

PERFORMANCE PROFILE FOR TABATA INTERMITTENT TRAINING ON
TREADMILL

By

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ABSTRACT

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This study investigated the effect of supramaximal intensities on number of Tabata bouts performed by recreationally trained males. Eleven men with excellent VO_{2max} classifications according to ACSM standards (mean age = 22.27 ± 1.74 years, height = $1.72 \pm 0.07m$, mass = $78.74 \pm 15.77kg$) were assigned the four intensities in a counterbalanced order. Subjects completed a warm up which was then followed by consecutive 20-second bouts of treadmill running with 10 second bouts of rest until fatigue given each intensity (110%,130%,150%,170% of VO_{2max}). Given that the ideal number of Tabata bouts is ~8 with an intensity of 170% VO_{2max} , results suggested that intensities ranging between 130% and 150% were optimal. The number of bouts outside this range were found to be too high or too low what is deemed normal. With the knowledge of this information practitioners, should prescribe intensities between 130% and 150% of recreational trained males' VO_{2max} when using the Tabata protocol. The findings acquired from this study provide a foundation for future studies to examine the use of this type of training with recreational athletes. Additionally, future studies can evaluate these intensities performed using different set speeds or inclines.

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INTRODUCTION

High intensity interval training (HIIT) is a mode of exercise that has increased in popularity largely due to its potential to maximize physiological adaptations while minimizing total time spent exercising (4,10,11,15,31,32). HIIT has been promoted as an alternative to common modes of aerobic exercise and consists of exercise bouts at or above an intensity equal to the subject's VO_{2max} separated by bouts of complete rest or relatively low intensity (4,8,11,12,18,27,33,34). When the working bouts of HIIT are sustained more than a few seconds, adenosine triphosphate (ATP) is resynthesized by both aerobic and anaerobic processes (18,21,22,28,29). The amount of ATP in working muscle, creates the ability for an individual to maintain a higher amount of muscle force outputs for longer extents of time (18). During moderate intensity exercise, this process is achieved by aerobic metabolism while higher intensity exercises rely on anaerobic metabolism as the oxygen demand exceeds the oxygen uptake (22).

The Tabata protocol, a form of HIIT created by Izumi Tabata, is an exhaustive intermittent training consisting of seven to eight sets of 20-second exercise bouts at an intensity of 170% of VO_{2max} with a 10-second rest between each bout (5,6,8,10-12,17,23-26;28,29;31,32,34). This protocol has been shown to provide sufficient stimuli to improve both the aerobic and anaerobic ability of the participant (8,10,12,24,27-29). The protocol has been performed using many various modes all of which utilizing the similar interval of 170% of the subject's VO_{2max} for 20 seconds with a 10 second rest period between each bout of exercise. Researchers (5,6,10,11,15-17,24,25,28,29,31-34) have

replicated the Tabata protocol to various modes of exercise including cycle ergometer (5,6,9,11,23,25,28,29), kettlebell exercise (15,16), and other Tabata styled workouts (7,8,10,15,16,26,31,32). These different variations of the protocol have allowed researchers to design their studies for certain populations such as the older and/or injured population. For example, a Tabata protocol utilizing squats can be used for a variety of subject populations as each of the different types of squats have different energy costs (26). Additionally, Tabata protocols as a shallow water swimming pool workout can be effective for older and/or injured population (10). However, a true Tabata protocol (~8 bouts at 170% of $\text{VO}_{2\text{max}}$) on a treadmill has not been established. Researchers have not noted how speed and incline of the treadmill are set to apply 170% of $\text{VO}_{2\text{max}}$, opening up potential research for manipulating these variables with regards to a Tabata treadmill protocol.

To date, adaptations of the Tabata protocol have been performed on a cycle ergometer (5,6,9,11,23,25,28,29), aquatic treadmill (24), through callisthenic workouts (7,8,15,16,26,31,32) and shallow water exercise (10). Rebold and colleagues (24) took a different approach to a Tabata treadmill protocol by using an aquatic treadmill (24). The protocol included sprinting on the aquatic treadmill at 7.5 mph with a progressive resistance (80, 85, 90, and 95% water flow resistance) provided by underwater jets (24). The study found that the protocol effects body composition less and performance adaptations more. Therefore, proving to be a potentially benchmarking study when establishing a Tabata protocol as progressive intensities were used rather than the 170% of a subject's $\text{VO}_{2\text{max}}$. Several observations suggest Tabata protocol can be conducted

with the hopes of achieving the desired intensity of 170% $\text{VO}_{2\text{max}}$ (1, 5,6,10,11,15-17,24,31-34). These observations, although not true Tabata protocols, suggest whether manipulation of treadmill speed and grade, with regards to setting the supramaximal intensity could be executed for the completion of a true Tabata protocol (17,24,34). Further understanding of these variables with regards to conducting this protocol on a treadmill may increase the knowledge about this protocol and this mode of exercise with regards to possibly incorporating it to the training of athletes.

The hypothesis for this study was that a true Tabata protocol (~8 bouts) performed on a treadmill with the moderate intensity (130-150% $\text{VO}_{2\text{max}}$) would be the most beneficial (trains both aerobic and anaerobic systems) when designing the protocol for relatively trained individuals. This being due to the idea that the total work volume during multiple sets of Tabata styled treadmill protocol will be affected by the intensity (% of $\text{VO}_{2\text{max}}$) applied via speed and grade settings during periods of work. If the setting of a Tabata protocol being performed on a treadmill was at 170% $\text{VO}_{2\text{max}}$ total bouts would decrease, therefore a total of eight bouts of a Tabata protocol may be achieved on a treadmill at a lower intensity than previously recommended (170% $\text{VO}_{2\text{max}}$); for example, 130-150% $\text{VO}_{2\text{max}}$. An increased number of bouts imply a more aerobic intensity protocol as oppose to both. It is hypothesized that the number of bouts elicited from the 110% intensity would only stimulate the aerobic adaptations while the number of bouts that would be elicited during the 170% intensity protocol may only benefit the anaerobic system. While the 130% intensity protocol could potentially train both. Therefore, this

study could establish a spectrum in order for athletes and exercise professionals to decide whether or not they would like to train more aerobically or anaerobically.

METHODS

Experimental Approach to the Problem

To research the hypothesis of this study, counterbalanced design was used to evaluate the difference in number of bouts performed in eleven recreationally trained males who participated in Tabata-styled treadmill workouts of varying intensities in different orders. Subjects completed an inclusion screening, documentation, a Bruce Protocol, and a familiarization session. Two to three days following the completion of the Bruce Protocol, subjects performed four Tabata sessions (110%,130%,150%, and 170% of VO_{2max}) with a period of rest (24-36 hours). A counterbalanced design was used for each session in order to assure the subjects experienced different orders which minimized any learning or order effects. All tests were done at the same time of day for each subject. The environment conditions (temperature, barometric pressure, and humidity) within the Human Performance Lab were well maintained for all of the testing sessions.

Subjects

Eleven recreationally trained (according to ACSM standards) male runners completed five experimental sessions. In Table 1, the subject's descriptive data is presented. The protocol was approved by the Institutional Review Board and all subjects provided informed, written consent prior to participation.

Subjects participated in regular cardiorespiratory exercise, and their $\text{VO}_{2\text{max}}$ values were at or greater than what qualifies as a “excellent” classification, according to ACSM standards for age and gender (ACSM guidelines, 2010). Subjects were screened for cardiovascular or musculoskeletal disease using a medical history questionnaire, an activity questionnaire, and the Physical Activity Readiness Questionnaire (PAR-Q) (Heyward, 2002) in order to determine any physical limitations that could prevent them from performing the necessary procedures. Using the power analysis equation and SDs from Tabata’s data (29), approximately 10 subjects would be sufficient to detect a significant difference in the average total time (or sets) to voluntary exhaustion at 110%, 130%, 150%, and 170% of their $\text{VO}_{2\text{max}}$ ($\alpha = 0.05$ and a power of 0.9).

PROCEDURES

On a testing day, subjects arrived at the Human Performance lab after refraining from caffeine, heavy meals, and vigorous exercise in the previous 24 hours. The Bruce Protocol was performed on clinical treadmill (Quinton et. al.) whereas the Tabata session were performed on a commercial treadmill (Platinum Club Series Treadmill, Life Fitness, Rosemont, IL). The Bruce Protocol included an initial speed with an incline of 1.7mph and 10%, which was gradually increased every three minutes until subjects reached volitional exhaustion. The subject’s $\text{VO}_{2\text{max}}$ was recorded as the highest VO_2 achieved during the Bruce protocol. The subject’s $\text{VO}_{2\text{max}}$ were considered successful if they achieved at least three of the four of the criteria: respiratory exchange ratio > 1.10 , rating

of perceived exertion > 18, heart rate within 10 beats of $\text{VO}_{2\text{max}}$ (220-age), or VO_2 plateau (20).

