



# Affective Responses to High Intensity Interval Training Relative to Moderate Intensity

## Continuous Training

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### Abstract

- Physical activity among adults is associated with several health benefits
- The purpose of this study was to examine the affective responses among participants who completed a high intensity interval training (HIIT) class or a moderate intensity continuous training (MICT) class
- Participants (n=41) were randomized to participate in either the HIIT or MICT class
- There was no effect of group assignment on enjoyment, self-efficacy in physical activity, tranquility, positive engagement, or revitalization
- There was an effect of group assignment on physical exhaustion and mid-class affect
- HIIT resulted in more physical exhaustion and displeasurable affect during physical activity than MICT
- The MICT condition reported significantly greater levels of remembered pleasure post-class relative to the HIIT condition
- These findings suggest that although HIIT requires more exertion and intensity relative to MICT, the affect and enjoyment experienced as a result of physical activity does not differ

### Introduction

- Adults are recommended to engage in 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity per week
- Based on self-report measures only 19% of women and 26% of men meet the physical activity guidelines (USDHHS, 2018)
- Adults meeting physical activity guidelines significantly increases positive health outcomes (USDDHS, 2018)
- HIIT consists of small bouts of intense physical activity interspersed with rest intervals
- HIIT has been shown to produce physiological benefits comparable to endurance training despite HIIT's reduced time commitment
- Research has linked physical activity adherence to three states including mood, emotion, and affective responses (Crocker et al., 2004; Ekkekakis, 2010; Williams et al., 2008)
- Hedonic theory suggests that the feelings one experiences during physical activity, or their affective response, may dictate their future desire to engage in physical activity (Jung et al., 2014)
- Dual-mode theory suggests that an individual can experience a pleasurable affective response even after completing physical activity perceived as an aversive stress or stimulus (Hoekstra et al., 2017)

Table 1. Questionnaire administration

Measure	Variable	Pre	Mid	Post
Exercise-Induced Feeling Inventory	Affect	X		X
Feeling Scale	Affect	X	X	X
Exercise Self-Efficacy Scale	Self-efficacy	X		X
Physical Activity Enjoyment Scale	Enjoyment	X		X
Felt Arousal Scale	Perceived arousal	X		X
Leisure Time Exercise Questionnaire	Physical activity	X		
Reasons for Exercise Inventory	Exercise motivation	X		
Future Intention to Exercise Scale	Future motivation	X		X
Rate of Perceived Exertion Scale	Perceived exertion		X	
Remembered Pleasure	Pleasure			X
Forecasted Pleasure	Pleasure			X

Table 2. Specific Aim One

Descriptive statistics for the EFI subscales, PACES, FAS, and ESES over time by condition.

Variable	Condition	Possible Range	M	(SD)	M	(SD)
<b>EFI-Positive Engagement</b>						
	HIIT	0-12	7.27	(2.10)	7.82	(1.59)
	MICT		6.47	(2.29)	7.90	(2.08)
	Total		6.90	(2.20)	7.85	(1.81)
<b>EFI-Revitalization</b>						
	HIIT	0-12	6.00	(2.33)	7.14	(2.49)
	MICT		5.21	(2.37)	7.05	(2.09)
	Total		5.63	(2.35)	7.10	(2.29)
<b>EFI-Physical Exhaustion</b>						
	HIIT	0-12	3.86	(2.46)	6.00	(2.76)
	MICT		3.11	(2.33)	3.90	(1.88)
	Total		3.57	(2.40)	4.10	(3.15)
<b>EFI-Tranquility</b>						
	HIIT	0-12	8.00	(3.21)	6.18	(2.46)
	MICT		6.00	(2.36)	6.95	(2.70)
	Total		7.07	(2.99)	6.54	(2.57)
<b>PACES</b>						
	HIIT	18-126	103.27	(16.31)	101.32	(16.79)
	MICT		101.26	(14.97)	104.53	(17.66)
	Total		102.34	(15.54)	102.81	(17.06)
<b>FAS</b>						
	HIIT	1-6	3.36	(1.09)	3.77	(1.02)
	MICT		2.95	(1.27)	3.32	(1.31)
	Total		3.17	(1.18)	3.56	(1.07)
<b>ESES</b>						
	HIIT	10-40	32.77	(4.69)	33.14	(5.29)
	MICT		33.58	(3.76)	35.21	(4.17)
	Total		33.15	(4.25)	34.10	(4.86)

