate Harmful alcohol consumption. The AUDIT shows good psychometric properties according to a large number of studies, with confirmed validity and reliability to identify harmful alcohol use in diverse countries and across a broad age range (de Menes-Gaya, Zuardi, Loureiro & Crippa, 2009; Leonardson et al., 2005; McCusker et al., 2002; Pal, Jena, & Yadav, 2004; Reinert & Allen, 2007; Rubin et al., 2006).

Procedure

Approval from the Bond University Human Research Ethics Committee (BUHREC) was granted prior to recruitment of participants. As described above, participants were recruited via the online survey administration tool eSearch in Australia as well as locally via

advertisements in a local newspaper and by notices posted on campus. Those who responded to the advertisements and notices did so by telephone so that the researcher and volunteer could arrange a testing session at Bond University where they completed the questionnaire battery online via another online survey administration tool, Survey Monkey. Local community participants were paid $30 for their time, whereas local university undergraduates were rewarded with a credit slip towards a psychology subject. ESearch participants were paid US$3.50 to complete the survey online by the survey company. The minimum age for participation was 18 years. All participants read an explanatory statement before completing the questionnaires in a constant order. Participants were instructed to provide no identifying information on the survey in order to preserve their anonymity.

Results

The current smoker, ex-smoker and never-smoker groups did not differ in their proportions of participants that had been recruited via eSearch, community advertising or on campus, $\chi^2(4) = 3.34$, $p = .50$. These groups also did not significantly differ in gender composition, $\chi^2(2) = 4.21$, $p = .12$, nor did they differ in education level, $\chi^2(2) = 3.41$, $p = .18$, or employment status, $\chi^2(2) = .14$, $p = .93$. However there was a trend such that the ex-smokers were non-significantly older on average ($M = 31.37$ years, $SD = 12.47$) compared to the current smokers ($M = 27.97$ years, $SD = 10.17$) and never-smokers ($M = 25.72$ years, $SD = 7.34$), $F(2, 115) = 2.82$, $p = .064$. Current smokers scored in the moderately dependent range of nicotine dependence on the FTND overall ($M = 4.47$, $SD = 2.26$).

Potential influences of age and gender were controlled as covariates in a MANCOVA comparing current smokers ($n = 38$), long-term abstinent ex-smokers ($n = 19$) and never-smokers ($n = 61$) on the FrSBe subscales, the DASS-21 scales, the NMR scale, and the AUDIT. Box's M test of equality of covariance matrices was non-significant ($p = .16$), indicating no violation, and Levene's Test of equality of error variances was significant only

for DASS-21 Anxiety ($p = .006$), which was thus assessed at a more stringent significance level of $p < .001$ (Tabachnik & Fidell, 2007). The overall multivariate effect of group was significant according to Pillai's Trace, $F(16, 210) = 3.12$, $p < .0001$, partial $\eta^2 = .19$, observed power = 1. Univariate effects were significant for all three DASS-21 scales: Depression, $F(2, 111) = 4.42$, $p = .014$, partial $\eta^2 = .07$, observed power = .75; Anxiety, $F(2, 111) = 15.52$, $p < .0001$, partial $\eta^2 = .22$, observed power = 1; Stress, $F(2, 111) = 3.40$, $p = .018$, partial $\eta^2 = .06$, observed power = .63. Univariate effects were also significant for NMR, $F(2, 111) = 4.94$, $p = .009$, partial $\eta^2 = .08$, observed power = .80; FrSBe Disinhibition, $F(2, 111) = 6.07$, $p = .003$, partial $\eta^2 = .10$, observed power = .88; FrSBe Executive Dysfunction, $F(2, 111) = 3.05$, $p = .05$, partial $\eta^2 = .05$, observed power = .58; and AUDIT, $F(2, 111) = 4.14$, $p = .018$, partial $\eta^2 = .07$, observed power = .72. Tukey post hoc test ($p < .05$) indicated that current smokers scored significantly higher than both ex-smokers and never-smokers on all three DASS-21 scales, FrSBe Disinhibition and Executive Dysfunction scales, and NMR, and current smokers scored significantly higher than never-smokers on AUDIT; there were no other significant group differences. Group means are shown in Table 1 for all dependent measures.