Subject's respiratory responses (i.e., oxygen uptake, expired carbon dioxide, and pulmonary ventilation) were taken with each by a gas analyzer (ParvoMedics, Sandy, UT) which were then measured during the Bruce Protocol in order to determine maximum oxygen uptake ($\text{VO}_{2\text{max}}$). Also, the subject's heart rate was recorded (Polar 800CX, Polar, Finland). The gas analyzer (ParvoMedics, Sandy, UT) was calibrated through the use of known gas samples and the pneumotach was calibrated through a 3-L syringe (ParvoMedics, Sandy, UT). 30 minutes after the Bruce Protocol, a familiarization session was performed on the commercial treadmill using 140% of the subject's $\text{VO}_{2\text{max}}$ in order to become comfortable jumping on and off the treadmill at such intense speeds. The participant was instructed to utilize both handrails while straddling the treadmill with both feet placed on the sides of the treadmill carpet as it gains speed. Subjects then began to brush one foot on the moving carpet while the other foot remained planted on the side of the treadmill as the desired speed is achieved, allowing them to become accustomed to the speed. The rate of perceived exertion was measured at the end of each three-minute stage and at the completion of the Bruce Protocol through the usage of the 6-20 Borg scale.

Tabata Sessions

The treadmill intensity was set assuming 10% grade (Tabata, 2016). Once ready, the participant began running on the treadmill with both feet and let go of the handrails. Total

run time began being timed once the participant let go of the hand rails until they reached 20 seconds of run time. The end of the run was marked by the moment the participant grabbed the handrails again and the session was timed with a stopwatch. This process was completed until exhaustion. Prior to each session, subjects were required to perform a warm-up on a treadmill at 6.5mph for 5 minutes (30). After 3 minutes of rest, bouts of a Tabata treadmill workout (2:1 work: rest ratio) were performed until fatigue (30). Every session of Tabata included 20-second bouts accompanied by a 10-second recovery (27,28) which consisted of the subject straddling the treadmill. Subjects were then allowed a cool down to be performed on a treadmill at 2mph (30) for 15 minutes or until heart rate dropped under 120 bpm. Subjects had 2-3 days of rest between each session. The primary measurement that was recorded in this study is the number of sets/bouts that subjects were able to perform on a treadmill for each exercise intensity. The following equation that incorporates body mass, speed, time, and grade of a participant was used to calculate work of each exercise bout:

$$\text{Work(J)} = \text{body mass (N)} \times \text{speed} \left(\frac{\text{m}}{\text{s}} \right) \times \text{time (s)} \times \text{grade (\%)}$$

(Beam, 2011)

The measure of work was important in this study as it established a comparison between the five exercise intensities and individual sets within each protocol. After each session, a record of RPE, HR, cadence, and stride length were taken note of.

Statistical Analyses

Before using parametric tests, the data was first analyzed using a box plot graph to determine if there were any outliers, and the distribution of each variable was examined

with the Kolomogorov-Smirnov normality test. Homogeneity of variance was verified with a Levene's test. All statistical computation was carried out using STATISTICA version 7.1 software (StatSoft, Inc., Tulsa, OK, USA). A repeated one-way ANOVA was used to quantify differences in time, sets, work (kJ), RPE, HR, cadence, stride length, between exercise intensities. When a significant F ratio was obtained, a Tukey's Honestly Significant Differences test was performed. Statistical significance was accepted at $p \leq 0.05$. All data was presented as the mean $\pm$ SD.

RESULTS

Number of Bouts

The number of exercise bouts per intensity were significantly different ($p \leq 0.05$), Figure 1. The post hoc analysis showed that the 110% (26 ± 10) condition had significantly higher mean number of bouts than 130% (10 ± 4), 150% (5 ± 2), and 170% (3 ± 1) conditions respectively. Additionally, there was no significant difference in the mean number of bouts between 130% and 150% conditions ($p=0.06$) or between the 150% and 170% conditions ($p=0.07$).

Work

There were significant differences in work volume between the conditions ($p \leq 0.05$) (Figure 2). Mean work volume (kJ) of 110% (116 ± 28) was significantly higher than 130% (55 ± 17), 150% (33 ± 9), and 170% (21 ± 7), ($p \leq 0.05$) respectively. Tukey HSD post hoc showed that the three Tabata conditions (130%, 150%, and 170% of VO_{2max}) were significantly different from 110% of VO_{2max} ($p \leq 0.05$). Furthermore, Tukey HSD post

hoc showed that three Tabata conditions (110%, 150%, and 170% of $\text{VO}_{2\text{max}}$) were significantly different from 130% of $\text{VO}_{2\text{max}}$ ($p \leq 0.05$). However, there was not a significant difference in the mean work volume between 150% and 170% conditions ($p=0.23$).

Work Per Bout

Works per bouts were significantly different among conditions ($p \leq 0.05$). 110% condition (5 ± 1) had significantly lower mean work per bout (kJ/bout) than 130% (6 ± 1), 150% (6 ± 1), and 170% (7 ± 1), Figure 3. Tukey HSD post hoc showed that all conditions (110%,130%,150%,170% of $\text{VO}_{2\text{max}}$) were significantly different from each other ($p \leq 0.05$).

Rating of Perceived Exertion (RPE), Stride Frequency, Stride Length, HRmax, HR at the Failure Intensity

There were no significant differences in RPE (110%, 17 ± 2 , 130%, 17 ± 2 , 150%, 18 ± 2 , 170%, 17 ± 2) during the four conditions, ($p=0.8$). Stride frequency was significantly different among all combinations ($p \leq 0.05$). 110% condition (85 ± 3.90) had significantly lower stride frequency (Hz) than 130% (90 ± 2.99), 150% (96 ± 5.83), and 170% (104 ± 5.37), (Table 2). Tukey HSD post hoc showed that all conditions (110%,130%,150%,170% of $\text{VO}_{2\text{max}}$) were significantly different from each other ($p \leq 0.05$). Which also showed that these values increased as the intensities did. Stride length was also significantly different among Tabata variations ($p \leq 0.05$). The 110% condition (0.99 ± 0.05) had significantly lower stride length (m) than 130%

(1.12 ± 0.07), 150% (1.22 ± 0.10), and 170% (1.28 ± 0.06), respectively (Table 2). Tukey HSD post hoc showed that all conditions (110, 130, 150, 170% of VO_{2max}) were significantly different from each other ($p \leq 0.05$) and as intensity increased, so did these values. Max heart rate was not significantly different between conditions (110, 194 ± 6 , 130, 191 ± 9 , 150, 191 ± 7 , 170%, 190 ± 5 of VO_{2max}) ($p = 0.07$). However, heart rate at failure did significantly differ between conditions ($p \leq 0.05$). Post hoc analysis revealed that 110% condition was significantly different from 150% and 170% conditions ($p \leq 0.05$) but not 130% ($p=0.06$). There were also no significant differences between 130% and 150% variations ($p=0.17$) nor 150% and 170% ($p=0.81$).

DISCUSSION

The purpose of the present study was to establish a Tabata protocol that can be completed on a treadmill. It was hypothesized that a true Tabata protocol (~8 bouts 170% VO_{2max}) performed on a treadmill with the intermediate intensities (130-150% VO_{2max}) would be the most efficient when designing the protocol for relatively trained individuals. This hypothesis was established with the idea that the necessary number of bouts for a true Tabata protocol would be more efficient rather than the interval training with the greatest number of bouts. These four types of short interval training bouts (20 s – 10 s of work and rest intervals) were performed at different intensities higher than the subjects VO_{2max} . The 110% intensity protocol yielded the highest volume of work; however, the number of bouts elicited using this intensity (26 ± 10 bouts) deemed too high and outside the scope of Tabata (~8 bouts). The 170% intensity resulted in the lowest average total work (21 ± 7 kJ).

and the average number of bouts (3 ± 1 bouts) seemed too low to be considered a Tabata protocol (~ 8 bouts) while the 130 and 150% intensity protocols, elicited the more ideal number of bouts within range (10 ± 4 and 5 ± 2 bouts). However, in regard to work/bout, the 170% condition yielded the greatest number when compared to other intensities. This establishes the idea that high work/bout does not necessarily equal a Tabata protocol. Due to the fact that the protocol using this intensity did not elicit an ideal number of bouts. The data collected from this study demonstrates that for this particular group of recreationally trained runners, the conditions with the intermediate intensities were the most effective in creating optimal work volume for the optimal number of bouts.

The original Tabata study (27) used Olympian speed skaters and had them perform ~ 8 bouts using their 170% $\text{VO}_{2\text{max}}$ intensity. It was necessary to find the ideal intensity for the participants in this study that would elicit eight bouts as the original study (27) and it was found that the athletes aerobic and anaerobic capacity simultaneously increased when compared to baseline. Given this, it was assumed that the number of bouts elicited from the 110% intensity only stimulate the aerobic adaptations whereas the number of bouts elicited during the 170% intensity protocol may only benefit the anaerobic system. It is possible that different numbers of bouts may produce more ideal outcomes for running on a treadmill. Based on the fact that RPE was not significantly different between conditions, it was assumed that the subjects performed until voluntary failure and were also challenged by the protocol. It seems like the ideal intensity for the sample used in this particular study was within 130-150% of $\text{VO}_{2\text{max}}$ due to the fact that it resulted the goal range of bouts.

The results that have been concluded from this study show both differences (6,8,10,12,17,25-26,31-32) and similarities (5,11,23-24, 28-29, 34) to that of prior Tabata protocols research. In the current study, intensities less than or equal to 170% of VO_{2max} were used to elicit similar work (5-6,8,10-12,17,23-26;28-29;31-32,34). The factor of intensity is crucial in acute effective responses as intensity for the Tabata protocol in regard to Tabata et al. (28-29) was 170% VO_{2max} which maximally stressed the aerobic and anaerobic energy systems. This was represented when the 170% intensity protocol was compared to higher intensities in one Tabata study (29) which is a goal of the Tabata protocol. The reasoning behind the similarities in RPE were likely due to the specific protocols that were matched to the relative intensity.

