

Afraid to vomit? The relationship between temperamental fear, emetophobia symptoms, and the impact of sex

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Emetophobia, the specific phobia of vomiting (SPOV), is an anxiety disorder associated with a persistent fear of emesis. The temperament of fear is evident in phobic and anxiety disorders, which behaviorally manifests through a sensitivity in the fight, flight, freeze system (FFFS). The present study aimed to test specific associations between these constructs. Undergraduate students (N= 186) completed self-report measures assessing symptoms of emetophobia, the FFFS, and general anxiety. Correlational analyses were used to test initial relations, followed by regression analyses to assess the unique contribution of temperamental fear to the emetophobia symptom experience. Significant positive correlations were found between emetophobia symptoms with anxiety symptoms and the overall temperament of fear. However, only the fight response of the FFFS was significantly associated with symptoms of emetophobia. Further regression analyses demonstrated that the fight response did not uniquely predict emetophobia symptoms above and beyond anxiety. However, post-hoc analyses illustrated sex moderated the relationship between temperamental fear and emetophobia symptoms, such that the relationship was significantly stronger for male participants than female participants. Results of this study expand upon the current conceptualization of emetophobia to incorporate underlying temperamental vulnerabilities and sex differences, which may function to exacerbate and/or maintain symptoms.

Keywords: emetophobia; specific phobia of vomiting (SPOV); fight, flight, freeze system (FFFS); fight, flight, freeze questionnaire (FFFQ); sex differences

The specific phobia of vomiting (SPOV), also known as emetophobia, is a specific phobia characterized by a marked fear of emesis (self or other). Though symptoms have a mean age of onset occurring between 7.5 to 15.7 years, symptoms may develop and frequently persist beyond young adulthood (Keyes & Veale, 2018). In fact, symptoms are pervasive and persist for an average duration of 25.9 years before individuals seek treatment (Keyes et al., 2017; Lipsitz et al., 2001). Although inconsistent (Veale et al., 2015), prevalence estimates of emetophobia demonstrate a much higher occurrence in females (6-7%) than in males (1.8-3.1%; Kirkpatrick & Berg, 1981; van Hout & Bouman, 2012). Those with emetophobia symptoms have severe, negative impairments in quality of life and may develop co-occurring anxiety disorders (e.g., generalized anxiety disorder (GAD), obsessive-compulsive disorder (OCD), social anxiety disorder (SAD); Boschen, 2007; Keyes et al., 2017).

In addition to the core symptom of pervasive fear of vomiting, there are a variety of fear emphases that an individual may also hold. For example, 41-75% of individuals with emetophobia present with a primary fear of vomiting themselves; while 18-45% of individuals are primarily debilitated upon seeing others vomit in their presence (Keyes & Veale, 2018). Other fears of vomiting surround the potential of choking on vom-

it leading subsequent to death, the act of vomiting in public (16-62%), and/or the physiological symptoms themselves associated with vomiting (Keyes & Veale, 2018). These impairing symptoms of emetophobia are supported through elaborate safety-seeking and avoidance behaviors, such as checking food expiration dates and avoiding contact with an ill person (Simons & Vloet, 2018; van Hout & Bouman, 2012). Through these consistent responses with acute reinforcement, the phobia is actively maintained and exacerbated.

Though symptoms overlap, it is evident that anxiety and fear are both unique constructs and components observed in anxiety disorders (Gullone et al., 2000; McNaughton & Corr, 2008; Perkins et al., 2007; Woody & Teachman, 2000). The psychological constructs of anxiety and fear have been conceptualized using the revised Reinforcement Sensitivity Theory (r-RST), a neuropsychological model of personality and motivation developed by Gray and McNaughton (2000). The r-RST consists of three motivational systems that work together to respond to threats: behavioral activation and inhibition systems (BIS and BAS) and the fight, flight, freeze system (FFFS; Corr & Krupić, 2017; McNaughton & Corr, 2008). The BIS and BAS are predominantly used to conceptualize anxiety, which is posited to occur upon approaching of perceived danger (Gray & McNaughton, 2000;

