

Examining Temperament in Exercise Dependence and Eating Disorders

Exercise Dependence (EXD) is a term used to describe pathological exercise characterized by a preoccupation with exercise, withdrawal symptoms when unable to exercise, and an interference with social relationships and/or occupational commitments [1]. In short, EXD is a maladaptive pattern of exercise that manifests in negative physiological, psychological and social symptoms [2]. EXD is defined by applying the Diagnostic and Statistical Manual of Mental Disorders-IV-R (DSM-IV-R) criteria for substance dependence [3]. Specifically, there are seven criteria of dependence (e.g., tolerance, withdrawal, intention, reduction in other activities, continuance, time and lack of control) [4]. Exercise is considered dependent when at least three of these criteria are met. For example, an individual may experience continuance as exercising despite recurring negative physical (e.g., injuries) or psychological effects, experience withdrawal symptoms such as depression or anxiety when they are unable to exercise, and/or reduce important obligations (e.g., work, spending time with family/friends, school, etc.) in favor of spending time in activities related to exercise [5].

Two distinct variants of EXD have been identified. Primary EXD is when individuals exercise solely for the gratification of exercise despite the negative consequences mentioned above. In other words, exercise is the primary problem. Secondary EXD occurs when individuals exercise to facilitate some other disorder or condition [5]. This most commonly occurs in attempt to control or change body size and shape as part of an eating disorder [6].

The negative physical, psychological, and social outcomes associated with EXD and eating disorders provide a rationale for identifying variables that may predict primary and secondary EXD [7]. However, there is a lack of research exploring the potential predisposing factors that may predict primary and secondary EXD. A recent pilot study found support for

different temperament styles related to primary and secondary EXD [8]. Temperament is an individual's predisposition of self-regulation processes such as effortful control, emotions, motor abilities and attentional reactivity [9]. The two most commonly conceptualized temperament styles are Behavioral Inhibition (BI) and Behavioral Activation (BA). BI is associated with sensitivity to punishment, non-reward, novelty, anxiety, and depression [10]. Conversely, BA is associated with impulsivity and reactivity to rewarding consequences. A review of the literature found temperament differences in eating disorders and EXD [11]. Therefore, BI and BA may be factors that could predict each EXD variant.

A recent pilot study indicated that BI is associated with eating disorders, and BA is associated with risk for EXD [8]. However, these results were from a unique clinical sample which included hospitalized patients with eating disorders and German elite athletes (e.g., Olympic level). To understand the specific link of temperament styles in EXD and eating disorders, research should examine more representative samples [8]. The purpose of my study was to examine temperament styles in EXD and eating disorders in a population-based sample. I hypothesized that individuals with eating disorders will be associated with BI temperament and individuals with EXD will be associated with BA temperament.

METHOD

Participants:

A total of 880 individuals who completed an online survey. Participant's demographics were mean age = 28.46+10.13, mean Body Mass Index = 27.29+6.34, 63.92% female, 66.90% Caucasian, 42.41% never married/currently single, 29.60% earned a college diploma, 60.41% with an annual personal income of <\$25k and 79.63% were non-Hispanic or Latino.

Measures:

Demographic Questionnaire: Participants self-reported age, sex, height, weight, ethnicity, marital status, education level, employment status, and income level.

Exercise Dependence Scale (EDS): The EDS [12] is a 21-item measure that can distinguish when exercise behavior becomes problematic. The EDS includes seven subscales that correspond to the DSM-IV-R. Each subscale is measure on a 6-point Likert scale ranging from 1 (never) to 6 (always), with lower scores revealing fewer EXD symptoms. The EDS reliability in this study was excellent ($\alpha = 0.95$)

Eating Disorder Examination-Questionnaire (EDE-Q): The EDE-Q version 6 [13] is a 28-item questionnaire that evaluates symptoms of an eating disorder. The EDE-Q has been validated for categorical use to determine the probable diagnosis of anorexia nervosa, bulimia nervosa, and binge eating disorder [14]. A comprehensive symptom score can be calculated to determine the eating disorder risk. The EDE-Q reliability in this study was excellent ($\alpha = 0.90$)

Leisure-Time Exercise Questionnaire (LTEQ): The LTEQ [15] is a self-report questionnaire that assesses strenuous, moderate, and light intensity exercise. Scores for each intensity level are converted to metabolic equivalents (METs) using the following values – strenuous 9 METs, moderate 5 METs, and light 3 METs.