The variability in use of the Tabata protocol that occur between studies limits the generalizability of the results. This variation within the Tabata protocol is primarily due to the high number of variables (intensity, grade, speed) that can be manipulated when completing a Tabata protocol on a treadmill. Tabata treadmill running using 130-150% VO_{2max} produced optimal number of bouts compared to 110 and 170% of VO_{2max} . This is likely due to the 110 and 170% of VO_{2max} not strenuous enough and too strenuous respectively for the population included in the study, resulting in the protocols relying more on aerobic and anaerobic systems, respectively. However, there is still more research to be done on treadmill intensity configuration with regards to a Tabata protocol completed on a treadmill.

Intermediate workload sets during Tabata treadmill running resulted in moderate sustained volume work whilst maintaining moderate work per bout compared to the

extremes of the intensity range used for this study. This was likely due to the less demanding 110% resulting in greater number of bouts that were outside of the scope of Tabata and the highest intensity producing too few numbers of bouts. Future research on this topic could potentially benefit from analysis of a variety of Tabata protocols performed on a treadmill, different intensities (i.e. 130%,135%,140%,145%, and 150% of VO_{2max}), treadmill speed and grade, as it will see which variable has the greatest impact on bouts, work volume and work per bout. Also, incline/grade was set constant between protocols and subjects (10%), which limited the capability of examining what variables of the Tabata protocol were being specifically influenced in the results (Tabata Preceding). Additionally, in this particular study, only recreationally trained, young males were observed. In studies prior to this one, researchers have found various results when using untrained subjects (9,11). Therefore, researchers should include a mixed group for studies that includes untrained, trained, and elderly individuals.

PRACTICAL APPLICATIONS

Given that perceived lack of time is one of the main factors contributing to lack of adherence to an exercise programs (13), professionals should employ the use of a Tabata protocol in order to maximize benefits while minimizing the exercise time requirement (27). In this study, a commercial treadmill was used which may be more practical to other studies or training protocols. Also given that the original 170% of VO_{2max} was found to not be ideal, practitioners should use an intensity within 130% and 150% of VO_{2max} to be

more practical, when working with clients with similar characteristics to subjects used in this study

LIST OF FIGURES

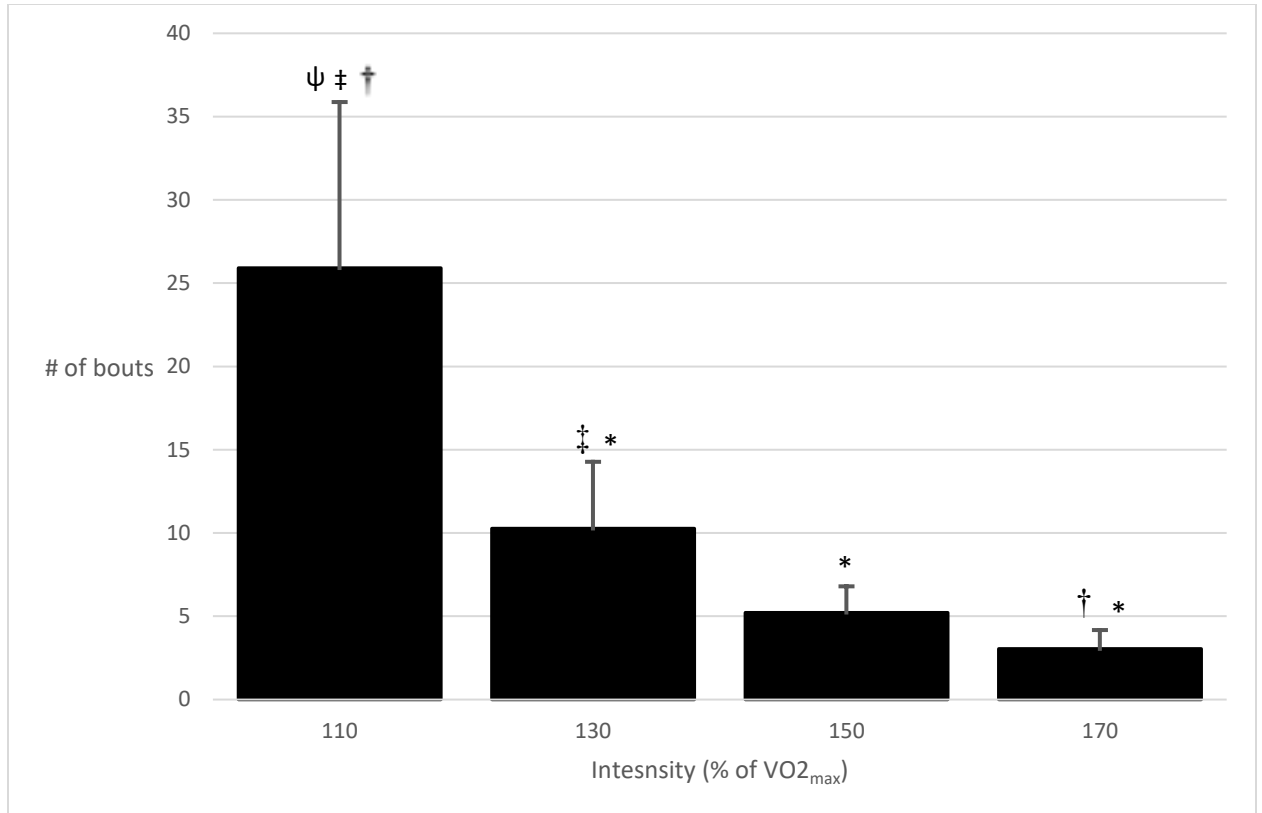


Figure 1: Average number of bouts of Tabata during 110%, 130%, 150%, 170% conditions. Error bars indicate SD. Asterisk (*) indicates 110 vs. conditions ($p \leq 0.05$). Symbol (†) indicates 130 vs. conditions ($p \leq 0.05$). Symbol (ψ) indicates 150 vs. conditions ($p \leq 0.05$). Symbol (‡) indicates 170 vs. conditions ($p \leq 0.05$).

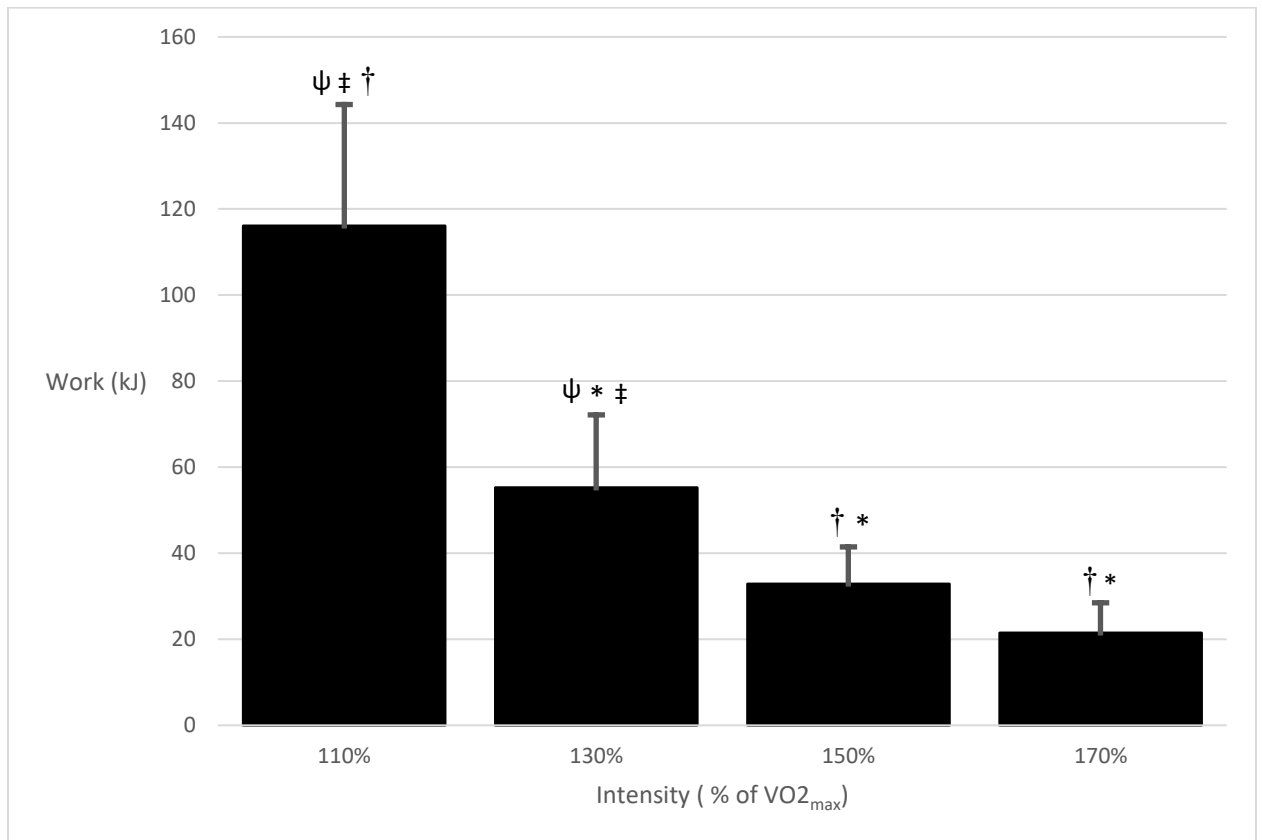


Figure 2: Average work during 110%, 130%, 150%, and 170% conditions. Error bars indicate SD. Asterisk (*) indicates 110 vs. conditions ($p \leq 0.05$). Symbol ($\ddagger$) indicates 130 vs. conditions ($p \leq 0.05$). Symbol (ψ) indicates 150 vs. conditions ($p \leq 0.05$). Symbol ($\ddagger$) indicates 170 vs. conditions ($p \leq 0.05$).