McNaughton & Corr, 2008). The third motivational system, the FFFS, is used to operationalize the temperament of fear, which operates upon active avoidance (i.e., leaving the vicinity) of perceived danger (Gray & McNaughton, 2000; McNaughton & Corr, 2008; Walker & Jackson, 2017). Indeed, the BIS and BAS, and to a lesser extent the FFFS (Kimbrel et al., 2008), have been used in the conceptualization of anxiety symptoms and disorders (e.g., SAD and OCD; Bijttebier et al., 2009; Katz et al., 2020). One area of limited research is the relationship of FFFS with anxiety disorders (Kambouropoulos et al., 2014; Kimbrel et al., 2008). As the r-RST motivational symptoms are concurrently activated (Corr & Krupić, 2017; McNaughton & Corr, 2008), it stands to reason that the temperament of fear, as operationalized by the FFFS, is implicated in the experience of anxiety symptoms, and likely emetophobia symptoms.

The FFFS is maintained through learned avoidance of aversive stimuli and is theorized to be highly sensitive to punishment (Kimbrel et al., 2008), thereby reinforcing avoidance behaviors seen in anxiety disorders and likely emetophobia. Specifically, the fight response is characterized by defensive aggression evoked in the presence of proximal, unescapable threats; while the flight response is conceptualized as a quick, direct escape from distal threats (Walker et al., 2017). Finally, the freeze response is considered a physiological panic response to distal threats involving physical immobility (Walker et al., 2017). Although the flight and freeze responses are classic avoidance behaviors seen in emetophobic responses to potential or distal fear (e.g., leaving the vicinity of an ill individual or shutting down mentally and physically upon the sight of vomit; Keyes et al., 2017, Veale et al., 2013), the fight response may also occur. For example, a threatening situation (e.g., the inability to vacate a room with ill colleagues) may provoke a fight response expressed as outright physical or verbal aggression or subtle nonverbal hostility. As is consistently demonstrated in phobic disorders, reinforcement and behavioral responses have a significant effect on the presentation and severity of emetophobia (Keyes & Veale, 2018; Wu et al., 2015).

The Present Study

To date, the symptoms of emetophobia have not been assessed within the r-RST framework or the specific FFFS motivational system. The primary aim of

the present exploratory study was to assess the overall relationship between emetophobia symptoms, general symptoms of anxiety, and fight, flight, freeze tendencies (combined and individually) in an undergraduate, analog population. As fear is inherently involved in phobias and other anxiety disorders, the current study aimed to examine both symptoms of emetophobia and overall anxiety with the FFFS motivation system. Based on the r-RST theory and current conceptualization of emetophobia, it was hypothesized that emetophobia symptoms, general anxiety, and FFFS would be positively associated. A secondary aim of the study was to investigate the unique contribution of fear in the experience of emetophobia symptoms when controlling for the known association of general anxiety symptoms (Boschen, 2007).

Methods

Participants and Procedures

Participants ($N = 186$; $M_{age} = 19.05$ years, $SD = 1.69$) were undergraduate students, aged 18 to 36 years old, enrolled in an introductory Psychology course at a large South-Eastern university in the United States. Participants were recruited via class announcements and through SONA Systems (an online participant recruitment portal). No other inclusion or exclusion criteria were present as this was an exploratory study assessing potential associations between temperamental fear and symptoms of emetophobia in an analog sample. Further, symptoms of emetophobia may develop after the average age of onset and often persist through adulthood (Keyes et al., 2017), the current sample of undergraduate students is consistent with individuals with emetophobia who may seek treatment for persistent symptoms. The majority of participants were female (74.9%; 25.1% male) and White (71.7%), though participants also identified as African American (21.2%), Asian (1.6%), Native American or Alaskan Native (0.5%), or Multiracial (4.6%), and 5.2% identified as Hispanic.