Intercorrelations among the dependent variables were calculated for the overall sample and are shown in Table 2. As expected, all three FrSBe frontal dysfunction sub-scales were significantly positively correlated with all three DASS-21 indices of negative moods and negatively correlated with NMR.

Discussion

As predicted, long-term abstinent ex-smokers and never-smokers did not significantly differ on any measure, whereas current smokers indicated significantly worse functioning on all measures except FrSBe Apathy compared to the other two groups, and even the Apathy scale showed a trend in the expected direction (see Table 1). The present findings are

consistent with similar evidence of the benefits of long-term abstinence for mood and cognitive functioning in other types of drug addictions including addictions to alcohol, cannabis, opiates or stimulants (e.g., McIntosh & Ritson, 2001; Wetterling & Junghanns, 2003) and suggest that chronic smoking, like other drug addictions, is characterized by "hedonic homeostatic dysregulation" (Koob & Le Moal, 1997) arising from chronic drug-induced alteration of anterior brain dopamine systems and associated disruption of prefrontal cortical functioning (Baler & Volkow, 2006; Lyvers, 2000). The finding that all three FrSBe indices of frontal dysfunction were significantly negatively correlated with NMR and positively correlated with DASS-21 indices of negative moods supports the notion that the ability to self-regulate one's negative mood states is highly dependent on the functioning of the frontal executive control systems of the brain (Lyvers et al., 2010; Volkow & Li, 2004). Such functioning becomes disrupted or abnormal during addiction but shows improvement following extended abstinence (Goldstein & Volkow, 2002). The present finding that ex-smokers were like never-smokers on all measures suggests that chronic smoking may resemble other addictions in being characterized by difficulties with mood and mood regulation stemming from drug-induced frontal systems dysfunction; such difficulties tend to resolve with long-term abstinence as brain function gradually returns to pre-drug baseline and "hedonic homeostasis" is restored (Koob & Le Moal, 1997).

Although both current smokers and ex-smokers in the present study said they had smoked for at least one year and were thus defined as current or former chronic smokers, there is a possibility that the ex-smoker group may have had less psychopathology and better executive function independently of smoking than the current smoker group, a difference which might explain why the ex-smokers had successfully quit smoking. On the other hand, longitudinal studies indicate that taking up smoking leads to worsening of mood (Boden, Fergusson, & Horwood, 2010; Kang & Lee, 2010), whereas quitting smoking is followed by

improvements in mood (Parrott, 2004, 2005, 2006), consistent with addiction-induced "hedonic homeostatic dysregulation" as proposed by Koob and Le Moal (1997). In any case the possibility that the ex-smokers could have differed from current smokers on the measures employed in the current study even when the ex-smokers were smoking cannot be ruled out.

The diverse recruitment methods of the present study might appear problematic, however the proportions of participants recruited by each method did not come close to significantly differing between current smoker, ex-smoker and never-smoker groups, and thus could not have exerted a confounding influence on group differences. Likewise the varying group sizes might appear to present a limitation too, yet Levene's Test did not indicate violation of the assumption of equal group variances except for one of the eight dependent measures, and a more stringent alpha criterion was used for that particular variable. Another issue concerns the finding that current smokers scored significantly higher on AUDIT than never-smokers, and AUDIT was significantly correlated with most other dependent measures. We treated alcohol-related risk as a dependent measure as it has shown strong relationships with smoking in other research (Biederman et al., 2005; Grucza & Bierut, 2006), but the significant relationships of AUDIT scores to other measures could mean that heavy drinking by current smokers underlies the associations of negative mood and frontal dysfunction indices with smoking. Arguing against that interpretation is the finding that AUDIT scores were uncorrelated with NMR and DASS-21 Stress scores, yet those scores were significantly higher in current smokers than in ex-smokers and never-smokers, thus they were associated with current smoking and not risky drinking in the present sample. Interestingly, all three groups scored in the Harmful drinking range on AUDIT overall, with ex-smokers scoring between current smokers and never-smokers. The current sample was thus characterized by riskier self-reported alcohol consumption than is the norm in Australia (AIHW, 2011). Further, nearly half reported being unemployed at the time of the study. These characteristics

may limit the generalizability of the present findings.