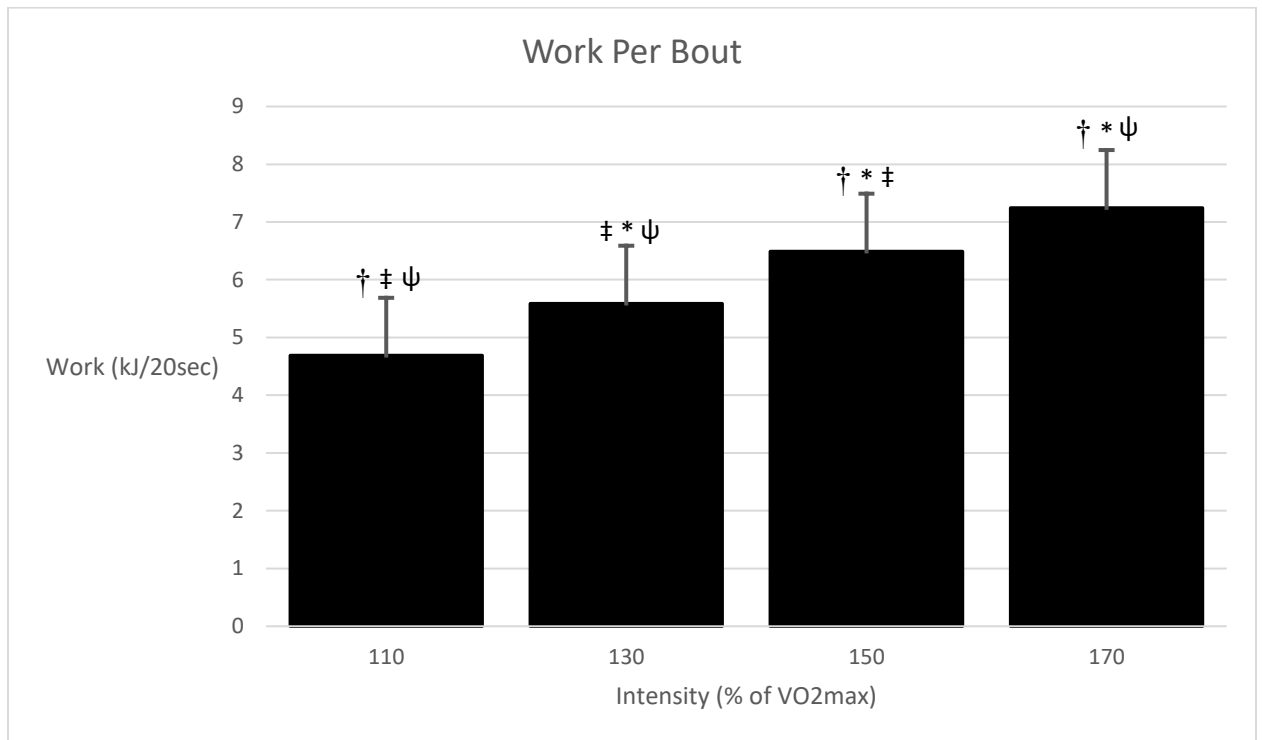


Figure 3 The amount of work per bout during 110%, 130%, 150%, and 170% conditions. Error bars indicate SD. Asterisk (*) indicates 110 vs. conditions ($p \leq 0.05$). Symbol (†) indicates 130 vs. conditions ($p \leq 0.05$). Symbol (ψ) indicates 150 vs. conditions

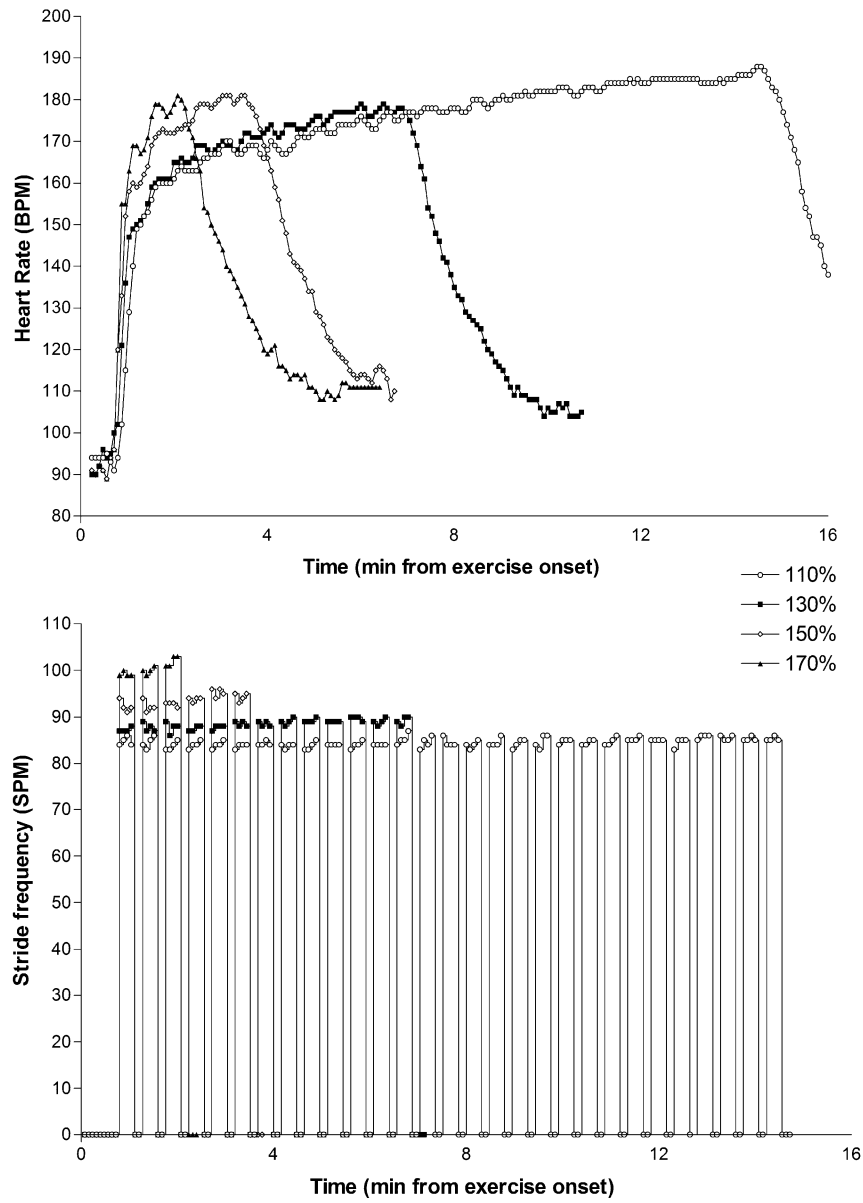


Figure 4. Single subject all conditions heart rate and stride frequency all protocols. At termination of 170% protocol, there was a drift in heart rate at each protocol

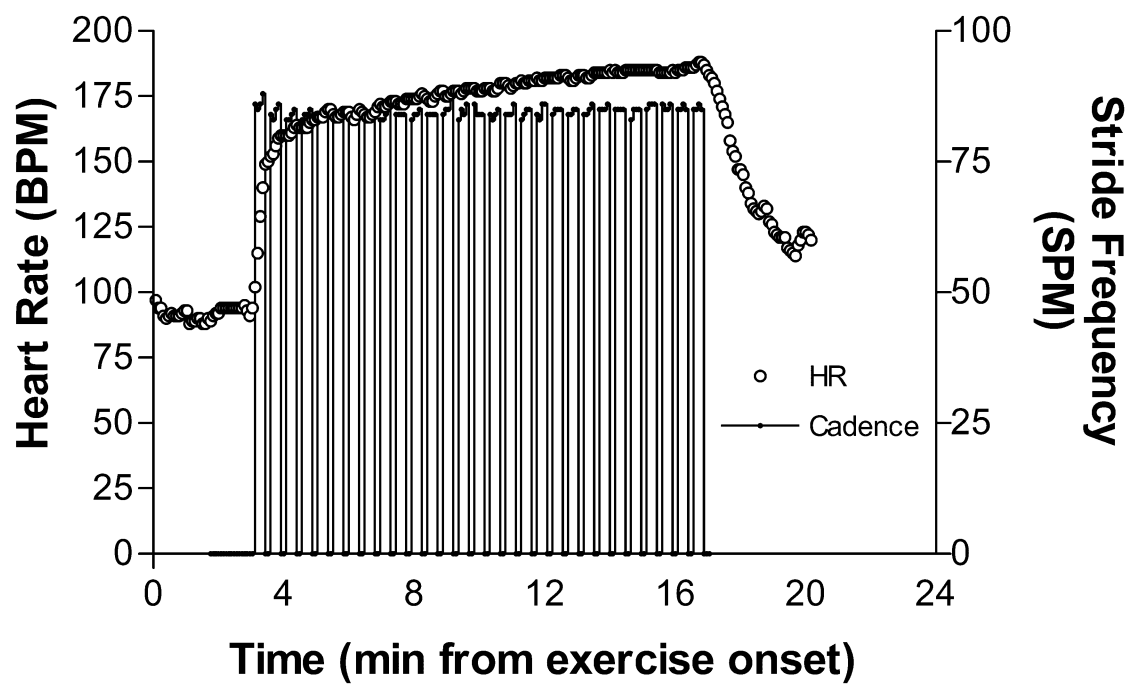


Figure 5. 110% Tabata variation attenuates a rise in heart rate and stride frequency and cardiovascular drift across intensities in a single subject. An abrupt spike in heart rate occurred at the beginning of protocol.

