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The impact of emotions on body-Focused repetitive behaviors: Evidence from a non-treatment-seeking sample

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ABSTRACT

Body-focused repetitive behaviors (BFRBs) are repetitive, injurious, and non-functional habits that cause significant distress or impairment, including hair-pulling, skin-picking, and nail-biting. The emotion regulation (ER) model suggests that BFRBs are triggered by negative emotions and reinforced by alleviation of unpleasant affect. The frustrated action (FA) model suggests that BFRBs are triggered by and alleviate impatience, boredom, frustration, and dissatisfaction. Individuals with BFRBs are hypothesized to be particularly susceptible to these emotions because they demonstrate maladaptive planning styles characterized by high standards and unwillingness to relax.

Objectives: The objective of this study was to test these two models.

Methods: This study compared urge to engage in BFRBs in a BFRB group ($n = 24$) and a control group ($n = 23$) in experimental conditions designed to elicit boredom/frustration, stress, and relaxation, respectively.

Results: The BFRB group reported a significantly greater urge to engage in BFRBs than did the control group across conditions. Participants in the BFRB group reported a stronger urge to engage in BFRBs in the boredom/frustration condition than in the relaxation condition but not in the stress condition. Finally, the BFRB group presented significantly higher scores on maladaptive planning style, and maladaptive planning style was significantly correlated with difficulties with ER.

Limitations: Future studies may wish to exclusively use validated mood induction techniques and more stringent inclusion criteria.

Conclusions: The results highlight the role of boredom, frustration, and impatience in triggering BFRBs, and support the FA model.

1. Introduction

Body-focused repetitive behaviors (BFRBs) are repetitive, damaging, and seemingly non-functional habits such as hair-pulling, skin-picking, and nail-biting (O'Connor, Lavoie, Robert, Stip, & Borgeat, 2005; Snorrason et al., 2012). Although many individuals engage in harmless "nervous habits," the term BFRBs refers to behaviors that fall on the maladaptive end of the continuum, causing significant distress or impairment in functioning (Teng, Woods, Marcks, & Twohig, 2004).

1.1. Trichotillomania

Trichotillomania (TTM) refers to chronic hair-pulling (HP) resulting in noticeable hair loss; repeated efforts to stop or decrease pulling; and significant distress or impairment caused by HP. Hair may be pulled out from any area of the body, including the scalp, eyebrows, arms, legs, and pubic area (American Psychiatric Association [APA], 2013). The prevalence of TTM is approximately 0.6% (Christenson, Pyle, & Mitchell, 1991; Duke, Bodzin, Tavares, Geffken, & Storch, 2009), however this rate refers to TTM as described by DSM-IV (APA, 2000) criteria, which also included the following: tension prior to pulling or relief or gratification after pulling. Clinical prevalence rates as per DSM-5 criteria are not yet available, and are likely to be higher.

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1.2. Skin-picking

Skin-Picking Disorder (SPD) refers to recurrent skin-picking (SP) resulting in lesions, with repeated attempts to decrease or stop SP. The symptoms cause clinically significant distress; impairment in social, occupational or other important areas of functioning; and are not better explained by another mental disorder (APA, 2013). The prevalence of SP ranges from 1.4% to 5.4% in various populations (Hayes, Storch, & Berlanga, 2009; Keuthen, Koran, Aboujaoude, Large, & Serpe, 2010). However, prevalence rates must be interpreted with caution due to inconsistent diagnostic criteria across studies, all of which were conducted prior to the inclusion of SPD in the DSM.

1.3. Nail-biting

Nail-biting (NB) refers to an insertion of the fingers into the mouth, with contact between the nails and teeth. Many individuals occasionally use the teeth to replace nail clippers in grooming, but NB as a BFRB involves biting past the nail bed and cuticles, drawing blood, and resulting in chronic scarring, or in red, sore, and infected fingers (Penzel, 1995; Wells, Haines, & Williams, 1998). Reports of NB prevalence are limited by dated research and inconsistent operational definitions across studies. Snyder and Friman (2012) reviewed the literature and tentatively concluded that the prevalence of NB is 25%–60% at puberty, and subsequently declines to 10%–25% in young adults and below 10% in adults over 35 years.

2. Emotion regulation model for BFRBs

Although BFRBs and their consequences create considerable distress, HP, SP, and NB also seem to satisfy an urge and deliver some form of reward. One etiological model that has received empirical support proposes that BFRBs serve an emotion regulation (ER) function (Roberts, O'Connor, & Bélanger, 2013). The ER model suggests that individuals with BFRBs have difficulty managing unpleasant emotions, and engage in body-focused habits to avoid, modulate, or alleviate aversive affect. HP, SP, and NB persist despite negative consequences because they are reinforced by distraction or escape from undesired experiences (Roberts et al., 2013; Teng et al., 2004). The ER model further suggests that individuals with BFRBs are characterized by global deficits in ER (Shusterman, Feld, Baer, & Keuthen, 2009; Snorrason, Smári, & Ólafsson, 2010).

