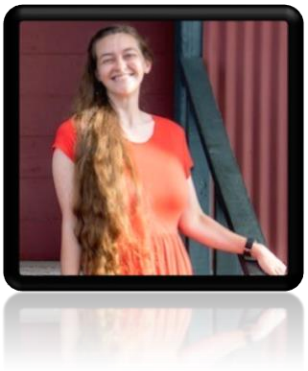

Damaris Thrash
Major in Exercise Science
Mentor: Dr. Shannon Jordan
Research in Exercise Science
Department of Health and Kinesiology

Effects of Motivational Music on Post-Exercise Recovery

Previous studies have been conducted to analyze the physiological effects listening to motivational music has on exercise performance. For music to be considered "motivational", literature suggests a tempo of 120-140 bpm if it is expected to elicit a positive response during high-intensity exercises. However, there is a scarcity of research analyzing the effects of music during the post-exercise recovery period (EPOC). Due to this, my research study was meant to examine the effects of types of music on exercise recovery.

With OUR support, my mentor Dr. Shannon Jordan and I were able to carry out this project. With the funds provided, we purchased materials needed to conduct this experiment, including filters, hoses, and headgear for the Lamar University Health and Kinesiology Department's ParvoMedics Metabolic Cart (in order to measure metabolic gas exchange variables) and the book *Applying Music in Exercise and Sport* by Costas I. Karageorghis. This textbook provided the Music Brunel Rating Inventory (MBRI), a validated survey tool that was used to assess the degree to which is deemed motivational.

While working on this research project, I learned many new skills that will be beneficial to me in the future, as one of my goals is to attend graduate school. These new skills include becoming more proficient in taking exercise blood pressure, analyzing data, and using Excel. Dr.

Jordan has also taught me how to calibrate and perform maintenance on the metabolic cart, as well as analyze lactate samples.

For this experiment, our goal was to recruit ten healthy, college-age (non-smokers, 18-30 years) participants. Each participant completed an initial evaluation – including providing an informed consent and a PARQ+ (an IRB approved screening tool). Participants meeting the criteria performed a treadmill exercise test to determine their aerobic fitness level (VO_{2peak}). Throughout the test heart rate (HR), blood pressure (BP), and lactate were monitored, along with metabolic gas exchange. Next, participants performed at 70% of their VO_{2peak} for three different exercise trials in which they would listen to different types of music during the recovery period of each session. Participants completed three trials in random order:

Exercise	**Recovery**
Motivational Music	No Music
Motivational Music	Motivational Music
Motivational Music	Calming Music

Exercise recovery was determined based on post-exercise gas exchange data, heart rate, blood pressure, and blood lactate. Data were organized into an excel sheet and analyzed in the statistical program SPSS. A total of ten participants have completed all exercise trials.

Our findings showed no difference in recovery when comparing the three different trials. This conflicts with our research hypothesis that calm music, or no music would allow the participants to recover more quickly during the EPOC. In the attached data table, you can see the means ± SD for heart rate, systolic and diastolic blood pressure, lactate, VO2 (absolute and relative), ventilation (VE), respiratory rate (RR), and respiratory exchange ratio (RER). When the statistical analysis was performed in SPSS, there were no significant differences between music trials for any physiological variable associated with recovery during the EPOC.

Throughout this process, there were challenges we faced and overcame, one being when a participant's braces made it difficult to fit the mouthpiece in their mouth correctly, causing it to pop out in the middle of their run. Since the trial was not completed, the participant had to reschedule while the team retrieved a mouthpiece that was shaped differently and more suitable for the participant's condition. Another problem manifested itself with scheduling and the number of participants able to complete all five visits of the experiment. Originally, we aimed to have

fifteen or more participants sign up in order to have ten totals, accounting for attrition. We recruited thirteen participants. One dropped out due to being a front-line worker and not having time off work. Another took a full-time job in another city. The third person who dropped out of the study was uncomfortable walking on a treadmill and had trouble keeping their balance.

Personally, I also found monitoring blood pressure to be a little challenging; it can be difficult to detect Korotkoff sounds (the sounds emitted while recording a person's blood pressure) when the person being monitored is active; their constant movement can affect the gauge, and their footfalls can make it difficult to hear. For this experiment, motivational music was required during exercise at a certain volume, adding to the noise levels. However, as I grew more experienced, I also grew more confident in my readings.

While I have not yet had an opportunity to present my research at any conference or venue to date, I hope to do so at both the Ninth Texas STEM Conference and the 2022 Texas American College of Sports Medicine meeting. We plan to extend our recruitment efforts further into the fall in order to obtain more participants beyond our initial goal of ten participants in order to have a larger data set to present at the ACSM conference in the spring. This will also give us a more robust data set to prepare a manuscript for a publication in a peer-reviewed scientific journal within the field of exercise science.