LIST OF TABLES

Table 1. Descriptive characteristics of the subjects (N=11) *

Age (years)	Height (m)	Weight (kg)	VO _{2max} (ml/kg/min)	Fitness Category
22.3 ± 1.7	1.7 ± 0.1	78.7 ± 15.8	51.5 ± 7.4	Excellent

* Values are given as mean ±SD.

Table 2: Relationship between Tabata Variations and stride and heart rate. Table 2: Values are given as mean + SD. Asterisk (*) indicates 110 vs. conditions ($p \leq 0.05$). Symbol (†) indicates 130 vs. conditions ($p \leq 0.05$). Symbol (ψ) indicates 150 vs. conditions

	110%	130%	150%	170%
Stride frequency (Hz)	85±3.90 ψ † ‡	90±2.99 ‡ * ψ	96±5.83 † * ‡	104±5.37 † * ψ
Stride length (m)	0.99±0.05 † ψ ‡	1.12±0.07 ‡ * ψ	1.22±0.10 † * ‡	1.28±0.06 † * ψ
HR at the failure of the 170% intensity (bpm)	178±11.19 ψ ‡	184±12.42 ‡	188±9.38 *	190±5.46 † *

Table 3. Cycle ergometer studies

Study	Subjects	Duration	Intervention	Intervals	Results
Tabata et al., 1996	14 trained men (23±1 yrs.)	6 weeks	Two groups: 70% VO _{2max} (CON) 170% VO _{2max} (EXP)	60 min (cont.) 20 secs with 10 secs rest per bout (7-8)	EXP group improved anaerobic (23%) and aerobically (7 ±1 ml/kg/min).
Tabata et al., 1997	9 trained men	~ 1 week	Two groups: 170% VO _{2max} (IE1)	20 secs with 10 secs rest per bout (6-7)	IE1 protocol maximally

Study	Subjects	Duration	Intervention	Intervals	Results
	(22 $\pm$ 1 yrs.)		200% VO _{2max} (IE2)	30 secs with 2 min rest per bout (4-5)	recruited aerobic and anaerobic
Carney et al., 2011	10 subjects (6 males, 4 females; 23 years)	5 weeks	Two groups: 170% VO _{2max} 170% VO _{2max}	20:10 secs (work: rest) 10:10 secs (work: rest)	High intensity interval training can increase one's exercise ability.
Foster et al., 2015	Untrained subjects (N=55)	8 weeks	Three groups: 90% VT (SS) 170% VO _{2max} (TAB) 100% P VO _{2max} (MEY)	20 min (cont.) 20 secs with 10 secs rest per bout (8 sets) 30 secs with 60 secs rest (13 sets)	18% (SS and TAB) and 19% (MEY) increase in VO _{2max} .
Harbin et al., 2015	Untrained subjects (N=55)	8 weeks	Three groups: 90% VT (AER) 100% P VO _{2max} (INT) 170% VO _{2max} (TAB)	20 min (cont.) 30 secs with 60 secs rest (13 sets) 20 secs with 10 secs rest per bout (8 sets)	INT and TAB intervals did not improve [AER] in peak sprint or incremental cycle power output.
Chapoton et al., 2016	10 collegiate distance runners (19 $\pm$ 1.2 yrs.)	2 weeks	Two groups: Run 60 miles (males) and 30 miles (females) at 70% VO _{2max} (no TAB intervention) (CON) Run 40 miles (males) and 15 miles (females) + 8 sessions of TAB (@max effort)	N/A 20:10 secs (work: rest)	Tabata training prevents decrease in VO _{2max} /performance times. Reducing leg stress.

Study	Subjects	Duration	Intervention	Intervals	Results
Otto et al.,2016	13 male subjects (21+1 yrs.)	~2 weeks	Two groups: 10 secs @ 20-watt recovery (TP) 80% max workload (SS)	4-6 minutes	Anaerobic workload/minimal recovery provides stimulus for aerobic/ anaerobic metabolism Net aerobic requirement of 87% of the SS VO ₂ . Glycolytic contribution 66% greater than SS.
Schaun and Vecchio et al., 2018	12 young adult males	~ 1 week	Two groups: 170 Pmax All out whole-body callisthenic exercises	Eight 20-second bouts Eight 20 second intervals with 10-second rest	HR autonomic control similar to McRae protocol

Notes: EXP=Experimental; CON= Control; IEI= Intermittent Exercise Group 1; IE2= Intermittent Exercise Group 2; TAB= Tabata Protocol; MEY= Meyer Protocol; SS= Steady State; INT= Incremental Power Output; AER= Aerobic; HR= Heart Rate

Table 4. Treadmill studies

Study	Subjects	Duration	Intervention	Intervals	Results
Rebold et al., 2013	17 males, 8 females	8 weeks	Sprinting on ATM @ 7.5 miles	Front jets turned on at 80, 85, 90, and 95% progressively each week	<--> %BF, <--> force production, increase in flexibility and anaerobic power

Study	Subjects	Duration	Intervention	Intervals	Results
Laird et al., 2016	28 active women	11 weeks	Resistance training Concurrent sprint training	N/A 20 seconds alternated with 10 seconds recovery + resistance training	Similar improvements to maximal muscular strength, power, and VO_{2max} .
Xu et al., 2016	24 healthy male subjects	6 weeks	Two groups: High intensity intermittent training (170% VO_{2max}) High intensity intermittent cross training 170% VO_{2max} alternating bike/treadmill	20:10 secs (work: rest) 10:10 secs (work: rest)	HIICT improves VO_{2max} . Impact of HIIT on VO_{2max} of both exercises was relatively weak.

Notes: ATM= Aquatic Treadmill; BF= Body Fat; HIICT= High Intensity Intermittent Cross Training; HIIT= High Intensity Interval Training

Table 5. Tabata styled workouts

Study	Subjects	Duration	Intervention	Intervals	Results
Emberts et al., 2013	16 trained volunteers	1 week	High knees, jump rope, burpees, etc.	20 seconds of as many reps as possible with 10 second rest (20 mins)	Increase calorie expenditure
Scott et al., 2015	4 males and three female participants	~2 weeks	Callisthenic squatting routines: isometric, isotonic, and jump	20 second bouts cadence =2 seconds per squat (10 reps each)	Plyometric + isotonic energy costs > isometric

Study	Subjects	Duration	Intervention	Intervals	Results
				rest for 10 seconds	
Williams et al., 2015	8 male participants	~2 weeks	Two groups: Kettle bell sumo squats, swings, clean & press, and sumo deadlifts All out sprints	3 circuits of 20 sec of exercise and 10 secs of rest 30 second all-out effort with 4 min/2 min recovery	Similar cardiorespiratory and metabolic responses to those created by SIC.
Keilman et al., 2016	60 participants with various experience levels	~2 weeks	High intensity kettle bell exercise +dynamic warm up Brief dynamic warm up	8 consecutive rounds of 20 sec of exercise with 10 secs of rest	High intensity kettle bell more effective than a dynamic warm up alone.
Chen et al., 2017	Community dwelling older adults over 60 yrs	12 weeks	squatting, forward lunge, heel raise, table plank	30:30, 30:20, and 40:20 during the 1 st -6 th , 7 th -10 th , and 11 th -12 th week	Modification= safe Tabata exercise for older population.
Fisher et al., 2017	9 healthy males	~2 weeks	Shallow water exercise	Four 4 min bouts with each bout alternating between 20 sec all out exercise followed by 10 sec rest	TW-SWE elicited vigorous/near maximal intensity cardio metabolic and psychophysical responses for both males and females.

Notes: SIC=Sprint Interval Training; TS-SWE= Tabata Style Shallow Water Exercise Workout

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APPENDECIES

Appendix A

Humboldt State University Health and Wellness Institute Medical Information and History and Release of Liability

Name _____

Address _____

Home Phone _____ Work Phone _____

Age _____ Date of Birth _____ Gender _____

The following questions are designed to help us tailor the health and fitness assessment and follow-up counseling to your personal situation. It is extremely important for us to know if you have any medical conditions which may affect your testing process or your progress in our program. Please take the time to answer these questions accurately.