The ER model has been supported by studies that demonstrate change in affective states over the course of BFRB episodes. In clinical and non-clinical samples, individuals with HP and SP consistently report that emotions such as boredom, anxiety, tension, and frustration are present prior to BFRBs and decrease during or after pulling or picking episodes (Roberts et al., 2013). Guilt, shame, sadness, and anger may develop during or after BFRB episodes, as do feelings of satisfaction, indifference, and relief (Bohne, Wilhelm, Keuthen, Baer, & Jenike, 2002; Diefenbach, Mouton-Odum, & Stanley, 2002; Duke et al., 2009; Mansueto, Thomas, & Brice, 2007; Neal-Barnett & Stadulis, 2006; Wilhelm et al., 1999). Furthermore, two studies that measured ER in individuals with and without BFRBs found that individuals with HP and SP reported greater difficulty regulating negative affective states than did controls (Shusterman et al., 2009; Snorrason et al., 2010), and that difficulty regulating particular emotions predicted the degree to which those emotions triggered HP (Snorrason et al., 2010). For a review of this literature, see Roberts et al. (2013).

3. Frustrated action model

O'Connor and colleagues (O'Connor et al., 2001; O'Connor, Gareau, & Borgeat, 1997; Pélissier & O'Connor, 2004) reported that some individuals with BFRBs demonstrate a form of organisational perfectionism characterized by unwillingness to relax and difficulty with appropriate pacing of tasks. Individuals with this maladaptive style of planning aim to be productive at all times, often setting unrealistic standards and trying to do too much at once. They are consequently susceptible to frustration, impatience, and dissatisfaction when standards are not met, and to boredom when productivity is impossible. According to the frustrated action (FA) model for BFRBs, body-focused habits function to release the tension generated by these emotions (O'Connor, 2002). BFRBs are subsequently negatively reinforced by a decrease in negative affect and positively reinforced by the feeling of 'taking action' (i.e., engaging in BFRBs) after the initial desired action was thwarted. Frustration could be viewed as a general negative emotion within the emotion regulation model, but the FA model defines frustration very specifically through the processes that generate it.

The FA model has its roots in clinical studies of the triggers for tics and BFRBs (O'Connor, Brisebois, Brault, Robillard, & Loiselle, 2003). It was observed that participants with various BFRBs (TTM, NB, skin-scratching, bruxism) were at the greatest risk of engaging in BFRB during activity appraised as inactive or unsatisfying, and associated with a tense state. Adopting an overprepared and overactive style of action, where the individual invests more effort than necessary (overprepared) and tries to accomplish too much (overactive) leads to a build-up in tension and frustration. This frustration is manifest in the indivdual's feelings that he or she has not accomplished enough, is wasting time, not busy enough, and should be doing more. There is a strong cognitive component to this style of action which is accompanied by perfectionist beliefs relating to personal organization. Although frustration can be classified as stress, the frustration in BFRBs is generated specifically by dissatisfaction with performance. In the style of planning action, questionnaire (STOP), the overpreparation and overactive subscales emerge as independent factors (O'Connor, 2005) and change consistently after successful cognitive behavior therapy.

The FA model has also received some independent research support. Studies that used questionnaire measures to measure emotional state during BFRBs have found that individuals engage in HP, SP, and NB when they are bored, frustrated, or inactive (Bohne et al., 2002; Diefenbach et al., 2002; Duke, Keeley, Ricketts, Geffken, & Storch, 2010).

Teng et al. (2004) reported that students with SP, NB, mouth-chewing, skin-biting, and skin-scratching demonstrated significantly more BFRBs in conditions designed to induce boredom than in a control condition. Similarly, Williams, Rose, and Chisholm (2006) manipulated emotion in undergraduates students reporting NB, and concluded that NB occurred primarily in states of boredom or frustration.

4. Current study

The objective of the present study was to test the FA model for BFRBs. Specifically, the study was designed to measure BFRBs in experimental conditions designed to test the hypothesis that BFRBs are triggered by boredom, frustration, dissatisfaction, and impatience. We hypothesized that: (a) The BFRBs group would demonstrate more BFRBs and a greater urge to engage in BFRBs in conditions of boredom and frustration than in stress or relaxation conditions; (b) frustration, boredom, impatience, and dissatisfaction would predict BFRBs or urge to engage in BFRBs. Consistent with the model, we also hypothesized that (c) the BFRB group

would demonstrate greater perfectionism and maladaptive planning styles; and that perfectionism and maladaptive planning style would correlate with difficulties with ER.

4.1. Participants

Participants were recruited via the website of the hospital research center where the study was conducted; an online community bulletin board; posters in local universities, cafes, and healthcare institutions; and from lists of participants in past or current studies at our center. The research protocol was approved by the University Institute in Mental Health at Montreal research ethics committee.

Individuals who responded to our recruitment efforts were referred to a clinical evaluator for a 15- to 30-min telephone screening interview concerning sociodemographic variables, BFRB severity and degree of impairment, and comorbid psychopathology. Inclusion criteria for participants in the BFRBs group were the following: (a) age 18–65 years; (b) BFRB with a subjective severity rating of at least 3/10 or significant distress or impairment as the result of the BFRB; (c) BFRB as a primary presenting problem, even if another psychological problem or disorder was present; and (d) if on psychotropic medication, medication had to be stable for three months. Inclusion criteria for the control group were the following: (a) age 18–65 years; (b) if on psychotropic medication, medication had to be stable for three months (c) if any HP, SP, or NB was present, it had to be non-chronic and non-distressing. Exclusion criteria for the present study were: (a) DSM Axis I or Axis II disorder other than TTM or SPD as primary problem; (b) alcohol or drug abuse; and (c) BFRB comorbid with chronic tics or Tourette Syndrome.

