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Original Research Article

The Acute and Chronic Health Benefits of TRX Suspension Training® in Healthy Adults

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Abstract

Aim: The purposes of this study were (a) to quantify the acute cardiovascular and metabolic responses to TRX Suspension Training, and (b) to determine the effectiveness of an 8-week TRX Suspension Training program at improving cardiorespiratory, muscular, neuromotor, and flexibility fitness and positively modifying cardiometabolic risk factors. **Methods:** Sixteen women and men (mean ± SD: age, height, weight, percentage body fat, and VO_2max = 40.1 ± 13.5 years, 165.3 ± 8.2 cm, 64.2 ± 11.9 kg, 23.0 ± 5.0 %, and 41.2 ± 7.3 mL/kg/min, respectively) completed both a maximal graded exercise test and a single 60-min TRX Suspension Training class on non-consecutive days. Cardiovascular and metabolic data were collected via a portable calorimetric measurement system. Additionally, participants completed an 8-wk TRX Suspension Training program (60-min sessions performed 3 times/wk). Cardiometabolic risk factors and muscular, neuromotor, and flexibility fitness were measured at baseline and post-program. **Results:** Overall heart rate for a 60-min TRX Suspension Training class was 131.3 ± 10.8 beats/min, which corresponded to 59.9 ± 10.2% HRR. Exercise intensity in METs was 5.8 ± 1.0, which equated to 45.9 ± 8.6% VO_2R. Total energy expenditure for a TRX Suspension Training class was 398.1 ± 114.1 kcal/class. After 8-wk of TRX Suspension Training there were significant ($p < 0.05$) improvements in the following cardiometabolic risk factors and muscular fitness parameters: waist circumference, systolic and diastolic blood pressure, body fat, one-repetition maximum for leg press and bench press, curl ups, and pushups. **Conclusions:** Findings from the present study support the activity of TRX Suspension Training as a feasible alternative to traditional exercise modalities for adults that elicits metabolic responses within the accepted moderate-intensity range. Moreover, regular participation in TRX Suspension Training improves muscular fitness and positively modifies several major cardiovascular disease risk factors including reductions in waist circumference, both systolic and diastolic blood pressure, and body fat.

Key Words: Energy Expenditure, Exercise Intensity, Group Exercise, Primary Prevention

Introduction

Regular physical activity confers various health benefits including the prevention and management of hypertension, obesity, Type 2 diabetes, dyslipidemia, and cardiovascular disease (CVD). Physical activity may also contribute to improved cardiorespiratory fitness provided that exercise intensity is sufficient. Cardiorespiratory fitness, typically determined by maximal oxygen uptake (VO_2max), refers to the highest rate at which oxygen can be taken up and consumed by the body during incremental exercise. Studies have consistently demonstrated an inverse relationship between VO_2max values and risk of CVD and all-cause mortality[1-2]. Given its relationship to positive health, the parameters of an exercise program needed to improve cardiorespiratory fitness have been studied extensively, and subsequently well-defined guidelines have been published by numerous organizations[3-4], including the American Council on Exercise (ACE) and the American College of Sports Medicine (ACSM). Current recommendations[5] to improve cardiorespiratory fitness are 20-60 minutes of aerobic exercise 3-5 days/week at an intensity of 64/70-94% of heart rate maximum (HRmax), 40/50-85% of heart rate reserve (HRR) or oxygen uptake reserve (VO_2R), and 12-16 rating of perceived exertion (RPE). Additionally, the ACSM has recommended a target energy expenditure of 150 to 400 kilocalories per day (kcal/day). Traditional forms of aerobic exercise include walking, jogging, and cycling. Despite the myriad of health benefits associated with regular physical activity, the majority of North American adults do not fulfill the minimal requirements of physical activity wherein the benefits are proposed to accumulate[6].

Suspension Training bodyweight exercise is purported to develop strength, balance, flexibility and core stability simultaneously[7]. It requires the use of the TRX Suspension Trainer, a highly portable performance training tool that leverages gravity and the user's body weight to complete hundreds of exercises[7]. In recent years TRX Suspension Training has gained in popularity. However, there is a lack of research on TRX Suspension Training. To our knowledge there is no research examining the physiological responses to TRX Suspension Training. Understanding the acute cardiovascular and metabolic responses to TRX Suspension Training is essential for designing safe and effective exercise training programs[3-4]. Moreover, it would be beneficial to understand the amassed health benefits obtained by more long-term participation in TRX Suspension Training. For instance, does regular participation in TRX Suspension Training benefit balance, muscular fitness and/or cardiometabolic risk factors (e.g., improved cholesterol profile)? The lack of research concerning the physiological responses to TRX Suspension Training coupled with its increasing popularity prompted the present study.