Medical History

YES   NO   In the past five years have you had:

☐	☐	1. Pain or discomfort in chest, neck, jaw, or arms
☐	☐	2. Shortness of breath or difficulty breathing at rest or with mild exertion (e.g., walking)
☐	☐	3. Dizziness or fainting
☐	☐	4. Ankle edema (swelling)
☐	☐	5. Heart palpitations (forceful or rapid beating of heart)
☐	☐	6. Pain, burning, or cramping in leg with walking
☐	☐	7. Heart murmur
☐	☐	8. Unusual fatigue with mild exertion

Have you ever had:

☐	☐	9. Heart disease, heart attack, and/or heart surgery
☐	☐	10. Abnormal EKG
☐	☐	11. Stroke
☐	☐	12. Uncontrolled metabolic disease (e.g., diabetes, thyrotoxicosis, or myxedema)
☐	☐	13. Asthma or any other pulmonary (lung) condition
☐	☐	14. Heart or blood vessel abnormality (e.g., suspected or known aneurysm)
☐	☐	15. Liver or kidney disease
☐	☐	16. Are you currently under the care of a physician?
☐	☐	17. Do you currently have an acute systemic infection, accompanied by a fever, body aches, or swollen lymph glands?
☐	☐	18. Do you have a chronic infectious disease (e.g. mononucleosis, hepatitis, AIDS)?
☐	☐	19. Do you have a neuromuscular, musculoskeletal, or rheumatoid disorder that is made worse by exercise?
☐	☐	20. Do you have an implantable electronic device (e.g. pacemaker)?
☐	☐	21. Do you know of any reason why you should not do physical activity?

If you answered yes to any of these questions, please explain.

Risk Factors

YES NO DON'TKNOW

☐	☐	☐	1. Are you a male 45 years of age or older?
☐	☐	☐	2. Are you a female 55 years of age or older?
☐	☐	☐	3. Do you have a father or brother who had a heart attack or heart surgery before age 55?
☐	☐	☐	4. Do you have a mother or sister who had a heart attack or heart surgery before age 65?
☐	☐	☐	5. Do you smoke or have you quit in the past 6 months?
☐	☐	☐	6. Do you have frequent secondhand smoke exposure?
☐	☐	☐	7. Do you know your blood pressure?_____/____mmHg-Date:
☐	☐	☐	8. What is your total cholesterol?_____mg/dL-Date:
☐	☐	☐	9. Are you taking cholesterol lowering medication?
☐	☐	☐	10. Do you know your HDL cholesterol?_____mg/dL-Date:
☐	☐	☐	11. Is your HDL cholesterol > 60mg/dL?
☐	☐	☐	12. What is your fasting blood glucose?_____mg/dL – Date:
☐	☐	☐	13. Do you exercise regularly? If so, explain.

If you answered yes to any of these questions, please explain.

BMI_____	SBP_____	DBP_____	Office Use	TC_____	LDL_____	HDL_____	FBG_____
Family History_____		Smoking_____	Sedentary_____				

Health-Related Questions

YES NO

☐	☐	1. Are you pregnant?
☐	☐	2. Are you allergic to isopropyl alcohol (rubbing alcohol) or latex?
☐	☐	3. Do you have any allergies to medications, bees, foods, etc.? If so please list _____
☐	☐	4. Do you have any skin problems?
☐	☐	5. Do you have any other medical condition(s)/surgeries?
☐	☐	6. Have you had any caffeine, food, or alcohol in the past 3 hours?
☐	☐	7. Have you exercised today?
☐	☐	8. Are you feeling well and healthy today?
☐	☐	9. Do you have any other medical concerns that we should be aware of?

If you answered yes to any of these questions, please explain.

Medications

Please Select Any Medications You Are Currently Using:

☐ Diuretics	☐ Other Cardiovascular
☐ Beta Blockers	☐ NSAIDS/Anti-inflammatories (Motrin, Advil)
☐ Vasodilators	☐ Cholesterol
☐ Alpha Blockers	☐ Diabetes/Insulin
☐ Calcium Channel Blockers	☐ Birth Control
☐ Other Drugs (record below)	

Please list the specific medications that you currently take:

What are your health and fitness goals?

I certify that the information I have provided is complete and accurate to the best of my knowledge.

Date _____ Signature of Subject _____

Date _____ Signature of Witness _____

Office Use Only		
_____ Low Risk	_____ Moderate Risk	_____ High Risk

Appendix B

HUMBOLDT STATE UNIVERSITY RELEASE OF LIABILITY, PROMISE NOT TO
SUE, ASSUMPTION OF RISK AND AGREEMENT TO PAY CLAIMS

I have read this form, and I understand the test procedures that I will perform and the attendant risks and discomforts. Knowing these risks and discomforts and having had an opportunity to ask questions that have been answered to my satisfaction, I consent to participate in this test.

In consideration for being allowed to participate in this Activity, on behalf of myself and my next of kin, heirs and representatives, I **release from all liability and promise not to sue** the State of California, the Trustees of The California State University, California State University, Humboldt State University and their employees, officers, directors, volunteers and agents (collectively “University”) from any and all claims, **including claims of the University’s negligence**, resulting in any physical or psychological injury (including paralysis and death), illness, damages, or economic or emotional loss I may suffer because of my participation in this Activity, including travel to, from and during the Activity.

I am voluntarily participating in this Activity. I am aware of the risks associated with traveling to/from and participating in this Activity, which include but are not limited to physical or psychological injury, pain, suffering, illness, disfigurement, temporary or permanent disability (including paralysis), economic or emotional loss, and/or death. I understand that these injuries or outcomes may arise from my own or other’s actions, inaction, or negligence; conditions related to travel; or the condition of the Activity location(s). **Nonetheless, I assume all related risks, both known or unknown to me,** of my participation in this Activity, including travel to, from and during the Activity.

I agree to **hold** the University **harmless** from any and all claims, including attorney’s fees or damage to my personal property that may occur as a result of my participation in this activity, including travel to, from and during the Activity. If the University incurs any of these types of expenses, I agree to reimburse the University. If I need medical treatment, I agree to be financially responsible for any costs incurred as a result of such treatment. I am aware and understand that I should carry my own health insurance.

Date:_____Signature of Subject:

_____

Date:_____Signature of Witness:_____

**Humboldt State University Department of Kinesiology
Consent to Participate in Research**

Performance Profile for Tabata Intermittent Training on Treadmill

Purpose and General Information

You are being asked to participate in a research study conducted by Nathan Tamayo (Principal Investigator)-and Young Sub Kwon, Ph.D. (supervising staff member). The purpose of this study is to investigate the performance affected by different intensities during the alternating bout of Tabata intermittent training protocol running on the treadmill. Specifically, this study aims to determine the optimal intensity for achieving the ideal number of bouts of a Tabata intermittent training protocol on a treadmill. This form will explain the study, including possible risks and benefits of participating, in order for you to make an informed choice about whether or not to participate. Please read this consent form carefully. Feel free to ask the investigators or study staff to explain any information that you do not clearly understand.

What will happen if I participate?

This proposed project was developed based on science and theory in the fields of Exercise Science. All testing will take place in the Human Performance Lab (HPL). When scheduling takes place, you will be asked to refrain from using caffeine, alcohol, and vigorous exercise for 24 hours before each testing session. Upon signing, the following will occur:

- The investigators will provide a detailed description of the study's protocol, purposes, procedures, and the risks and benefits in detail both verbally and in writing. You will be encouraged to ask questions. Following this introductory information, you will be asked to fill out all pre-screening forms, which include a Health History and Activity Questionnaire, in a private room in the Human Performance Lab.
- Anthropometric and cardiorespiratory endurance assessments in a laboratory test will be completed. Skin fold measurements and BMI will be taken in order to assess body composition. Your cardiorespiratory fitness will be assessed via completion of a Bruce protocol, and training interventions will be prescribed over a two to three-week period with 5 total visits with days 2-5 prescribed in a counterbalanced design. Bouts of Tabata intermittent training protocol will be counted and recorded each session to be used later to calculate work. A record of RPE, HR, cadence, stride length, VO₂, RER, and ventilation per session will also be taken note of.
- The risk of breaching confidentiality will be minimized by using only professional personnel to perform all study activities as well as identification numbers instead of names, and rooms will be utilized at times when others will not need access. A private room is available for discussion and testing, and all study data will be kept

in a file cabinet in the supervising faculty's office. All data will continue to be coded so that your identity is not revealed throughout the duration of the research.

- All participants will be asked to complete 5 sessions. Since participants can withdraw at any time without penalty, they cannot be required to complete all 5 sessions. Each session will last for approximately 30 minutes. The rest period will be at least 48 hours between each session.

What are the possible risks or discomforts of being in this study?

Every effort will be made to protect the information you give us as well as minimize any risk by allowing proper warm-up. As with any research, there may be unforeseeable risks. These risks include muscle soreness, muscle fatigue, and common injuries and issues associated with exercise.

How will my information be kept confidential?

Your name and other identifying information will be maintained in files, available only to authorized members of the research team for the duration of the study. For any information entered into a computer, the only identifier will be a unique study identification (ID) number. Any personal identifying information and record linking that information to study ID numbers will be destroyed when the study is completed. Information resulting from this study will be used for research purposes and may be published; however, you will not be identified by name in any publications.

Will I be paid for taking part in this study?

There will be no compensation.