Although the sample described here included individuals who did not meet all of the DSM criteria for TTM or SPD, all references to BFRBs in the current paper refer to chronic HP, SP, and NB that caused significant distress or impairment in functioning. The study described in this article focuses on HP, SP, and NB to the exclusion of other repetitive body-focused habits because these BFRBs have received the most research attention and are the most clearly defined.

Over the course of one year, 111 individuals responded to our recruitment advertisements. Forty-one dropped out of the study prior to or following the telephone screening interview, and 22 were excluded following the telephone interview; 48 participants ($n = 24$ HD; $n = 24$ controls) completed the study.

4.2. Measures

Subsequent to the screening interview, eligible participants completed a questionnaire package at home, including the Style of Planning questionnaire (STOP; O'Connor, 2005); Frost Multidimensional Perfectionism Scale (Frost, Marten, Lahart, & Rosenblate, 1990); Symptom Checklist-90-Revised (SCL-90-R; Derogatis, 2000)' and Massachusetts General Hospital Hair-Pulling Scale (MGH-HPS; Keuthen et al., 1995) and analogue SP, NB, and skin-scratching scales. A separate scale for skin-scratching was included because, although skin-scratching is a component of SP (Keuthen, Koran, et al., 2010; Tucker, Woods, Flessner, Franklin, & Franklin, 2011), it is not directly addressed in the SP scale. The questionnaire package included a standard consent form, approved by the institution research ethics committee, for participants to read prior to beginning the questionnaire battery. The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) and Affective Regulation Scale (ARS; Shusterman et al., 2009) were completed on site prior to the experiment. For the DERS, ARS, MGH-HPS, and STOP, French-speaking participants completed a French-Canadian version of the questionnaire, translated using a back-translation and consensus procedure (Vallerand, 1989).

4.2.1. Affective Regulation Scale

The ARS (Shusterman et al., 2009) consists of a list of nine emotions (bored, angry, guilty, indifferent, tense, irritable, sad, anxious, and ashamed); participants are instructed to "check the circle that indicates your ability to control each of these emotions. How easily can you "snap out" of it?" Responses on a five-point scale range from "never able to control" (0) to "always able to control." Shusterman et al. (2009) reported acceptable internal consistency ($\alpha = .83$ for hair-pullers and $\alpha = .87$ for non-pullers).

4.2.2. Difficulties in Emotion Regulation Scale

The DERS (Gratz & Roemer, 2004) consists of 36 items that assess six dimensions of difficulties with ER: non-acceptance of emotional responses, difficulties engaging in goal-directed behavior, impulse control difficulties, lack of emotional awareness, limited access to effective ER strategies, and lack of emotional clarity. Gratz and Roemer (2004) reported strong internal consistency on the DERS ($\alpha = .93$), adequate internal consistency for all subscales ($\alpha > .80$), and adequate test-retest reliability for the total scale over 4–8 weeks ($r = .88$).

4.2.3. Massachusetts General Hospital Hairpulling scale

The MGH-HPS (Keuthen et al., 1995) is a 7-item self-report measure of the frequency and intensity of HP behaviors during the past month, using a 5-point scale and producing a total HP severity score. The MGH-HPS demonstrates good internal consistency ($\alpha = .89$) and test-retest reliability ($r = .97$). Participants also completed analogue SP, NB, and skin-scratching scales (i.e., the MGH-HPS with the word *hair-pulling* replaced by *skin-picking*, *nail-biting*, and *skin-scratching*, respectively). Although BFRBs are , they can be measured along the same parameters (i.e., frequency, subjective severity, distress). Although an SP scale has been validated (The skin picking scale; Keuthen et al., 2001), we chose to use an analogue scale to obtain comparable severity scores across BFRBs. All participants completed the MGH-HPS, and the analogue SP, NB, and skin-scratching scales. For participants in the BFRBs group, MGH score was their score on the scale corresponding to their reported BFRB. Control participants' MGH score was the mean of their scores across all four scales. One control participant's data was excluded from the analysis because she endorsed significant BFRBs on all four BFRB scales. The final sample ($N = 47$; $n = 24$ BFRB; $n = 23$ controls) was primarily female ($n = 34$), with an average age of 34.57 years (range 20–59 years).

4.2.4. Style of Planning Questionnaire

The STOP (O'Connor, 2005) is a 34-item scale evaluating maladaptive planning style in individuals with obsessive-compulsive (OC) spectrum disorders. The questionnaire measures overactivity (i.e., unwillingness to relax, failure to pace self appropriately), overpreparation (i.e., need to be over-prepared; high standards of personal organization), and overcomplication (i.e., complicating straightforward tasks, imagining unforeseen difficulties). More negative scores index greater pathology. Good test-retest reliability ($r = .91–.94$) and internal consistency ($\alpha = .79–.85$) have been demonstrated for the main factor (O'Connor, 2005).