Notes: EFI= Exercise-Induced Feeling Inventory; PACES=Physical Activity Enjoyment Scale; FAS=Felt Arousal Scale; ESES=Exercise Self-Efficacy Scale. Standard deviations are listed in parentheses.

### Purpose

The purpose of this study was to examine the affective responses among participants who completed a high intensity interval training (HIIT) class or a moderate intensity continuous training (MICT) class

### Methods and Materials

- Participants (N=41) were a convenience sample of college-aged students capable of completing a 25-minute physical activity class
- Participants completed questionnaires before, during, and after their session of physical activity
- Participants were shown either a HIIT or MICT video through Zoom, which were created by an American College of Sport Medicine Exercise Physiologist®
- The class consisted of a five-minute warm up, 20-minute body weight HIIT or body weight MICT, and five-minute cool down
- Questionnaires had participants reflect on affect, exercise-feeling, self-efficacy physical activity enjoyment, perceived activation, physical activity level, exercise motivation, and perceived exertion
- A between group univariate analysis was used for specific aims one and two
- A linear regression analysis was used for exploratory aims one and two

### Results

#### Specific Aim One

Assignment impact on participants' exercise feeling, enjoyment, arousal, self-efficacy, and future intentions to exercise

- Participants in the HIIT session reported higher levels of exhaustion relative to participants in the MICT session after controlling for pre-class scores,  $F(1, 38)=27.596, p<.001$
- No significant differences of condition assignment on positive engagement, revitalization, and tranquility subscales on the EFI, PACES, FAS, or ESES

#### Specific Aim Two

Assignment impact on on participants' affect during and after HIIT relative to MICT

- Participants in the HIIT condition did report significantly less pleasure relative to the MICT condition during the mid-class second rating,  $F(1, 38)=7.503, p<.01$
- No differences between HIIT and MICT on the FS-current measure during the first mid-class or post-class ratings

#### Exploratory Aim One

Explore the relationship between reasons for exercise and exercise feelings

- Higher REI-Health/Fitness related to higher tranquility
- REI Enjoy/Mood had a significantly inverse relationship with tranquility

#### Exploratory Aim Two

Explore the relationship between exercise feeling and affect with self-efficacy

- Higher EFI-Revitalization and FS-Enjoyment were related to higher exercise self-efficacy
- EFI-Positive Engagement had a significant inverse relationship with exercise self-efficacy

Table 3. Specific Aim Two

Descriptive statistics for FS-current and FS-enjoyment over time by condition

Variable	Condition	Pre		Mid #1		Mid #2		Post	
		M	(SD)	M	(SD)	M	(SD)	M	(SD)
<b>FS-Current (Range: 5-5)</b>									
	HIIT	2.32	(2.03)	2.14	(1.75)	1.95	(2.19)	2.68	(1.84)
	MICT	2.37	(1.86)	3.42	(1.68)	3.53	(1.71)	3.11	(1.73)
	Total	2.34	(1.93)	2.73	(1.82)	2.68	(2.12)	2.88	(1.78)
<b>FS-Enjoyment (Range: 1-7)</b>									
	HIIT	4.23	(1.27)	2.32	(1.64)	2.14	(1.83)	4.86	(1.17)
	MICT	4.16	(1.12)	2.63	(1.71)	2.79	(1.51)	4.63	(1.30)
	Total	4.20	(1.19)	2.46	(1.66)	2.44	(1.70)	4.76	(1.22)

HIIT=High Intensity Interval Training; MICT=Moderate Intensity Continuous Training.