As a part of a larger study, undergraduate students presented in person to the lab. Prior to study commencement participants provided verbal and written informed consent, and then completed a series of self-report questionnaires (non-randomized). Participants received research course credit for participation. The following three questionnaires were examined for the purposes of the current study. All procedures were

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approved by the University's Institutional Review Board.

Instruments

The Specific Phobia of Vomiting Inventory (SPOVI; Veale, et al., 2013). The SPOVI is a short, 14-item measure assessing fear of vomiting symptoms experienced within the last seven days. All items are rated on a Likert-type scale from 0 (symptoms not at all experienced) to 4 (symptoms experienced all the time). Scores are summed, with higher scores suggesting an increased experience of SPOV symptoms (range 0-35). A clinical cut-off of 10 has been previously proposed (Veale, et al., 2013), which was endorsed by 9.14% of the current study sample ($n = 17$). The SPOVI has displayed good internal consistency ($\alpha = .89$), good convergent and divergent validity in college samples, and has evidenced invariance across sex (Maack et al., 2017). In the current study, the SPOVI also demonstrated good internal consistency ($\alpha = .82$).

The Fight, Flight, Freeze Questionnaire (FFFQ; Maack et al., 2015). The FFFQ is a 21-item measure assessing the typical reaction of an individual to a threatening situation. All items are rated on a Likert-type scale from 1 (experienced almost never) to 5 (experienced almost always). The measure results in a total FFFQ score as well as three subscale scores individually assessing fight, flight, and freeze. The FFFQ has demonstrated reliable internal consistency overall ($\alpha = .92$) and with all subscale scores (fight: $\alpha = .91$; flight: $\alpha = .94$; freeze: $\alpha = .86$; Maack et al., 2015; Walker & Jackson, 2017). The current study found similarly good internal consistency for the overall FFFQ score ($\alpha = .93$) and individual subscales (fight: $\alpha = .90$; flight: $\alpha = .94$; freeze: $\alpha = .91$).

The Depression, Anxiety, Stress Scale (DASS-21; Lovibond & Lovibond, 1995). The DASS-21 assesses depression, anxiety, and stress symptoms experienced within the last week, consisting of 21 items. All items are on a Likert-type scale from 0 (not applicable) to 3 (applicable much of the time). The 7-item anxiety subscale was used to assess anxiety as a potential covariate apart from overall temperamental fear. Both the overall scale and anxiety subscale scores have demonstrated good internal consistency ($\alpha = .82$ and $\alpha = .81$, respectively; Crawford & Henry, 2003; Osman et al., 2012). The current study showed acceptable internal consistency for the subscale of interest (anxiety subscale: $\alpha = .71$) and overall scale ($\alpha = .74$).

Statistical Analysis

All data analyses were conducted using SPSS version 27. Data was cleaned prior to analyses. Of the original sample ($N = 194$), three participants were removed for missing more than 10% of data, five multivariate outliers were removed using Mahalanobis distance, and additional missing data was replaced with variable means. Preliminary analyses of the final sample ($N = 186$) included descriptive statistics and zero-order correlations for all variables of interest. Following this, a hierarchical regression analysis was run to assess the unique variance of predictors on the experience of emetophobia symptoms. Post-hoc analyses, including correlations, independent samples t-tests, and a moderation analysis, examined the potential impact and interaction effects of sex on the relationship between temperamental fear and emetophobia symptoms.

Results

Descriptive statistics and intercorrelations among variables of interest are presented in Table 1. As illustrated, SPOV symptoms were significantly related to anxiety ($r = .20$, $p < .01$) and both the overall temperament of fear ($r = .17$, $p < .05$) and the fight subscale ($r = .15$, $p < .05$). However, the subscales of freeze ($r = .13$, $p = .08$) and flight ($r = .13$, $p = .08$) were not significantly associated with SPOV symptoms.