4.2.5. Frost Multidimensional Perfectionism Scale

The FMPS (Frost et al., 1990) is a 35-item questionnaire that measures perfectionism across six dimensions: Concern over Mistakes (CM), Personal Standards (PS), Parental Expectations (PE), Parental Criticism (PC), Doubts about Actions (DA), and Organization (OR). Internal consistency ($\alpha = .73–.91$) and test-retest reliability

($\alpha = .75–.88$) are satisfactory. For French-speaking participants, we used the validated French-Canadian (Labrecque, Stephenson, Boivin, & Marchand, 1999) version of the FMPS.

4.2.6. Symptom Checklist 90-Revised

The SCL-90-R (Derogatis, 2000) is a 90-item psychiatric self-report inventory. Participants respond to items using a five-point Likert scale, indicating symptom occurrence during the past week, yielding three global distress indices. The scale has been demonstrated to have satisfactory internal consistency ($\alpha = .71–.85$ for various subscales) and test-retest reliability ($r = .68–.91$) (Derogatis & Savitz, 2000). French-speaking participants completed the validated French-Canadian (Fortin & Coutu-Wakulczyk, 1985) version of this scale.

4.2.7. Modified Stress Arousal Checklist (MSACL)

The MSACL was developed for the current study; it is based on the Stress Arousal Checklist (SACL; Mackay, Cox, Burrows, & Lazzarini, 1978). The scale contains 32 emotions including positive and negative arousal (energetic, idle), positive and negative stress (calm, jittery), and also boredom, frustration, impatience, dissatisfaction and relaxation. Participants are asked to "Please indicate to what extent you are currently experiencing the following emotions/moods" and may respond *not at all* (0), *a little* (1), or *a lot* (2). French- and English-language versions were developed.

4.2.8. Measure of urge to engage in BFRBs

Individuals with BFRBs often report a mounting urge to pull hair, pick skin, or bite nails prior to engaging in the behavior (APA, 2013, 2000; Arnold, Auchenbach, & McElroy, 2001; Flessner et al., 2008). To capture the sensation of urge and to account for the possibility that participants would resist pulling, picking, or biting during the study, we developed a brief measure of urge to engage in BFRBs. Participants answered *"During the past 10 min, how strong was your urge to pull out your hair/pick your skin/bite your nails?"* by drawing a line on a scale from 1 to 10 (1 = very weak; 3 = weak; 5–6 = moderate; 7–8 = Strong; 10 = very strong). This measure was developed in French- and English-language versions.

4.2.9. Measure of duration of BFRBs

Two trained research assistants who were blind to experimental condition and experimental group scored all of the DVD recordings by counting seconds of BFRBs in each condition using the operational definitions in Table 1.

Table 1
Operational definitions of BFRBs provided to DVD raters.

Behavior	Definition
Hair-pulling	Using fingers to remove hair from the head or other body part; twirling, feeling, and touching hair for the sole purpose of touching hair. Adjusting hair, such as tucking strands behind the ears or moving hair out of face, is not considered HP.
Skin-picking	Using the fingers or nails to remove skin or scabs from the body; focused, intensive, or interactive scratching or rubbing skin on any part of the body. Scratching or rubbing skin over clothes is not considered SP.
Nail-biting	Insertion of fingers or part of finger into the mouth or full contact between tips of fingers and mouth, lips, or teeth; visually examining nails, and using the fingers on the same hand or the opposite hand to touch, rub, or pick at the nails or the skin around the nails. Resting the face in the hand with only the palm or knuckles touching the mouth is not considered NB.

4.3. Procedure

Upon arrival at the research center, participants submitted the questionnaires completed at home, reviewed and signed the consent form with the experimenter, and completed the ARS and DERS. Next, participants completed the MSACL and the measure of urge, to establish baseline affective state and baseline urge to engage in BFRBs.

Each participant was exposed to five experimental conditions, administered according to balanced randomized allocation: stress, three instances of the relaxation condition, and either the boredom or the frustration condition. The stress condition was essentially designed to elicit anticipatory anxiety rather than stress of an uncontrollable socially evaluative nature (Dickerson & Kemeny, 2004). Experimental conditions are described in Table 2. A random numbers table (Fisher & Yates, 1963) was used to randomly assign consecutive participants to either the boredom or the frustration condition and to randomize the order of the stress and boredom or frustration conditions to control for order effects. The relaxation condition at baseline was used to evaluate participants' BFRB activity/urge to engage in BFRBs in a relaxed state. It was presented again between the stress condition and the boredom or frustration conditions to allow participants to return to a neutral baseline between conditions. To measure fluctuations in affect and in urge to engage in BFRBs, participants completed the MSACL and measure of urge after each condition, for a total of six times. Participants were filmed during the experiment, as per their informed consent. Following the experiment, participant

Table 2
Description of experimental conditions.