The purpose of this study was (a) to quantify the acute cardiovascular and metabolic responses to TRX Suspension Training, and (b) to determine the effectiveness of an 8-week TRX Suspension Training program at improving cardiorespiratory, muscular, neuromotor, and flexibility fitness and positively modifying cardiometabolic risk factors. It was hypothesized that (a) TRX Suspension Training would meet the recommended guidelines for moderate-to-vigorous intensity exercise as defined by ACE and ACSM, and (b) TRX Suspension Training program would elicit improvements in cardiorespiratory, muscular, neuromotor, and flexibility fitness and positively modify cardiometabolic risk factors.

Methods

Participants

16 healthy women and men (21 to 71 years of age) were recruited from the student population of a local university, as well as the surrounding community, via advertisement through the university website, local community newspaper, and word-of-mouth. Participants were eligible for inclusion into the study if they were low-to-moderate risk and physically active as defined by the ACSM[4]. Exclusionary criteria included evidence of cardiovascular pulmonary, and/or metabolic disease. This study was approved by the Human Research Committee at Western State Colorado University. Prior to participation, each participant signed an informed consent form. The physical and physiological characteristics of participants are presented in Table 1.

Table 1. Physical and physiological characteristics of the participants.

Parameter	Women (N=14)	Men (N=2)	Combined (N=16)
Age (years)	42.5 ± 12.7	23.5 ± 0.7	40.1 ± 13.5
Height (cm)	163.9 ± 7.5	175.0 ± 8.5	165.3 ± 8.2
Weight (kg)	61.4 ± 9.5	85.3 ± 1.2	64.2 ± 11.9
Body fat (%)	23.5 ± 5.0	19.0 ± 3.7	23.0 ± 5.0
Resting heart rate (beats/min)	67.5 ± 10.8	68.0 ± 17.0	67.7 ± 10.9
Maximal heart rate (beats/min)	176.5 ± 12.3	180.0 ± 9.9	176.9 ± 11.8
Maximal oxygen uptake (mL/kg/min)	40.4 ± 6.7*	47.0 ± 12.1	41.2 ± 7.3

Values are mean ± SD; *denotes sex difference, $p < .05$.

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Experimental Design

Acute responses to TRX Suspension Training

To quantify the acute cardiovascular and metabolic responses to TRX Suspension training an Oxycon Mobile portable calorimetric measurement system and Polar F1 heart rate monitor were worn by each participant throughout a single TRX Suspension Training class session (Figure 1).

Figure 1. – The Oxycon Mobile metabolic system attached to a participant before (upper left & lower right) and during (upper right & lower left) a TRX Suspension Training class.

Chronic responses to TRX Suspension Training

At baseline and post-program, participants performed a graded exercise test on a treadmill to determine maximal heart rate (HR) and maximal oxygen uptake (VO_2max). Resting heart rate was also measured at baseline. Additionally, resting blood pressure, body composition, fasting blood lipids and blood glucose, waist circumference, weight, muscular fitness, neuromotor fitness, and flexibility fitness were also assessed at baseline and post-program. These measures were obtained to determine the effectiveness of an 8-wk TRX Suspension Training intervention at positively modifying cardiometabolic risk factors. The experimental design for the chronic responses to TRX Suspension Training component of the study is presented in Figure 2.

Figure 2. Experimental design for chronic responses to TRX Suspension Training.

Protocols

Anthropometric measurements

All anthropometric measurements were obtained using standardized guidelines[4]. Participants were weighed to the nearest 0.1 kg on a medical grade scale and measured for height to the nearest 0.5 cm using a stadiometer. Percent body fat was determined via hydrostatic weighing. Waist circumference measurements were obtained using a cloth tape measure with a spring loaded-handle (Creative Health Products, Ann Arbor, MI). A horizontal measurement was taken at the narrowest point of the torso (below the xiphoid process and above the umbilicus). These measurements were taken until two were within 0.5 mm of each other.