Behavioral Inhibition/Activation System (BIS/BAS): The BIS/BAS [10] is a well validated scale to assess both BI and BA. The BI scale includes seven items. BI scale reliability in this study was good ($\alpha = 0.81$) The BA scale includes 13 items. BA scale reliability in this study was good ($\alpha = 0.86$).

Procedures and Analyses:

Prior to data collection, IRB approval was obtained and participants provided informed consent. Participants were grouped as regular exercisers (e.g., LTEQ >24.00), primary EXD (e.g.,

EDS>77.00 & EDE-Q<2.98), secondary EXD (e.g., EDS>77.00 & EDE-Q>2.99) and eating disorder only (e.g., EDE<77.00 & EDE-Q>2.99). Overall group differences were examined with ANOVA. Individual group differences were examined with Tukey Post Hoc analyses.

RESULTS

A series of ANOVAs were used to examine group differences in overall BI, overall BA, and each BA subscale scores. Means for all study variables are reported in Table 1. Significant group differences on overall BI scores were observed [$F(3,841)=27.13$, $p<0.01$, $\eta^2 = 0.088$]. Tukey post hoc revealed the primary EXD group reported lower BI scores than eating disorder only group ($p<0.01$), the secondary EXD group reported lower BI scores than eating disorder only group ($p<0.01$); and the regular exercisers group reported lower BI scores than eating disorder only group ($p<0.01$). No significant differences were observed for overall BA scores [$F(3,830)=1.52$, $p=0.21$, $\eta^2 = 0.005$], BA Drive [$F(3,850)=0.868$, $p=0.46$, $\eta^2 = 0.003$], or BA Fun [$F(3,852)=0.775$, $p=0.51$, $\eta^2 = 0.003$]. However, significant differences were observed in BA Reward subscale scores [$F(3,850)=4.76$, $p<0.01$, $\eta^2 = 0.017$]. Tukey post hoc revealed the secondary EXD group scores were lower than the eating disorder only ($p<0.01$) and regular exercisers groups ($p<0.01$). See figure 1.

DISCUSSION

In partial support of my hypotheses, I observed that BA Reward subscale scores were elevated in secondary EXD compared to the eating disorder only or regular exerciser groups, and that BI was highest in the eating disorder only group. My observations were similar, but also revealed key differences from a recent pilot study which used a clinical sample of hospitalized eating disorder patients and German elite/Olympic athletes [8]. I partially replicated the pilot

study's results in a more generalizable sample. Results of my research may have implications in understanding key etiological factors for EXD and eating disorder development.

My study had similarities and differences to the recent pilot study [8]. Similarities includes both studies examined different temperament styles in individuals with an eating disorder and individuals with EXD. In contrast, the difference is the sample that each study examined. My general population sample gives insight on the severity and development of different temperament styles between regular exercisers, primary EXD, secondary EXD, and eating disorder only groups. Furthermore, my results may provide insight on disease severity in individuals with eating disorders and individuals with EXD. Observing differences in BA reward indicated that secondary EXD, eating disorder only, and regular exerciser groups may experience different temperament styles during disease development.

My findings should be understood in the context of some limitations. First, my study used a cross-sectional design which prevents the ability to make casual inferences. Next, I did not use clinical diagnosis to determine eating disorders or EXD status, which may limit the accuracy of my assessments. Lastly, I didn't use an objective assessment of physical activity/exercise levels. Future research is encouraged to use clinical diagnoses and objective measurements of EXD, eating disorders and physical activity/exercise levels.

My use of a general population sample allows a better understanding of temperament styles among individuals with eating disorders and individuals with EXD. That is, my study revealed that temperament may be different in pre-clinical eating disorders or EXD. Future research is encouraged to continue to examine these relationships.