Emotion	Experimental condition
Stress (video segment)	8-min clip from the 1993 feature film *Alive* (Kennedy, Watts, & Marshall, 1993), featuring a vivid plane crash from the perspective of the airplane passengers designed to elicit anticipatory anxiety. Clip begins with light turbulence and concludes with the airplane resting in several pieces in the crevices of the Andes.
Relaxation (video segment)	6-min video of waves on a tropical beach, with instructions to "Settle in the chair so that you're comfortable. Focus on the images on the screen and let go of other thoughts. Stay awake during the video and don't touch the computer or anything else." Two similar beach videos were used with differences in time of day and colour of sand only.
Frustration	Participants were given five minutes to identify 4–6 differences between four pairs of nearly identical photos presented on a computer monitor. Participants were falsely informed that "the task is fairly easy" and that "most people are able to find all the differences in five minutes." To ensure that hands were free to engage in BFRBs during the task, participants were asked to state each difference out loud rather than recording them on paper. The experimenter was not present in the room during the task.
Boredom	Participants were left alone for six minutes in the experiment room. The experimenter pretended to have forgotten something and said, "I just need to grab a document from my office. Please wait here a minute." Participants did not have access to cell phones or reading material.

were debriefed about the objectives of the study and given the opportunity to ask questions.

5. Results

5.1. Sociodemographic data

There were no significant differences between groups in age, gender, or language. Scores on SCL-90-R global distress dimensions (Global Severity Index, Positive Symptom Total, Positive Symptom Distress Index) fell within the norms for the measure; between-group differences were not significant. Expected significant differences between groups were observed on the MGH-HPS, STOP, DERS, and ARS. In comparison to controls, individuals with BFRBs demonstrated maladaptive planning styles on the STOP and deficits in ER on the DERS and ARS (See Table 3).

5.2. Manipulation check

Participants completed the MSACL prior to the first experimental condition and after each condition (six times in total) and these data were used to determine whether or not the experimental manipulations effectively elicited the target emotions. To strengthen our analyses and to capture the complete spectrum of emotions relevant to the FA model, the boredom and frustration conditions were collapsed into one. Prior to collapsing the conditions, we compared the presence of each of the relevant emotions in the boredom condition and in the frustration condition and found no differences. Participants' experiences of frustration, boredom, impatience, dissatisfaction, and relaxation were defined by self-report. As per MSACL factor loadings, stress was defined by averaging participants' endorsements of tension, worry, apprehension, uneasiness, distress, fear, uptightness, jitteriness, and nervousness. The original MSACL has been psychophysiologically validated (Mackay, 1980).

We used repeated-measures analysis of variance (ANOVA) and pairwise post-hoc comparisons to conduct the manipulation check. As MSACL ratings following the experiment, Mauchly's test was used to ensure that data met the assumption of sphericity; unless indicated, this assumption was met.

Although the differences were not significant, participants became slightly less relaxed from R1 to R2 to R3. R1 was therefore retained as the relaxation condition for the remainder of the analyses. A repeated-measures ANOVA revealed that participants felt significantly more relaxed in the relaxation condition than in the stress and boredom/frustration conditions $F(2,44) = 32.86$, $p < 0.001$.

Participants reported significantly greater stress in the stress condition than in the boredom/frustration condition or in the relaxation condition, $F(1,45) = 33.34$, $p < 0.001$, and significantly greater frustration in the boredom/frustration condition than in the stress condition or relaxation condition, $F(2,45) = 9.58$, $p < 0.001$.

The boredom/frustration condition generated greater impatience, $F(2,45) = 5.25$, $p = .007$, and greater dissatisfaction, $F(1,45) = 12.27$, $p < 0.001$, than did the stress or relaxation condition. Since boredom, frustration, impatience, and dissatisfaction are equally important components in the FA model, the experimental conditions successfully provoked the intended emotions of interest.

Table 3
Participant data.

	BFRB group ($n = 24$)	Control group ($n = 23$)	t	df	*sig.* (2-Tailed)
BFRB					
Hair-pulling	6	–			
Skin-picking	6	–			
Nail-biting	12	–			
Age					
M (*SD*) years	34.29 (11.18)	34.87 (12.20)			*ns*
Range (years)	20-54	20–59			*ns*
Gender					
Male (*n*, %)	7 (29.16)	6 (26.08)			*ns*
Female (*n*, %)	17 (70.83)	17 (73.91)			*ns*
Language					
French (*n*, %)	23 (95.83)	18 (78.26)			*ns*
English (*n*, %)	1 (4.16)	5 (21.74)			*ns*
MGH-HPS or analogue *M* (*SD*)	16.21 (4.59)	.87 (1.22)	15.81	26	<.001
DERS Total					
M (*SD*)	78.13 (21.84)	64.13 (14.80)	2.60	44	.013
ARS Total					
M (*SD*)	21.00 (4.75)	26.18 (4.48)	−3.80	44	<.001
FMPS Total					
M (*SD*)	97.29 (20.82)	93.09 (16.10)			*ns*
STOP Total					
M (*SD*)	178.60 (37.25)	199.07 (30.16)	−2.06	45	.045
SCL-90-R*					
PSDI					
M (*SD*)	1.55 (.48)	1.38 (.36)			*ns*
PST					
M (*SD*)	29.67 (19.28)	23.64 (15.56)			*ns*
GSI					
M (*SD*)	.57 (.51)	.41 (.34)			*ns*

ARS = Affective Regulation Scale; DERS = Difficulties in Emotion Regulation Scale; FMPS = Frost Multidimensional Perfectionism Scale; GSI = Global Severity Index; MGH-HPS = Massachusetts General Hospital Hair-Pulling Scale; PSDI = Positive Symptom Distress Index; PST = Positive Symptom Total; SCL-90-R = Symptom Checklist-90-Revised; STOP = Style of Planning Questionnaire.