Fasting blood lipid and glucose measurement

All fasting lipid and blood glucose analyses were collected and performed at room temperature. Participants' hands were washed with soap and rinsed thoroughly with water, then cleaned with alcohol swabs and allowed to dry. Skin was punctured using lancets and a fingerstick sample was collected into heparin-coated 40 μl capillary tube. Blood was allowed to flow freely from the fingerstick into the capillary tube without milking of the finger.

Samples were then dispensed immediately onto commercially available test cassettes for analysis in a Cholestech LDX System (Alere Inc., Waltham, MA) according to strict standardized operating procedures. The LDX Cholestech measured total cholesterol, high density lipoprotein (HDL) cholesterol, low density lipoprotein (LDL) cholesterol, triglycerides, and blood glucose in fingerstick blood. A daily optics check was performed on the LDX Cholestech analyzer used for the study.

Resting blood pressure measurements

The procedures for assessment of resting blood pressure outlined elsewhere were followed[4]. Briefly, participants were seated quietly for 5 minutes in a chair with a back support with feet on the floor and arm supported at heart level. The left arm brachial artery blood pressure was measured using a sphygmomanometer in duplicate and separated by 1-minute. The mean of the two measurements was reported for baseline and post-program values.

Maximal exercise test

On a power treadmill (Powerjog GX200, Maine), a modified Balke protocol was performed with participants selecting a comfortable walking or jogging speed that could be maintained for the duration of the test. After a 2 min warm up performed at a walking speed of 2.0-3.0 mph, participants were gradually brought to the selected walking or jogging speed for the first minute of the test, this speed was maintained throughout the duration of the test. The warm up portion, and first 1 min of the protocol, were performed at 0% grade, thereafter, each minute the treadmill grade was increased by 1% until volitional fatigue was attained. The final workload (speed and grade) achieved was recorded. Individual VO_2max was subsequently estimated from the final workload using the ACSM metabolic equations for walking and running[4].

Muscular, neuromotor, and flexibility fitness

Participants performed one-repetition maximum (1-RM) testing for the bench press and leg press exercises. The following protocol was used for 1-RM testing[4]:

1. 10 repetitions of a weight the participant felt comfortable lifting (40-60% 1-RM) were performed to warm up muscles
2. RPE was recorded followed by 1 minute rest period
3. 5 repetitions of weight 60-80% 1-RM was performed as a further warm up, RPE recorded followed by a 2 minute rest period
4. First 1-RM attempt at weight of 2.5-20kg greater then warm up, weight was dependent on RPE of warm up
    a. If the first 1-RM lift was deemed successful by the researcher (appropriate lifting form), weight was increased until the maximum weight the participant could

lift was established with 3 minutes between each attempt.

b. If the first 1-RM lift was deemed unsuccessful by the researcher, the weight was decreased until the participant successfully lifted the heaviest weight possible.

There were 3 minutes rest between 1-RM attempts and a maximum of 5 1-RM attempts. There were 5 minutes of rest between the 1-RM testing of each resistance exercise. Flexibility was assessed using a modified sit-and-reach test and the best of three results was recorded to the nearest 0.1 cm as the final value[8]. Muscular endurance was evaluated using a push up test and curl up test[8]. Balance was assessed using the unipedal stance test with eyes closed[8].

Testing session to quantify acute cardiovascular and metabolic responses to TRX Suspension Training

Participants performed a 60-min TRX Suspension Training class. Participants were instructed to arrive 20 min prior to the start of the testing session for attachment of the heart rate monitor and portable metabolic analyzer, familiarization with the breathing apparatus, and an explanation of testing instructions and precautions. Each TRX Suspension Training class commenced with a 5-min warm-up consisting of light dynamic stretching. The TRX Suspension Training class concluded with a 5-min cool-down consisting of upper- and lower-extremity static stretching.

Training program to determine chronic responses to TRX Suspension Training

All participants completed a standard 8-wk TRX Suspension Training program. The program consisted of 3 x 60-min TRX Suspension Training class sessions per week on Monday, Wednesday, and Friday. All TRX Suspension Training sessions were instructed by the same qualified instructor. Only the data from those participants who completed ≥75% of the training sessions (i.e., 18 out of 24 sessions) were included in the final analysis.