Even with the above caveats in mind, the present study does provide further support for the notion that quitting smoking may eventually lead to improvements in mood and general functioning (Parrott, 2004, 2005, 2006) in addition to the well-documented health benefits. Further, the present findings are entirely consistent with a view of drug addiction – including addiction to nicotine – as a syndrome involving deficient mood regulation stemming from drug-induced disruption of frontal systems functioning (Lyvers, 2000; Volkow & Li, 2004), which promotes high levels of negative mood such as depression, anxiety and stress in addicts. Long-term abstinence is then necessary to restore frontal systems to pre-drug baseline functioning such that "hedonic homeostasis" (Koob & Le Moal, 1997) can be achieved. Chronic smokers may believe that smoking alleviates stress, anxiety or depression, but the evidence to date suggests that they would be far better off by quitting.

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Table 1.

Country (China vs. Australia), Smoker Status (Current Smoker vs. Never-Smoker) and Country X Status Interaction univariate *F* and *p* values (see text for details of measures).

	FrSBe Apathy		FrSBe Exec Dysfunction		FrSBe Disinhibition		NMR Scale		DASS Depression		DASS Anxiety		DASS Stress		Total AUDIT	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Country	10.33	.001	12.70	<.0001	19.41	<.0001	3.99	.047	15.29	<.0001	20.87	<.0001	16.74	<.0001	23.23	<.0001
Status	23.27	<.0001	40.42	<.0001	51.08	<.0001	45.92	<.0001	47.17	<.0001	94.17	<.0001	39.86	<.0001	54.84	<.0001
Country * Status	16.09	<.0001	11.26	.001	14.18	<.0001	5.44	.020	10.85	.001	11.03	.001	8.20	.004	14.49	<.0001

Table 2.

Means and Standard Deviations on the FrSBe, DASS-21, NMR Scale and AUDIT for Current Smokers and Never-Smokers Combined Across Chinese and Australian Samples.

	Smokers		Never-Smokers	
	M	*SD*	*M*	*SD*
FrSBe Apathy	38.35	7.78	28.71	5.79
FrSBe Dysfunction	48.32	8.94	35.40	7.82
FrSBe Disinhibition	43.25	8.90	30.41	6.56
DASS Depression	16.05	4.51	10.16	3.24
DASS Anxiety	16.18	4.38	9.04	3.04
DASS Stress	16.74	4.10	11.90	3.98
NMRS	97.46	12.07	114.15	13.60
AUDIT	28.37	7.84	16.89	5.13

Table 3

Means and Standard Deviations on the FrSBe, DASS-21, NMR Scale and AUDIT for the Chinese and Australian Smokers.

	Chinese		Australian	
	M	*SD*	*M*	*SD*
FrSBe Apathy	40.18	6.66	29.58	6.78
FrSBe Dysfunction	50.28	7.73	38.92	8.19
FrSBe Disinhibition	45.11	7.91	34.26	7.79
DASS Depression	16.98	4.12	11.45	3.48
DASS Anxiety	17.11	3.99	11.50	3.19
DASS Stress	17.50	3.75	12.95	3.65
NMRS	95.37	11.01	107.45	11.87
AUDIT	30.04	6.96	19.89	6.66

NOTE: All mean differences significant at $p < .001$

Figure 1.

Means and standard deviations for FrSBe Apathy as a function of country and smoker status.