Protected health information (PHI)

By signing this consent document, you are allowing the investigators and other authorized personnel to use your protected health information for the purposes of this study. This information may include resting blood pressure, height, weight, age, %body fat, and health and fitness related items on the questionnaires. In addition to researchers and staff at the Human Performance Lab (HPL) at Humboldt State University (HSU) and other groups listed in this form, there is a chance that your health information may be shared (re-disclosed) outside of the research study and no longer be protected by federal privacy laws. Examples of this include disclosures for law enforcement, judicial proceeding, health oversight activities and public health measures.

Right to Withdraw

You can withdraw from this study at any time without consequence. Your authorization for the use of your health information shall not expire or change unless you withdraw or change that information. Your health information will be used as long as it is needed for this study. However, you may withdraw your authorization at any time, provided you notify the Humboldt State University investigators in writing. To do this, please contact:

Nathan Tamayo
(408) 813-3242
nat178@humboldt.edu

Please be aware that the research team will not be required to destroy or retrieve any of your health information that has already been used or shared before your withdrawal is received.

Refusal to Sign

If you choose not to sign this consent form, you will not be allowed to take part in the project.

What if I have questions or complaints about this study?

If you have any questions, concerns, or complaints about this study, please contact Young Sub Kwon, Ph.D. (faculty adviser) at 707.826.5944 from Monday thru Friday 8am - 5pm. (or at 505-350-4345 after hours). If you would like to speak with someone other than the research team, if you have any concerns with this study or questions about your rights as a participant, contact the Institutional Review Board for the Protection of Human Subjects at irb@humboldt.edu or (707) 826-5165.

Liability

No compensation for physical injury resulting from participating in this research is available.

Consent and Authorization

You are making a decision whether to participate in this study. Your signature below indicates that you read the information provided (or the information was read to you). By signing this Consent Form, you are not waiving any of your legal rights as a research subject.

Sincerely,

Nathan Tamayo, B.S.
(408) 813-3242

I have read and had the opportunity to ask questions and all questions have been answered to my satisfaction. By signing this consent form, I agree to participate to this

study and give permission for my health information to be used or disclosed as described in this consent form.

A copy of this consent form will be provided to me.

Signature of participant

Date

2017 PAR-Q+

The Physical Activity Readiness Questionnaire for Everyone

The health benefits of regular physical activity are clear; more people should engage in physical activity every day of the week. Participating in physical activity is very safe for MOST people. This questionnaire will tell you whether it is necessary for you to seek further advice from your doctor OR a qualified exercise professional before becoming more physically active.

GENERAL HEALTH QUESTIONS

Please read the 7 questions below carefully and answer each one honestly: check YES or NO.	YES	NO
1) Has your doctor ever said that you have a heart condition ☐ OR high blood pressure ☐ ?	☐	☐
2) Do you feel pain in your chest at rest, during your daily activities of living, OR when you do physical activity?	☐	☐
3) Do you lose balance because of dizziness OR have you lost consciousness in the last 12 months? Please answer NO if your dizziness was associated with over-breathing (including during vigorous exercise).	☐	☐
4) Have you ever been diagnosed with another chronic medical condition (other than heart disease or high blood pressure)? PLEASE LIST CONDITION(S) HERE: _____	☐	☐
5) Are you currently taking prescribed medications for a chronic medical condition? PLEASE LIST CONDITION(S) AND MEDICATIONS HERE: _____	☐	☐
6) Do you currently have (or have had within the past 12 months) a bone, joint, or soft tissue (muscle, ligament, or tendon) problem that could be made worse by becoming more physically active? Please answer NO if you had a problem in the past, but it <i>does not limit your current ability</i> to be physically active. PLEASE LIST CONDITION(S) HERE: _____	☐	☐
7) Has your doctor ever said that you should only do medically supervised physical activity?	☐	☐

 **If you answered NO to all of the questions above, you are cleared for physical activity. Go to Page 4 to sign the PARTICIPANT DECLARATION. You do not need to complete Pages 2 and 3.**

-  Start becoming much more physically active – start slowly and build up gradually.
-  Follow International Physical Activity Guidelines for your age (www.who.int/dietphysicalactivity/en/).
-  You may take part in a health and fitness appraisal.
-  If you are over the age of 45 yr and **NOT** accustomed to regular vigorous to maximal effort exercise, consult a qualified exercise professional before engaging in this intensity of exercise.
-  If you have any further questions, contact a qualified exercise professional.

 **If you answered YES to one or more of the questions above, COMPLETE PAGES 2 AND 3.**

 Delay becoming more active if:

-  You have a temporary illness such as a cold or fever; it is best to wait until you feel better.
-  You are pregnant - talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the ePARmed-X+ at www.eparmedx.com before becoming more physically active.
-  Your health changes - answer the questions on Pages 2 and 3 of this document and/or talk to your doctor or a qualified exercise professional before continuing with any physical activity program.



2017 PAR-Q+

FOLLOW-UP QUESTIONS ABOUT YOUR MEDICAL CONDITION(S)

1. **Do you have Arthritis, Osteoporosis, or Back Problems?**
If the above condition(s) is/are present, answer questions 1a-1c If **NO** ☐ go to question 2
  - 1a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments) YES ☐ NO ☐
  - 1b. Do you have joint problems causing pain, a recent fracture or fracture caused by osteoporosis or cancer, displaced vertebra (e.g., spondylolisthesis), and/or spondylolysis/pars defect (a crack in the bony ring on the back of the spinal column)? YES ☐ NO ☐
  - 1c. Have you had steroid injections or taken steroid tablets regularly for more than 3 months? YES ☐ NO ☐
2. **Do you currently have Cancer of any kind?**
If the above condition(s) is/are present, answer questions 2a-2b If **NO** ☐ go to question 3
  - 2a. Does your cancer diagnosis include any of the following types: lung/bronchogenic, multiple myeloma (cancer of plasma cells), head, and/or neck? YES ☐ NO ☐
  - 2b. Are you currently receiving cancer therapy (such as chemotherapy or radiotherapy)? YES ☐ NO ☐
3. **Do you have a Heart or Cardiovascular Condition? This includes Coronary Artery Disease, Heart Failure, Diagnosed Abnormality of Heart Rhythm**
If the above condition(s) is/are present, answer questions 3a-3d If **NO** ☐ go to question 4
  - 3a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments) YES ☐ NO ☐
  - 3b. Do you have an irregular heart beat that requires medical management? (e.g., atrial fibrillation, premature ventricular contraction) YES ☐ NO ☐
  - 3c. Do you have chronic heart failure? YES ☐ NO ☐
  - 3d. Do you have diagnosed coronary artery (cardiovascular) disease and have not participated in regular physical activity in the last 2 months? YES ☐ NO ☐
4. **Do you have High Blood Pressure?**
If the above condition(s) is/are present, answer questions 4a-4b If **NO** ☐ go to question 5
  - 4a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments) YES ☐ NO ☐
  - 4b. Do you have a resting blood pressure equal to or greater than 160/90 mmHg with or without medication? (Answer **YES** if you do not know your resting blood pressure) YES ☐ NO ☐
5. **Do you have any Metabolic Conditions? This includes Type 1 Diabetes, Type 2 Diabetes, Pre-Diabetes**
If the above condition(s) is/are present, answer questions 5a-5e If **NO** ☐ go to question 6
  - 5a. Do you often have difficulty controlling your blood sugar levels with foods, medications, or other physician-prescribed therapies? YES ☐ NO ☐
  - 5b. Do you often suffer from signs and symptoms of low blood sugar (hypoglycemia) following exercise and/or during activities of daily living? Signs of hypoglycemia may include shakiness, nervousness, unusual irritability, abnormal sweating, dizziness or light-headedness, mental confusion, difficulty speaking, weakness, or sleepiness. YES ☐ NO ☐
  - 5c. Do you have any signs or symptoms of diabetes complications such as heart or vascular disease and/or complications affecting your eyes, kidneys, **OR** the sensation in your toes and feet? YES ☐ NO ☐
  - 5d. Do you have other metabolic conditions (such as current pregnancy-related diabetes, chronic kidney disease, or liver problems)? YES ☐ NO ☐
  - 5e. Are you planning to engage in what for you is unusually high (or vigorous) intensity exercise in the near future? YES ☐ NO ☐



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6. Do you have any Mental Health Problems or Learning Difficulties? *This includes Alzheimer's, Dementia, Depression, Anxiety Disorder, Eating Disorder, Psychotic Disorder, Intellectual Disability, Down Syndrome*

If the above condition(s) is/are present, answer questions 6a-6b

If **NO** ☐ go to question 7

6a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments) YES ☐ NO ☐

6b. Do you have Down Syndrome **AND** back problems affecting nerves or muscles? YES ☐ NO ☐

7. Do you have a Respiratory Disease? *This includes Chronic Obstructive Pulmonary Disease, Asthma, Pulmonary High Blood Pressure*

If the above condition(s) is/are present, answer questions 7a-7d

If **NO** ☐ go to question 8

7a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments) YES ☐ NO ☐

7b. Has your doctor ever said your blood oxygen level is low at rest or during exercise and/or that you require supplemental oxygen therapy? YES ☐ NO ☐

7c. If asthmatic, do you currently have symptoms of chest tightness, wheezing, laboured breathing, consistent cough (more than 2 days/week), or have you used your rescue medication more than twice in the last week? YES ☐ NO ☐

7d. Has your doctor ever said you have high blood pressure in the blood vessels of your lungs? YES ☐ NO ☐