Exercise intensity and metabolic calculations

Individual heart rate reserve (HRR) was determined as the difference between resting and HRmax values. Percent HRR was calculated by subtracting resting HR from the TRX Suspension Training HR response, dividing by HRR, and then multiplying the quotient by 100. Likewise, individual oxygen uptake reserve (VO_2R) was quantified by taking the difference between resting VO_2 (a constant of 3.5 mL/kg/min was used for all individuals) and maximum VO_2 values. Percent VO_2R was calculated by subtracting resting VO_2 from the TRX Suspension Training VO_2 response, dividing by VO_2R, and then multiplying the quotient by 100. The metabolic equivalent (MET) for TRX Suspension Training was determined by dividing the TRX Suspension Training VO_2 by resting VO_2. Energy expenditure (kcal/class) for the TRX Suspension Training class was calculated by first multiplying the above-calculated MET equivalent of the TRX Suspension Training class by individual resting VO_2. This term was then subsequently multiplied by individual body mass, divided by 1000, multiplied by the caloric equivalent for the measured respiratory exchange ratio or RER (e.g., an RER of 0.83 equates to an energy cost of 4.838 kcal/L of oxygen), and last multiplied by 60-min (duration of the TRX Suspension Training class).

Statistical analyses

All analyses were performed using SPSS Version 22.0 (Chicago, IL) and GraphPad Prism 6.0. (San Diego, CA). Measures of centrality and spread are presented as mean ± SD. Primary outcome measures for the acute cardiovascular and metabolic responses to TRX Suspension Training portion of the study were relative exercise intensity (% HRR and % VO_2R), metabolic equivalents (METs), and energy expenditure (kcal/min and kcal/class). Primary outcome measures for the chronic cardiovascular and metabolic responses to TRX Suspension Training portion of the study were the change in cardiometabolic risk factors, including VO_2max, systolic blood pressure, diastolic blood pressure, weight, waist circumference, body composition, blood lipids, blood glucose, muscular fitness, neuromotor fitness, and flexibility fitness. Paired t-tests were used to compare the mean primary outcome measures between baseline and post-program. The probability of making a Type I error was set at $p < 0.05$ for all statistical analyses. In order to make inferences about the true values (population values) of the effect of TRX Suspension Training on all primary outcomes, the uncertainty in effect was expressed as 90% confidence limits and the likelihood the true value of the effect represents a substantial and clinically meaningful change (harm or benefit). Effects were declared unclear if the confidence interval overlapped thresholds for substantiveness or the effect could be substantially positive and negative or beneficial and detrimental. All probabilistic magnitude based inferences were calculated using a published spreadsheet[9].

Results

Acute cardiovascular and metabolic responses to TRX Suspension Training

The acute cardiovascular and metabolic responses (mean ± SD) to a TRX Suspension Training class for the sixteen participants who completed the study are presented in Table 2. Overall heart rate for a 60-min class was 131.1 ± 10.8 beats/min, which corresponded to 59.9 ± 10.2% HRR. Exercise intensity in METs was 5.81 ± 1.0, which equated to 45.9 ± 8.6% VO_2R. Total energy expenditure for a TRX Suspension Training class was 398.1 ± 114.1 kcal/class. Figure 2 illustrates the exercise intensity in terms of HRR for a representative participant throughout the duration of the TRX Suspension Training class session.

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Table 2. Acute cardiovascular and metabolic responses to TRX Suspension Training.

Parameter	Women (N=14)	Men (N=2)	Combined (N=16)
HR (beats/min)	130.7 ± 11.4	136 ± 2.83	131.3 ± 10.8
%HRR	59.6 ± 10.4	61.7 ± 12.3	59.9 ± 10.2
%VO_2R	45.5 ± 8.7	43.5 ± 10.3	45.9 ± 8.6
METs	5.64 ± 0.66	7.04 ± 2.23	5.81 ± 0.97
kcal/min	6.1 ± 0.89*	10.5 ± 3.2	6.63 ± 1.9
kcal/class	365.1 ± 53.3*	629.0 ± 190.9	398.1 ± 114.1

Values are mean ± SD. (HR, heart rate; %HRR, percentage heart rate reserve; kcal, kilocalories; METs, metabolic equivalents; %VO_2R, percentage oxygen uptake reserve); *denotes sex difference, $p < .05$.