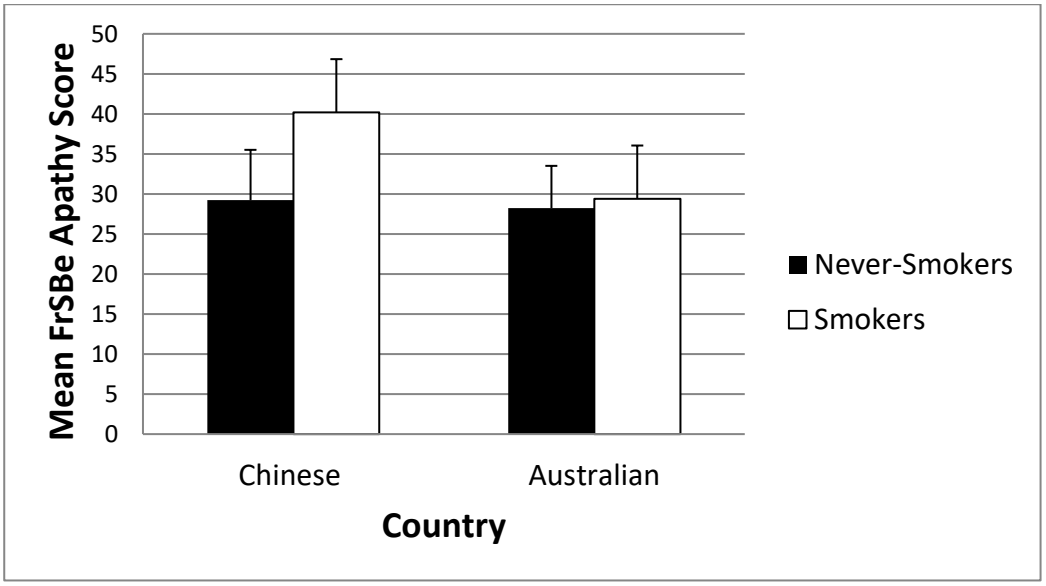

Figure 2.

Means and standard deviations for FrSBe Executive Dysfunction as a function of country and smoker status.

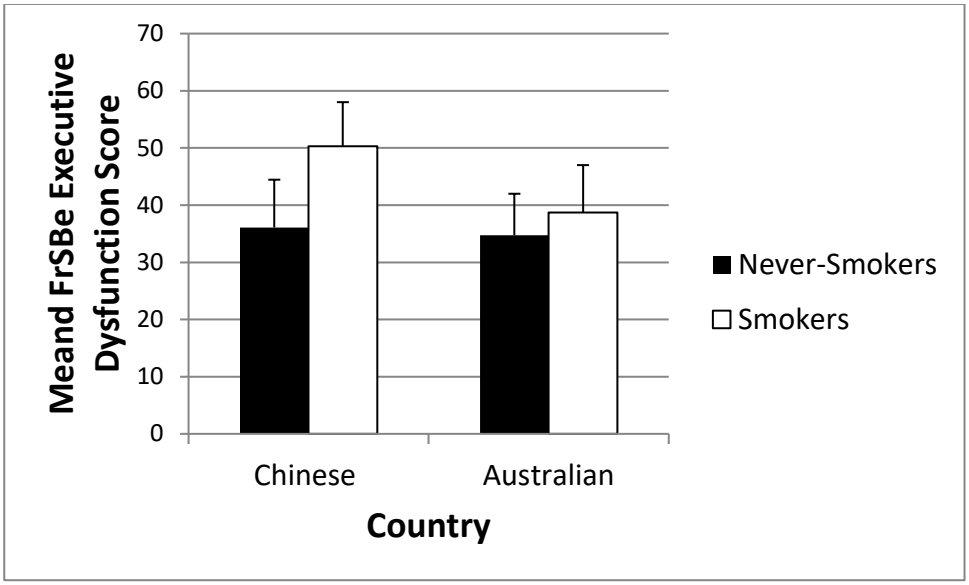

Figure 3.

Means and standard deviations for FrSBe Disinhibition as a function of country and smoker status.