This experience fueled my interests for this topic and my love for the study of exercise science in general. Not only has it made me more confident in my abilities and what I want my future career to revolve around, but it has created a much more curious mind and stimulated a great and newfound appreciation for research within me as well. If I had known how much I would come to enjoy research through this experience beforehand, I would have applied for SURF and all the opportunities if offers sooner. As it is, I cannot wait for future chances to conduct more studies.

	Exercise Intensity During 20-minute Exercise Trials				
	Absolute VO2 (L/min)	Relative VO2 (ml/kg/min)	Percent VO2max	Max Heart Rate (bpm)	Percent HRmax
No music	2.1 ± 0.7	24.29 ± 6.57	70.1 ± 4.59	187 ± 7	81.4 ± 4.7
Motivational	2.1 ± 0.6	23.73 ± 6.44	72.3 ± 4.8	188 ± 7	82.8 ± 5.4
Calm	2.1 ± 0.7	23.13 ± 6.71	69.8 ± 4.7	188 ±	83.4 ± 6.7

The goal for each 20 minute exercise session was to have the participants exercise at 70% of their VO2max…or maximal aerobic capacity. In this table, you can see the percent VO2max was

similar between treatment groups and we were able to hold the exercise intensity steady in order to ensure that any results were not due to different exercise intensities between trials.

		No Music	Motivational Music	Calm Music
Heart Rate (bpm)	IPE	136 ± 12	146 ± 13	135 ± 14
	7 Min Post	98 ± 9	100 ± 8	100 ± 8
	15 Min Post	92 ± 8	91 ± 8	91 ± 9
SBP (mmHg)	IPE	152 ± 18	165 ± 25	160 ± 17
	7 Min Post	131 ± 13	131 ± 18	131 ± 18
	15 Min Post	124 ± 7	124 ± 9	121 ± 8
DBP (mmHg)	IPE	75 ± 7	77 ± 8	77 ± 7
	7 Min Post	82 ± 6	82 ± 7	82 ± 4
	15 Min Post	82 ± 6	83 ± 8	81 ± 6
Blood Lactate (mmol/L)	IPE	4.2 ± 2.3	4.7 ± 2.6	4.5 ± 2.1
	7 Min Post	3.0 ± 1.6	3.1 ± 1.6	3.1 ± 2.0
	15 Min Post	2.1 ± 0.9	2.0 ± 1.1	2.1 ± 1.1
	No significant differences between treatments for any time point			
	SBP= Systolic Blood Pressure; DBP=Diastolic Blood Pressure			

Our findings showed no significant differences during the EPOC, or recovery stage between treatments, for the variables measured. Data in this table depicts the 15-minute EPOC period. IPE stands for Immediately post exercise. Participants had stopped exercising and stood still on the treadmill for the IPE measurements. Participants then sat quietly for the remainder of the 15-minute EPOC period, where measurements were taken at 7 and 15 minutes post exercise. Data represented in this table are heart rate, systolic and diastolic blood pressure, and blood lactate.

		No Music	Motivational Music	Calm Music
Absolute VO2 (L/min)	IPE	0.7 ± 0.2	0.7 ± 0.2	0.6 ± 0.2
	7 Min Post	0.4 ± 0.1	0.7 ± 1.2	0.4 ±0.1
	15 Min Post	0.3 ± 0.1	0.3 ± 0.1	0.3 ± 0.1
Relative VO2 (ml/kg/min)	IPE	8.50 ± 2.25	7.86 ± 2.32	7.15 ± 2.38
	7 Min Post	4.20 ± 1.20	3.82 ± 1.17	4.11 ± 1.46
	15 Min Post	3.69 ± 0.94	2.99 ± 1.11	3.89 ± 1.24
Ventilation (L/min)	IPE	20.18 ± 6.06	19.94 ± 3.76	19.10 ± 5.55
	7 Min Post	11.48 ± 4.03	9.61 ± 2.48	10.25 ± 2.17
	15 Min Post	9.89 ± 4.33	7.17 ± 1.82	8.63 ± 2.57
Respiratory Rate (bpm)	IPE	21.00 ± 3.61	22.40 ± 3.10	22.80 ± 2.90
	7 Min Post	18.67 ± 3.94	19.70 ± 3.56	17.90 ± 4.56
	15 Min Post	16.11 ± 4.26	15.20 ± 2.30	16.20 ± 2.30
Respratory Exchange Ratio	IPE	1.13 ± 0.11	1.13 ± 0.07	1.14 ± 0.05
	7 Min Post	0.97 ± 0.12	0.95 ± 0.06	1.02 ± 0.14
	15 Min Post	0.85 ± 0.07	0.90 ± 0.11	0.83 ± 0.05

Data represented in this table are absolute and relative VO2, ventilation, and respiratory rate during each measurement period of the EPOC. Respiratory exchange ratio, which is the ratio of expired volume of CO_2 to O_2 is also reported in this table. No significant differences were found between different treatment conditions.