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Table 1: Variable Means and Standard Deviations by Group

	Primary Exercise Dependence		Secondary Exercise Dependence		Eating Disorder Only		Regular exercisers	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
BA	39.62	8.37	37.25	7.67	39.50	6.41	39.27	5.98
BI	19.40	4.25	18.83	4.01	21.90	4.15	19.21	4.16
BA Reward	16.35	3.67	15.20	3.61	16.89	2.74	16.68	2.57
BA Fun	11.56	2.74	11.20	3.01	11.67	2.56	11.51	2.40
BA Drive	11.70	2.97	10.79	2.35	11.02	2.72	11.16	2.50
LTEQ Total	59.27	30.86	58.93	25.76	32.20	27.40	49.04	23.71
EDS Total	87.33	7.41	90.43	10.48	42.85	17.16	44.83	15.01
EDE-Q Global	1.07	0.73	3.38	0.70	3.40	0.84	0.92	0.67

NOTE: *M* = Mean; *SD* = Standard Deviation; BA = Behavioral Activation Scale; BI Behavioral Inhibition Scale; EDE-Q = Eating Disorders Examination Questionnaire; EDS = Exercise Dependence Scale; LTEQ = Leisure Time Exercise Questionnaire

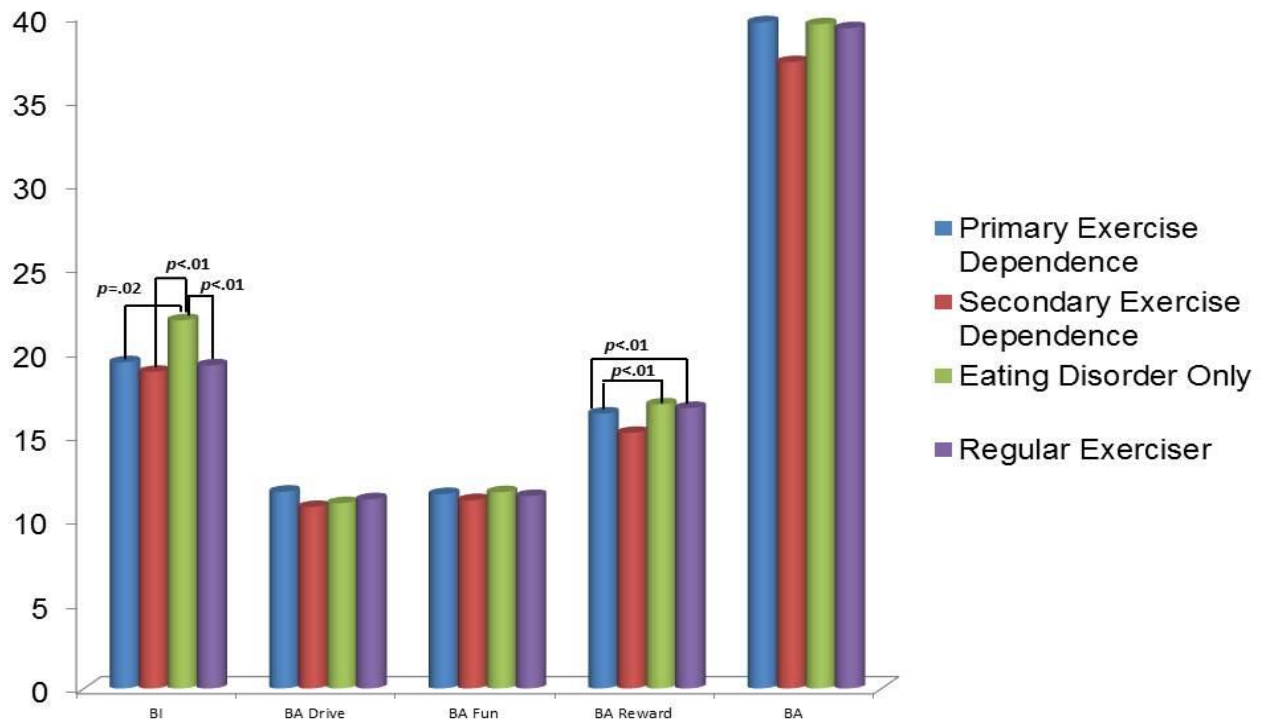


Figure 1: Group differences in BI/BA scores

NOTE: BI = Behavioral Inhibition Scale, BA = Behavioral Activation Scale