5.3. Inter-rater agreement

Two independent raters scored duration and frequency of BFRB across all of the DVD recordings. The correlation coefficients for inter-rater agreement ranged from $r = 0.75$ to $r = 1.00$, with an average of $r = 0.95$.

5.4. Duration of BFRBs

Of 46 participants (one participant's DVD data was damaged and therefore excluded), only nine individuals (6 [26%] in the BFRB group; 3 [13%] in the control group) engaged in observable BFRBs across the four experimental conditions. Mean seconds of BFRBs across conditions was 14.70 ($SD = 36.34$) for the BFRBs group and 1.43 ($SD = 4.01$) for the control group. Mean seconds of BFRBs across groups was 0.39 ($SD = 2.25$) for the relaxation condition, 3.65 ($SD = 21.19$) for the stress condition, and 4.02 ($SD = 12.86$) for the boredom/frustration condition (see Fig. 1).

Due to the uneven distribution, gamma generalized linear model was applied to duration for BFRBs between control and BFRB groups and across conditions. There was a significant difference between groups in duration of BRFBs (Wald $\chi^2(1) = 36.91$; $p < 0.0001$), indicating greater duration in the BFRB group. There was a significant difference over conditions (Wald $\chi^2(3) = 33.93$; $p < 0.0001$). Wald chi square statistics showed that the BFRB group had a significantly greater duration of BFRBs during the stress condition (Wald $\chi^2(1) = 36.9$; $p < 0.001$); relaxation condition (Wald $\chi^2(1) = 10.27$; $p < 0.0001$); boredom/frustration condition (Wald $\chi^2(1) = 9.38$; $p < 0.0002$) (See Table 4).

5.5. Urge to engage in BFRB

Given the limited BFRBs demonstrated by participants, we investigated the impact of the experimental conditions on reported *urge* to engage in BFRBs using again gamma generalized linear

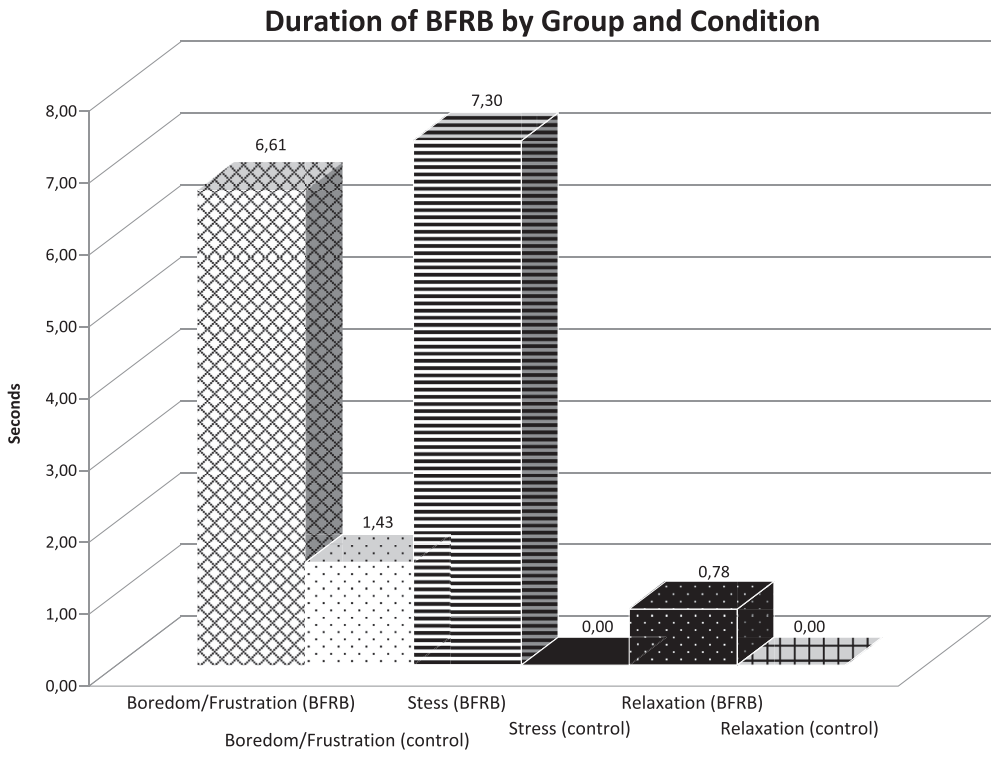

Fig. 1. Duration of BFRB by group.

models. Across all conditions, the BFRB group reported a significantly greater urge to engage in BFRBs than did the control group. In urge to perform BFRB there was a significant difference between groups in the stress condition (Wald $\chi^2(1) = 33.19$; $p < 0.0001$), in the boredom/frustration condition (Wald $\chi^2(1) = 45.56$; $p < 0.0001$), and in the relaxation condition (Wald $\chi^2(1) = 63.84$; $p < 0.0001$).