To assess the unique contribution of the temperamental fear response to the experience of emetophobia symptoms, distinct from general anxiety symptoms, a hierarchical regression analysis was run with SPOV symptoms as the dependent variable (see Table 2). In the first step of the model, the fight subscale (the only significantly associated subscale of fear) was entered. This step of the model was significant ($F[1, 184] = 4.03$, $p < .05$, $\Delta R^2 = .02$), with fight accounting for 2.1% of the variance in the prediction of emetophobia symptoms. Next, in the second step of the model, anxiety was added. The overall model was significant ($F[1, 183] = 5.72$, $p < .01$, $\Delta R^2 = .03$); however, the contribution of the fight subscale no longer added unique predictive ability.

Post-hoc Analyses

Given the above unexpected findings and clear sex differences in the occurrence of emetophobia symptoms evidenced in previous studies (Kirkpatrick &

Berg, 1981; van Hout & Bouman, 2012), post-hoc analyses related to sex were conducted to elucidate potential unique contributions of sex in the present preliminary study. Additionally, although using a non-clinical sample for an initial exploratory study, an assessment of clinical elevations of SPOV symptoms occurred. In the current study, 17 participants (9.14%) met or exceeded the threshold for clinical cut-off scores on the SPOVI (score > 10). Consistent with the previously mentioned studies (Kirkpatrick & Berg, 1981; van Hout & Bouman, 2012), of the 17 participants who met the SPOVI clinical cut-off, 13 were females (6.99%), while only 4 were males (2.27%). Point-biserial correlations demonstrated that sex was only significantly associated with the flight subscale ($r = .17$, $p < .05$) and was not significantly associated with SPOV symptoms, anxiety, overall temperamental fear, or the fight or freeze subscales. Further, independent samples *t*-tests demonstrated no significant differences between sex among any of the variables ($ps > .05$).

A simple moderation analysis using PROCESS 3.5 by Hayes (Hayes, 2018) was conducted to test if sex acted as a moderator among temperamental fear and emetophobia symptoms. Temperamental fear was entered as the predictor variable, sex as the moderator, and SPOV symptoms as the outcome. Anxiety was entered as a covariate. The overall model was significant ($F [4, 178] = 3.66$, $p < .01$, $R^2 = .08$). More importantly, the interaction between temperamental fear and sex was also significant ($F [1, 178] = 4.14$, $p < .05$, $R^2 = .02$). Specifically, the relationship between temperamental fear and SPOV symptoms was significantly stronger for men compared to women (see Figure 1).

Discussion

The aim of the current study was to investigate the fight, flight, freeze motivational system and its relations with symptoms of emetophobia. Results provided initial evidence for the impact of fear, specifically the fight tendency, on symptoms of the specific phobia of vomiting. However, further extrication of fear and anxiety is needed.

Consistent with theory and as hypothesized, the overall temperament of fear was found to be significantly associated with symptoms of emetophobia (Harnett et al., 2013; Keyes & Veale, 2018; Perkins et al., 2007; Wu et al., 2015). However, contrary to the hypotheses, not all domains of the FFFS behav-

ioral responses were related. Specifically, the flight and freeze responses, common reactions to potential threats across species (Roelofs, 2017), were not significantly associated with emetophobia symptoms in the current study. Notably, the fight response was the only fear domain significantly associated with SPOV symptoms. Regarding the salient role of the fight response in the overall sample, individuals may respond differently in situations wherein active avoidance (i.e., escape from the immediate and proximal threat) of vomit is not available (McNaughton & Corr, 2008). The perceived urgency of threat and inaccessible escape in these situations may prompt the fight response to override other FFFS reactions experienced more commonly among distal threats. However, upon further examination, the fight subscale did not add significant predictive utility above and beyond general anxiety symptoms. Additional research may examine the unique impact of the remaining motivational systems of the *r*-RST, the BIS and BAS, which are operationalized as the anxiety response (McNaughton & Corr, 2008), and provide a further understanding of these results. It is possible that SPOV symptoms are more closely linked to a preparatory response in anticipation of future negative consequences from the act of vomiting as opposed to a defensive response to vomiting alone (Barlow, 2002; Lang et al., 2000).