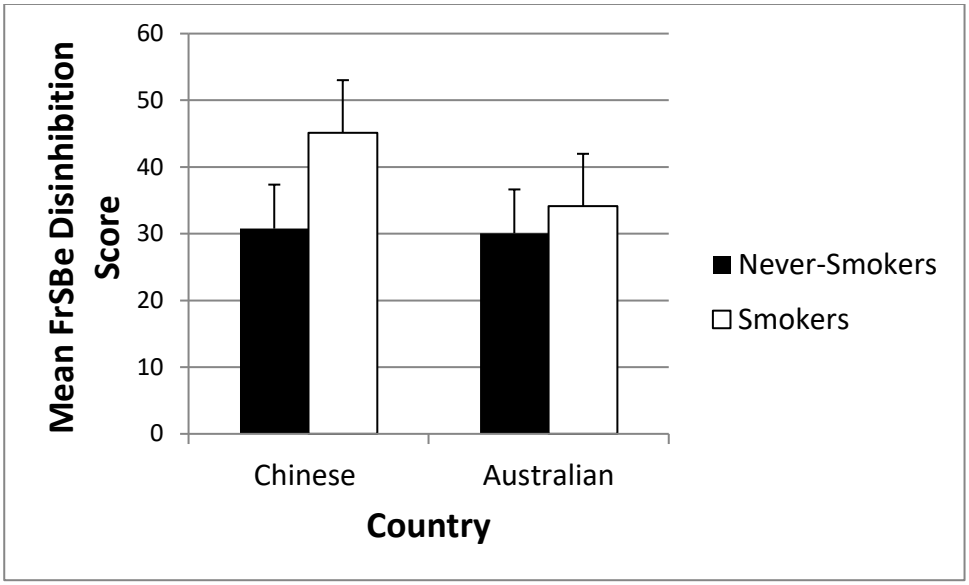

Figure 4.

Means and standard deviations for DASS-21 Depression as a function of country and smoker status.

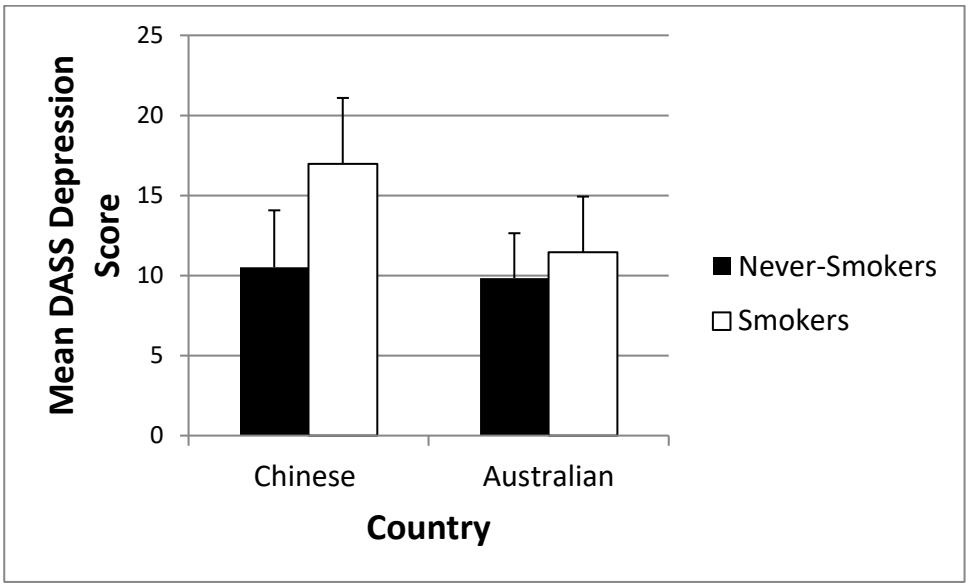

Figure 5.

Means and standard deviations for DASS-21 Anxiety as a function of country and smoker status.

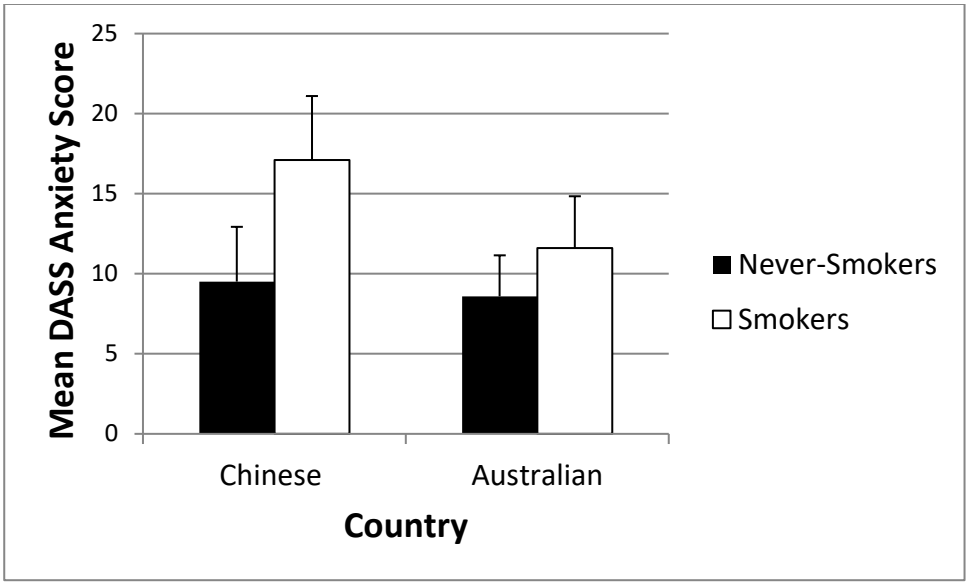

Figure 6.