Table 4. Exploratory Aim One

Reasons for Exercise Inventory Predicting Exercise-Induced Feeling Inventory

EFI Positive Engagement				
Independent Variables	Beta	t-value	Sig.	
REI-Appearance Reasons	0.30	1.88	0.07	
REI-Health/Fitness	0.20	1.09	0.28	
REI-Enjoy/Mood	-0.07	-0.41	0.68	
EFI Revitalization				
Independent Variables	Beta	t-value	Sig.	
REI-Appearance Reasons	0.15	0.90	0.38	
REI-Health/Fitness	0.01	0.04	0.97	
REI-Enjoy/Mood	0.15	0.78	0.44	
EFI Physical Exhaustion				
Independent Variables	Beta	t-value	Sig.	
REI-Appearance Reasons	-0.08	-0.48	0.64	
REI-Health/Fitness	-0.00	-0.01	0.99	
REI-Enjoy/Mood	-0.01	-0.04	0.97	
EFI Tranquility				
Independent Variables	Beta	t-value	Sig.	
REI-Appearance Reasons	0.04	0.24	0.81	
REI-Health/Fitness	0.40	2.24	0.03	
REI-Enjoy/Mood	-0.38	-2.15	0.04	

Notes: REI=Reasons for Exercise Inventory; EFI=Exercise-Induced Feeling Inventory.

Table 5. Exploratory Aim Two

Exercise-Induced Feeling Inventory and Feeling Scale Predicting Exercise Self-Efficacy Scale

ESES				
Independent Variables	Beta	t-value	Sig.	
EFI-Positive Engagement	-0.43	-2.31	0.03	
EFI-Revitalization	0.55	2.46	0.02	
EFI-Physical Exhaustion	0.07	0.42	0.68	
EFI-Tranquility	-0.02	-0.12	0.91	
FS-Current	0.11	0.50	0.62	
FS-Enjoyment	0.36	2.09	0.05	

Notes: FS=Feeling Scale; EFI=Exercise-induced Feeling Inventory; ESES=Exercise Self-Efficacy Scale.

### Discussion

#### Specific Aim One

- No effect of condition assignment on the positive engagement, revitalization, and tranquility of exercise feeling
- Exercise feeling related to physical exhaustion was higher in HIIT
- Consistent with dual-mode theory as participants interpreted HIIT as significantly more intense, but experienced similar levels of positive engagement, revitalization, and tranquility relative to MICT (Tuuri, 2014)
- There were no significant differences between conditions for enjoyment, arousal, and self-efficacy

#### Specific Aim Two

- During the second mid-class rating, HIIT was reported as significantly less pleasurable than MICT
- Alike the findings from Oliveira et al. (2013), who found that participants reported less pleasure during HIIT before experiencing a rebound in positive affect post-session
- A rebound was observed in the present study as the post-session affect revealed no significant differences in the HIIT condition relative to the MICT condition
- The reduction in positive affect could potentially be explained by the study from Martinez et al. (2015), which observed that once participants crossed the ventilatory threshold, positive affect was significantly reduced

### Conclusions

- The majority of the United States population does not meet physical activity recommendations (USDHHS, 2018)
- Due to this, many face health complications that could be offset by reaching the recommended levels of physical activity
- Young adulthood is a common point in life in which a large decrease in physical activity is observed (Lox et al., 2016), making physical activity interventions particularly relevant for this age group
- This study examined the impact of HIIT on affective responses relative to MICT
- Exercise feelings related to physical exhaustion was significantly higher in HIIT relative to MICT when controlling for pre-class scores
- In-class affect was significantly lower in HIIT relative to MICT when controlling for pre-class scores
- Enjoyment, post-class affect, self-efficacy, arousal, and exercise feeling related to positive engagement, tranquility, and revitalization did not differ significantly between conditions when controlling for pre-class scores
- Since participants in this study were homogenous and highly active, future research is warranted with young adults who are more representative of the population