Potential explanations for the aforementioned discrepancies observed in the FFFS and emetophobia symptoms may involve documented hypervigilance regarding perceived vomit-related risks and threats (Boschen, 2007; Keyes & Veale, 2018). The flight and freeze responses are implicated in response to perceived threats that are distal to the individual, while the fight response uniquely combats proximal threats (Walker et al., 2017). Given the significant association of emetophobia symptoms with the fight response, this suggests participants in the current study perceived a proximal, immediate threat wherein active avoidance was unattainable (McNaughton & Corr, 2008). However, this perception may have been overshadowed by the strong connection between emetophobia symptoms and general anxiety about potential future threats that could result from vomiting (e.g., difficulty breathing, choking, embarrassment). Further research may benefit by clarifying the situational contexts unique to emetophobia which provoke the perception of proximal and distal threats and consequent arousal.

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In addition to being impacted by assessed distance (i.e., proximal or distal) from threat (i.e., vomiting), sex differences have also been demonstrated to impact risk perception across species (Gruene et al., 2015; Gustafson, 1998; Jones & Monfils, 2016). In the current study, the flight response was associated with being female, which suggests differential behavioral responses in the motivational system may occur. One possibility is that females may achieve more successful attempts of physically or mentally distancing from vomit. For instance, females experiencing emetophobia may employ flight responses (such as actively avoiding ill children at the local preschool or temporarily restricting food consumption) to avoid possible situations of vomit that may or may not occur in the distal future. Additional research should examine the frequency of the specific motivational systems of the r-RST among males and females, and whether those systems were successful at avoiding the anxiety-provoking stimuli.

Negative affect, including experience of anger and irritability, may also account for differences in behavioral responses. Emotions of negative affect (anger or irritability, anxiety, disgust, etc.) are expressed among various emotional disorders, such as anxiety and depression (Hofmann et al., 2012; Hundt et al., 2013) and have been linked to higher intensity in women (Fujita et al., 1991). Within the revised Reinforcement Sensitivity Theory (r-RST), the experience of negative affect has also been demonstrated to negatively impact the perception of daily events (Hundt et al., 2013). Further, the specific emotion of anger has been positively associated with heightened sensitivity to reward and aggression, and it is further associated with an elevated flight response to threatening situations (Hundt et al., 2013; Roelofs, 2017). As such, the flight response may be perceived as resulting in a larger, more salient reward (to evade the proximal, immediate threat) than flight or freeze (to evade the distal, potential threat). Thus, negative affect, particularly when accounting for sex differences, may alter the behavioral response of the FFFS in individuals with emetophobia.

Given the inconsistencies between the current study's findings and theory, post-hoc analyses were conducted to explore a potential missing link of the previous analyses: sex. Results from the current study demonstrated clinical levels of emetophobia symptoms were three times more prevalent in female participants than males, consistent with prior research

(Kirkpatrick & Berg, 1981; van Hout & Bouman, 2012). Interestingly, the significant interaction effect found in the moderation model demonstrated a stronger relation among men for temperamental fear and emetophobia symptoms. That is, during moments wherein heightened fear symptoms are activated, men will likely experience increased severity of emetophobia symptoms. In comparison, this effect was not found in females in the current sample. Elucidating whether this demonstration is unique to the FFFS, as compared to the BIS and BAS, may provide further understanding regarding sex differences in emetophobia.