8. Do you have a Spinal Cord Injury? *This includes Tetraplegia and Paraplegia*

If the above condition(s) is/are present, answer questions 8a-8c

If **NO** ☐ go to question 9

8a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments) YES ☐ NO ☐

8b. Do you commonly exhibit low resting blood pressure significant enough to cause dizziness, light-headedness, and/or fainting? YES ☐ NO ☐

8c. Has your physician indicated that you exhibit sudden bouts of high blood pressure (known as Autonomic Dysreflexia)? YES ☐ NO ☐

9. Have you had a Stroke? *This includes Transient Ischemic Attack (TIA) or Cerebrovascular Event*

If the above condition(s) is/are present, answer questions 9a-9c

If **NO** ☐ go to question 10

9a. Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments) YES ☐ NO ☐

9b. Do you have any impairment in walking or mobility? YES ☐ NO ☐

9c. Have you experienced a stroke or impairment in nerves or muscles in the past 6 months? YES ☐ NO ☐

10. Do you have any other medical condition not listed above or do you have two or more medical conditions?

If you have other medical conditions, answer questions 10a-10c

If **NO** ☐ read the Page 4 recommendations

10a. Have you experienced a blackout, fainted, or lost consciousness as a result of a head injury within the last 12 months **OR** have you had a diagnosed concussion within the last 12 months? YES ☐ NO ☐

10b. Do you have a medical condition that is not listed (such as epilepsy, neurological conditions, kidney problems)? YES ☐ NO ☐

10c. Do you currently live with two or more medical conditions? YES ☐ NO ☐

**PLEASE LIST YOUR MEDICAL CONDITION(S)
AND ANY RELATED MEDICATIONS HERE:**

GO to Page 4 for recommendations about your current medical condition(s) and sign the PARTICIPANT DECLARATION.

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If you answered NO to all of the follow-up questions about your medical condition, you are ready to become more physically active - sign the PARTICIPANT DECLARATION below:

- It is advised that you consult a qualified exercise professional to help you develop a safe and effective physical activity plan to meet your health needs.
- You are encouraged to start slowly and build up gradually - 20 to 60 minutes of low to moderate intensity exercise, 3-5 days per week including aerobic and muscle strengthening exercises.
- As you progress, you should aim to accumulate 150 minutes or more of moderate intensity physical activity per week.
- If you are over the age of 45 yr and **NOT** accustomed to regular vigorous to maximal effort exercise, consult a qualified exercise professional before engaging in this intensity of exercise.



If you answered YES to one or more of the follow-up questions about your medical condition:

You should seek further information before becoming more physically active or engaging in a fitness appraisal. You should complete the specially designed online screening and exercise recommendations program - the **ePARmed-X+** at www.eparmedx.com and/or visit a qualified exercise professional to work through the ePARmed-X+ and for further information.



Delay becoming more active if:

- You have a temporary illness such as a cold or fever; it is best to wait until you feel better.
- You are pregnant - talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the ePARmed-X+ at www.eparmedx.com before becoming more physically active.
- Your health changes - talk to your doctor or qualified exercise professional before continuing with any physical activity program.

- You are encouraged to photocopy the PAR-Q+. You must use the entire questionnaire and NO changes are permitted.
- The authors, the PAR-Q+ Collaboration, partner organizations, and their agents assume no liability for persons who undertake physical activity and/or make use of the PAR-Q+ or ePARmed-X+. If in doubt after completing the questionnaire, consult your doctor prior to physical activity.

PARTICIPANT DECLARATION

- All persons who have completed the PAR-Q+ please read and sign the declaration below.
- If you are less than the legal age required for consent or require the assent of a care provider, your parent, guardian or care provider must also sign this form.

I, the undersigned, have read, understood to my full satisfaction and completed this questionnaire. I acknowledge that this physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if my condition changes. I also acknowledge that a Trustee (such as my employer, community/fitness centre, health care provider, or other designate) may retain a copy of this form for their records. In these instances, the Trustee will be required to adhere to local, national, and international guidelines regarding the storage of personal health information ensuring that the Trustee maintains the privacy of the information and does not misuse or wrongfully disclose such information.

NAME _____

DATE _____

SIGNATURE _____

WITNESS _____

SIGNATURE OF PARENT/GUARDIAN/CARE PROVIDER _____

For more information, please contact

**www.eparmedx.com
Email: eparmedx@gmail.com**

Citation for PAR-Q+

Warburton DER, Jamnik VK, Bredin SSD, and Gledhill N on behalf of the PAR-Q+ Collaboration. The Physical Activity Readiness Questionnaire for Everyone (PAR-Q+) and Electronic Physical Activity Readiness Medical Examination (ePARmed-X+). *Health & Fitness Journal of Canada* 4(2):3-23, 2011.

Key References

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The PAR-Q+ was created using the evidence-based AGREE process (1) by the PAR-Q+ Collaboration chaired by Dr. Darren E. R. Warburton with Dr. Norman Gledhill, Dr. Veronica Jamnik, and Dr. Donald C. McKenzie (2). Production of this document has been made possible through financial contributions from the Public Health Agency of Canada and the BC Ministry of Health Services. The views expressed herein do not necessarily represent the views of the Public Health Agency of Canada or the BC Ministry of Health Services.



Appendix F

Assess your health status by marking all *true* statements

History

You have had:

- ☐ a heart attack
- ☐ heart surgery
- ☐ cardiac catheterization
- ☐ coronary angioplasty (PTCA)
- ☐ pacemaker/implantable cardiac defibrillator/rhythm disturbance
- ☐ heart valve disease
- ☐ heart failure
- ☐ heart transplantation
- ☐ congenital heart disease

Symptoms

- ☐ You experience chest discomfort with exertion
- ☐ You experience unreasonable breathlessness
- ☐ You experience dizziness, fainting, or blackouts
- ☐ You experience ankle swelling
- ☐ You experience unpleasant awareness of a forceful or rapid heart rate
- ☐ You take heart medications

Other health issues

- ☐ You have diabetes
- ☐ You have asthma or other lung disease
- ☐ You have burning or cramping sensation in your lower legs when walking short distance
- ☐ You have musculoskeletal problems that limit your physical activity
- ☐ You have concerns about the safety of exercise
- ☐ You take prescription medications
- ☐ You are pregnant

Cardiovascular risk factors

- ☐ You are a man ≥ 45 yr
- ☐ You are a woman ≥ 55 yr
- ☐ You smoke or quit smoking within the previous 6 mo
- ☐ Your blood pressure is $\geq 140/90$ mm Hg
- ☐ You do not know your blood pressure
- ☐ You take blood pressure medication
- ☐ Your blood cholesterol level is ≥ 200 mg $\cdot$ dL⁻¹
- ☐ You do not know your cholesterol level
- ☐ You have a close blood relative who had a heart attack or heart surgery before age 55 (father or brother) or age 65 (mother or sister)
- ☐ You are physically inactive (*i.e.*, you get <30 min of physical activity on at least 3 d per week)
- ☐ You have a body mass index ≥ 30 kg $\cdot$ m⁻²
- ☐ You have prediabetes
- ☐ You do not know if you have prediabetes

☐ None of the above

*If you marked any of these statements in this section, consult your physician or other appropriate health care provider before engaging in exercise. You may need to use a facility with a **medically qualified staff**.*

*If you marked two or more of the statements in this section you should consult your physician or other appropriate health care as part of good medical care and progress gradually with your exercise program. You might benefit from using a facility with a **professionally qualified exercise staff**^a to guide your exercise program.*

You should be able to exercise safely without consulting your physician or other appropriate health care provider in a self-guide program or almost any facility that meets your exercise program needs.

^aProfessionally qualified exercise staff refers to appropriately trained individuals who possess academic training, practical and clinical knowledge, skills, and abilities commensurate with the credentials defined in *Appendix D*.

**707-826-5165 | irb@humboldt.edu |
www.humboldt.edu/human_subjects**

MEMORANDUM

**Thank you for submitting your application to the Committee
for the Protection of Human Subjects in
Research. I am able to provide expedited review of your
proposal because your research:**

**will involve the collection of data through noninvasive
procedures (not involving general anesthesia or
sedation) routinely employed in clinical practice, excluding
procedures involving x-rays or microwaves.**

To: Young S Kwon

**Title: Performance Profile for Tabata Intermittent Training on
treadmill**

Nathan Tamayo

IRB #: IRB 17-213

From:

**The Expedited approval of your research will expire on . By
Federal Regulations, all research
related to this protocol must stop on the expiration date and
the IRB cannot extend a protocol that is
past the expiration date. In order to prevent any interruption
in your research, please submit a renewal
application in time for the IRB to process, review, and extend
the Expedited designation (at least one
month).**

Important Notes:

- Any alterations to your research plan must be reviewed and
approved by the IRB prior to
implementation.**
- Change to survey questions**

- Number of subjects
- Location of data collection,
- Any other pertinent information
- If Expedited approval is not extended prior to the expiration date, investigators must stop all research related to this proposal.
- Any adverse events or unanticipated problems involving risks to subjects or others must be reported immediately to the IRB (irb@humboldt.edu).

5/8/2019

cc: Faculty Adviser (if applicable)

Institutional Review Board for the Protection of Human
Subjects

Institutional Review Board for the Protection of Human
Subjects

Susan Brater

Date: 5/9/2018

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