Urge fluctuated across experimental affective conditions, with the strongest urge in the boredom/frustration condition. Between conditions there was an overall effect between boredom/frustration and the other conditions only (Wald $\chi^2(3) = 4.16$; $p < 0.04$). Specifically, pairwise comparisons revealed significant differences in urge between the boredom/frustration conditions and the relaxation condition, 95% CI [0.129; 1.052]. The differences between the relaxation and stress conditions ($p < 0.40$) and between the stress and boredom/frustration conditions ($p < 0.13$) were not significant (See Table 5).

5.6. Affective predictors of urge to engage in BFRBs

The relationship between urge to engage in BFRBs and self-reported boredom and impatience was explored in the BFRB group and the control group separately. In the BFRB group, significant relationships were observed between urge and boredom ($r = .480$, $p = .018$) and between urge and impatience ($r = .457$, $p = .025$) in the boredom/frustration condition. Significant relationships between urge to engage in BFRB and boredom ($r = .417$, $p = .043$) and urge to engage in BFRBs and impatience ($r = .510$, $p = .011$) were also observed in the relaxation condition. Subsequent partial correlations revealed that the relationship between urge and boredom became non-significant when impatience was controlled, and that the relationship between urge and impatience was non-significant when boredom was controlled, indicating shared variance between boredom and impatience in the prediction of urge. In the BFRB group, boredom and impatience were not significantly related to urge in the stress condition. In the control group, boredom and impatience were not significantly related to urge in any condition.

5.7. ER, planning style, and perfectionism

Independent samples *t*-tests revealed between-group differences in style of planning, with the BFRB group demonstrating a more maladaptive planning style. Mean STOP total score was 178.60 ($SD = 37.25$) for the BFRB group and 199.06 ($SD = 30.16$) for the control group ($t(45) = -2.60$, $p = .045$). No significant between-group differences in perfectionism were observed for total score on the FMPS. On the DERS, the BFRB group reported

Table 4
Mean seconds of BFRB by group and condition.

Group	Seconds of BFRB *M (SD)*		
	Boredom/Frustration	Stress	Relaxation
BFRBs ($n = 23$)[a]	6.61 (17.56)	7.30 (29.84)	0.78 (3.16)
Controls ($n = 23$)	1.43 (4.01)	0.00 (0.00)	0.00 (0.00)
Total ($N = 46$)	4.02 (12.86)	3.65 (21.19)	0.39 (2.25)

[a] One participant's DVD data was unavailable.

Table 5
Mean urge to engage in BFRB by group and condition.

Condition	Urge to engage in BFRBs *M (SD)*	
	BFRBs	Controls
Boredom/Frustration	4.22 (2.13)	1.48 (1.34)
Stress	3.58 (1.98)	1.44 (1.24)
Relaxation	3.40 (2.57)	1.13 (0.27)

significantly greater difficulty with ER ($t(44) = 2.60$, $p = .013$) than did the control group. On the ARS, the BFRB group reported greater overall difficulty 'snapping out' of (i.e., regulating) emotions ($t(44) = -3.80$, $p < .001$) than did the control group, and rated themselves as less able to regulate each of the nine emotions measured.

Since style of planning is a dimension, we included the total sample to improve variance. We calculated Pearson's r for the relationships between perfectionism (FMPS), style of planning (STOP), and ER (ARS and DERS). For the total sample, we found significant correlations between FMPS total score and DERS total score ($r(47) = 0.34$, $p = .020$) and between FMPS and ARS total scores ($r(47) = -0.43$, $p = .003$). Further, significant correlations were observed between STOP total score and DERS total score ($r(47) = -0.61$, $p < 0.001$) and between STOP total score and ARS total score ($r(47) = 0.66$, $p < 0.001$). That is, participants with an overactive style of planning scored lower on ER and participants who scored higher on perfectionism also scored lower on ER. When we re-conducted the analyses with the data from the BFRB group only, the same relationships were observed between ER and style of planning (DERS and STOP $r(23) = -0.54$, $p = .007$; ARS and STOP $r(23) = -0.61$, $p = .002$) and ER and perfectionism (DERS and FMPS $r(23) = -0.43$, $p = .038$; ARS and FMPS $r(23) = -0.43$, $p = .037$).

There was a significant correlation between ability to control boredom and the total STOP score over all conditions ($r(47) = -0.32$; $p < 0.02$), between urge to pull and ability to control boredom ($r(47) = -0.32$; $p < 0.03$), and between degree to which boredom triggered the BRFBs ($r(47) = -0.43$; $p < 0.003$). There was a significant correlation in the boredom/frustration condition between the total STOP score and duration in seconds of the BFRBs ($r(21) = -0.57$; $p < 0.007$), and between the total STOP and urge to pull ($r(21) = -0.42$; $p < 0.05$), but no significant correlations between STOP, duration of BFRB and urge to pull in either stress or relaxation condition ($p > 0.10$).

6. Discussion

The present study explored the functional impact of diverse affective variables on HP, SP, and NB. Specifically, the study was designed to test the FA model for BFRBs and to test the hypothesis that BFRBs are triggered by boredom, frustration, dissatisfaction, and impatience. Individuals with BFRBs and controls were video-recorded in experimental conditions designed to elicit the target emotions.