It is possible, potentially as a result of societal differences and behavioral expectations among sex, that males and females may display and engage in emetophobia symptoms differently. Sex differences have been evidenced across the lifespan among temperamental fear and anxiety symptoms (McLean & Anderson, 2009). For example, disgust sensitivity, or the degree an individual regulates the emotion of disgust, has been found to be higher in females than in males (Cisler et al., 2009; Connolly et al., 2008). As disgust sensitivity promotes avoidance of perceived disease (Connolly et al., 2008), this suggests females may engage in increased flight responses, as evidenced in the current study. Future studies are needed to elucidate sex differences in the experience of emetophobia to provide additional contextual information to better inform treatment approaches. Overall, the results of the current preliminary study add to the current conceptualization of emetophobia as its relationship with the temperament of fear combined with the impact of sex has not yet been documented in the literature.

Limitations

Although this preliminary study of temperamental fear and symptoms of emetophobia furthers the extant literature, it is not without limitations. Specifically, data was collected from an undergraduate population with no formal diagnostic assessment of emetophobia or other psychiatric disorders. As the study was considered exploratory to first determine the potential of a relation between fear tendencies and symptoms of emetophobia, there were no exclusion or inclusion criteria. It is important to note that substantial variance in sample although having good internal validity ($\alpha = .82$ in this sample) may not be representative of external validity (i.e., true diagnostic status). Moreover, rep-

licating this study in a clinical sample with structured clinical assessments of emetophobia is needed to truly further the overall conceptualization of emetophobia.

Another limitation, as previously mentioned, was that the study relied upon self-report measures wherein the threat of immediate and proximal vomit was not present, thereby potentially impacting the innate behavioral responses of participants. Despite these limitations, the current study provides a novel, initial understanding of the FFFS and the impact of sex on emetophobia symptoms.

To address such limitations in the future, studies employing behavioral avoidance tasks (BATs) related to emetophobia stimuli may improve the understanding of natural behavioral responses across sex and in response to tangible vomit-specific threats. Additionally, research examining the FFFS in individuals formally diagnosed with emetophobia may contribute to a comprehensive conceptualization of this disorder. Additionally, clarity on possible confounding variables related to FFFS presentation may be provided by formal diagnostic assessment by a trained clinician and/or the addition of self-report measures. Finally, based on previous literature indicating anger is associated with an increased sensitivity to reward, the emotion of anger in relation to the overall temperament of fear, individual response tendencies (i.e. fight, flight, freeze), and symptoms of emetophobia is worth exploration (Hundt et al., 2013).

Conclusion

The present study assessed the associations of temperamental fear (fight, flight freeze systems) with the experience of emetophobia symptoms. Although symptoms of emetophobia were associated with the temperament of fear, specifically the fight subscale, none of the subscales offered predictive utility above and beyond general anxiety symptoms. Interestingly, post-hoc analyses revealed that sex moderated the relationship between the overall FFFS and emetophobia symptoms, such that this relationship was much stronger for male participants than for females. To advance the conceptualization of emetophobia, additional research is needed to first confirm the association between the FFFS and emetophobia behaviors (i.e. using behavioral tasks) and then assess/identify these specific fear behaviors in a clinical sample. Further, exploring whether the temperament of fear is generalized to vom-

it-specific stimuli and proximally threatening situations may provide information to assist with comprehensive treatment. Importantly, the current study expands the literature in the area of emetophobia by assessing the specific underlying temperamental vulnerability of fear, the impact of sex, and how this relationship significantly affects symptoms of this phobic experience.