Means and standard deviations for DASS-21 Stress as a function of country and smoker status.

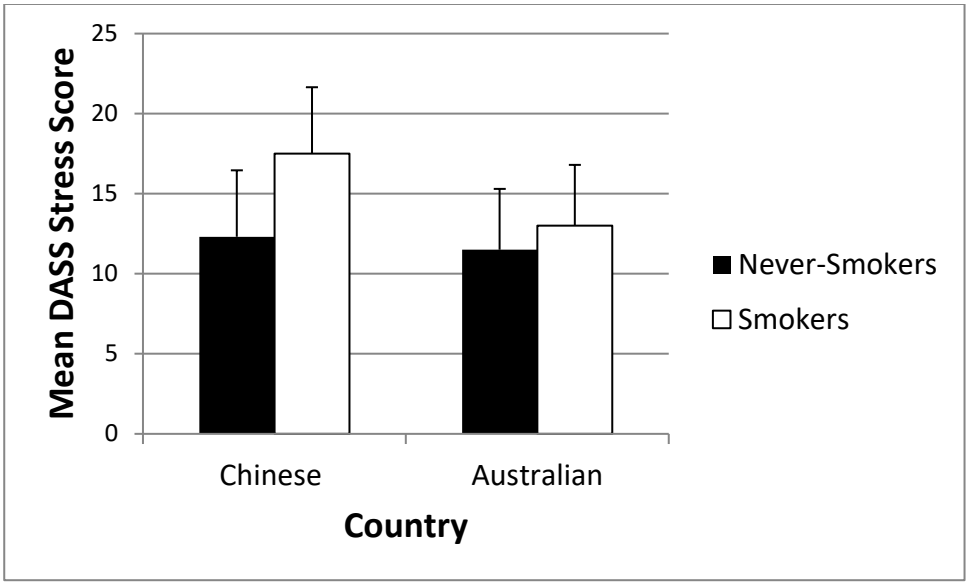

Figure 7.

Means and standard deviations for the NMR Scale as a function of country and smoker status.

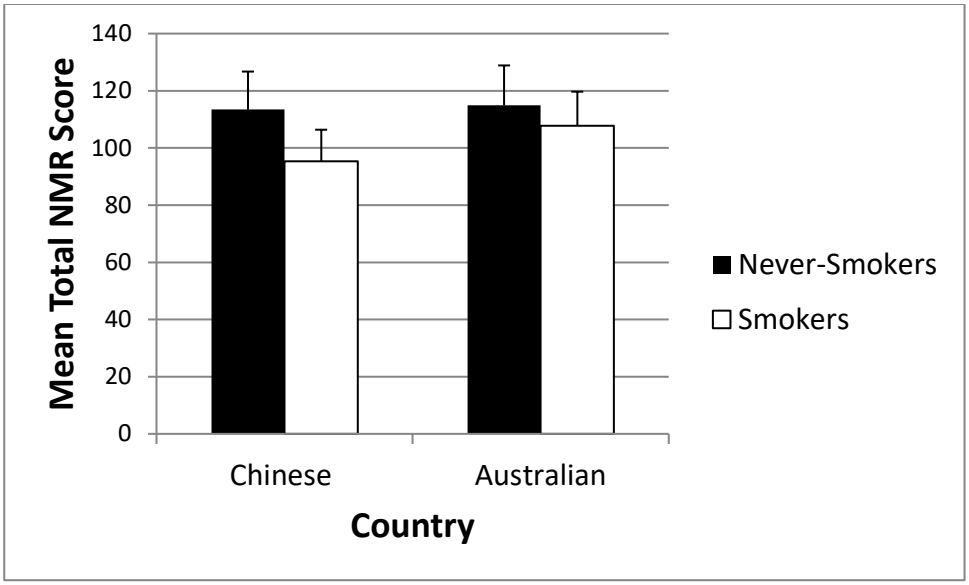

Figure 8.

Means and standard deviations for the AUDIT as a function of country and smoker status.