The results partially support the FA model in that participants were more likely to engage in BFRBs when they felt bored, frustrated, impatient, and dissatisfied than when they felt relaxed. The BFRB group had more urges to perform BFRBs than controls and reported a greater urge to engage in BFRBs in the boredom and frustration experimental conditions than in the relaxation condition. However, the hypothesis that individuals with BFRBs would report a stronger urge to engage in BFRBs when bored/frustrated than when stressed was not supported. One explanation may be that the numerical differences may have not reached significance due to small sample size. Another possibility is that the degree of boredom and frustration and degree of stress generated by the respective conditions was not sufficient to generate statistically significant fluctuations in urge. There may also exist confounding in individual definitions of various emotional states. That is, the emotion that one individual experiences as “stress” may be experienced by others as “boredom,” or “frustration.” The stress condition was designed to elicit stress defined as anticipatory anxiety, but recent reviews suggest that interpersonal conditions are better at eliciting performance stress (Dickerson & Kemeny, 2004).

The finding that boredom and impatience were significantly associated with urge to engage in BRFBs in the boredom/frustration and also the relaxation conditions may support the FA model. Boredom and impatience imply restlessness or irritation in the face of opposition, delay, or inactivity; the finding that urge fluctuated with the intensity of these emotions is consistent with prior research indicating that individuals with BFRBs tend to value productivity and to have difficulty waiting or relaxing. The finding that boredom and impatience predicted urge to engage in BFRBs in the relaxation condition indicates that relaxation may be a paradoxical condition for individuals with BFRBs; at the moment they are meant to be released from tension, the inactivity inherent to relaxation generates boredom and impatience, generating tension.

That impatience and boredom rather than frustration and dissatisfaction emerged as key predictors refines the ER model. The concepts of boredom and impatience appear to subsume the variety of emotions proposed to be involved in the model, and may be the emotions that most effectively capture the thwarted action that defines the FA model.

As predicted, individuals with BFRBs reported greater maladaptive planning styles than did the control group. However, no between-group differences were observed on the FMPS, a more classic measure of perfectionism. It is not surprising that the STOP distinguishes between the BFRB and control groups and the FMPS does not; the STOP was developed to differentiate individuals with tics and BFRBs from controls, whereas the FMPS measures global perfectionism. Past research (e.g., O'Connor et al., 2001, 2005) similarly found that total scores on the FMPS were not higher than average in tic and BFRB groups. However, a significant correlation between FMPS total score and STOP total score was observed, and it is possible that the relationship between BFRBs and general perfectionism is not direct but rather is mediated by planning and organizational style. In fact, the STOP measures organizational perfectionism, i.e., the way individuals organize and plan their actions, and correlates most robustly with the personal organization scale of the FMPS (Laverdure, Lahoud, Roberts, & O'Connor, 2009).

Individuals with maladaptive planning styles on the STOP and elevated perfectionism scores on the FMPS had greater difficulties regulating emotion. There are several possible explanations for this result. Lacking ER strategies, individuals with deficits in ER may try to self-regulate by imposing rigid and unrealistic standards for their actions and behavior and by overplanning and overinvesting in activities. Alternatively, individuals with maladaptive planning styles may experience more frequent or intense negative emotion subsequent to failure to meet self-imposed unrealistic standards. They may possess adequate ER skills overall, but experience ER difficulties as the result of excess negative emotion.

7. Conclusions

The present study has several important implications. First, the fluctuation in urge to engage in BFRBs across experimental affective conditions demonstrates that BFRBs are not simply “nervous” habits. The global ER model for BFRBs has been supported in prior literature (Roberts et al., 2013; Shusterman et al., 2009; Snorrason et al., 2010) and the results of this study add to the data, implying that individuals suffering from BFRBs could benefit from interventions designed to directly target the build up of frustration.

If these emotions trigger BFRBs because of tension-producing planning styles, cognitive therapies designed to modify maladaptive planning styles and address perfectionist cognitions about busy-ness and productivity could effectively decrease BFRB. Modification of perfectionist standards and reductions in overactive planning could allow individuals with BFRBs to avoid impatience and frustration and the subsequent need for tension release via BFRBs.

Several limitations of the present study must be acknowledged. First, the study was exploratory in nature, and a larger sample size would be preferable in a follow-up study. Non-significant statistical effects (e.g., differences across conditions in seconds of BFRBs; differences in urge to engage in BFRBs between the boredom/frustration and stress conditions) may have lacked sufficient power, and may have reached significance in a larger sample. Second, although our experimental conditions were overall effective in eliciting the desired emotions, future studies could use validated mood-induction measures (e.g., music, stress induction via public speaking and other validated stress-induction tasks) to increase the likelihood that participants would experience the intended emotions, and could employ psychophysiological measures of stress and arousal to remove the impact of demand characteristics.

Despite these limitations, the present study is one of few studies to directly measure BFRBs in experimental affective conditions, and provides further evidence for the role of ER in explaining the persistence of damaging body-focused behaviors such as HP, SP, and NB. The results confirm the complex nature of BFRBs, with maladaptive planning styles, deficits in ER, and certain key emotions combining to generate tension and trigger BFRBs. The findings presented here imply that individuals seeking help for BFRBs could benefit from treatments designed to target ER and specifically to decrease boredom and frustration either by adjusting level of activity or by modifying maladaptive perfectionist beliefs.

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