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Table 1

Descriptive Statistics and Zero-Order Relations Between Relevant Continuous Variables

	M(SD)	1	2	3	4	5	6	7
1. SPOVI	2.92 (4.50)	-	.20**	.17*	.15*	.13	.13	.03
2. Anxiety (Dass-21)	2.45 (2.97)		-	.28***	.18*	.12	.42***	-.10
3. FFFQ total	37.05 (13.55)			-	.82***	.83***	.68***	.03
4. Fight (FFFQ)	12.48 (5.81)				-	.51***	.39***	-.11
5. Flight (FFFQ)	13.62 (6.79)					-	.33***	.17*
6. Freeze (FFFQ)	10.95 (4.68)						-	-.02
7. Sex								-

Note: * $p < .05$, ** $p < .01$, *** $p < .001$; SPOVI = Specific Phobia of Vomiting Inventory; DASS-21 = Depression, Anxiety, Stress Scale -21; FFFQ = Fight, Flight, Freeze Questionnaire; Male sex was coded "0," while female sex was coded "1."13; DERS= Difficulties in Emotion Regulation Scale; DASS-21 = Depression, Anxiety, Stress Scale -21.

Table 2

Summary of Regression Analysis with Predictors of SPOV Symptoms (N = 186)

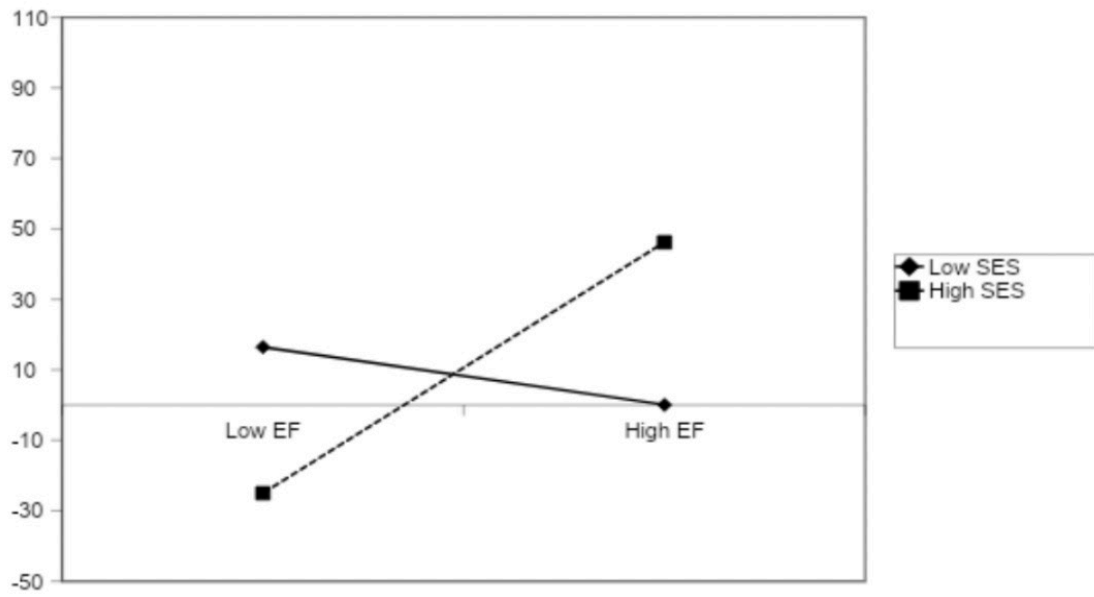
Variable	B	95% CI for B		SE B	β	R ²	ΔR^2
		LL	UL				
Step 1						.02*	.02*
Constant	1.51*	-.02	3.04	.78			
Fight (FFFQ)	.11*	.00	.23	.06	.15*		
Step 2						.05**	.03**
Constant	1.12	-.38	2.70	.78			
Fight (FFFQ)	.09	-.02	.20	.06	.12		
Anxiety (DASS-21)	.27**	.05	.48	.11	.02**		

Note. * $p < .05$; DASS-21 = Depression, Anxiety, Stress Scale -21; FFFQ = Fight, Flight, Freeze Questionnaire

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Figure 1

Predicted levels of SPOV symptoms as a result of the interactive effect of FFFQ (temperamental fear) and sex



Note. SPOV = specific fear of vomiting; FFFQ = Fight, Flight, Freeze, Questionnaire