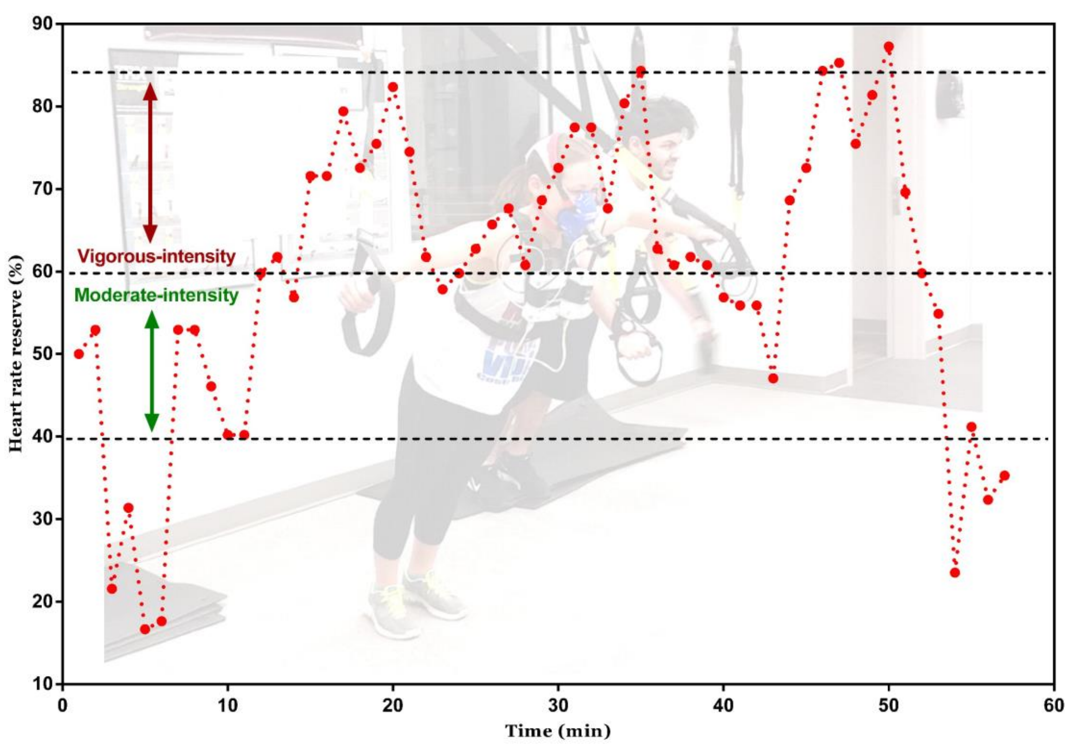

Figure 2 – Exercise intensity in terms of heart rate reserve (HRR) for a representative participant throughout the duration of the TRX Suspension Training class. The lower region (denoted by dashed lines) represents the moderate exercise intensity classification while the upper region (denoted by the dashed lines) represents the vigorous exercise intensity classification.

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Table 3. Baseline (mean ± SD) and mean change (95% CI) at 8-wk in all primary outcomes after the TRX Suspension Training program.

Variable	Baseline mean ± SD	Change at 8-wk mean (95% CI)	p-value difference to baseline
Weight (kg)	64.6 ± 12.2	.07 (-.83 to .69)	.839
Waist circumference (cm)	71.2 ± 5.9	-1.48 (.27 to 2.68)	.021
SBP (mmHg)	121.1 ± 9.4	-8.43 (2.32 to 14.5)	.011
DBP (mmHg)	79.1 ± 5.1	-9.00 (6.34 to 11.66)	.000
RHR (bpm)	65.1 ± 9.8	-1.29 (-3.29 to 5.86)	.554
Body fat (%)	22.8 ± 5.1	-1.56 (.95 to 2.18)	.000
TC (mg/dL)	194.9 ± 23.9	-9.73 (-2.46 to 21.93)	.109
HDL (mg/dL)	76.4 ± 19.5	-5.71 (.98 to 10.45)	.022
LDL (mg/dL)	99.4 ± 24.4	-1.58 (-10.56 to 13.72)	.779
TRIG (mg/dL)	79.4 ± 20.9	15.00 (-35.50 to 5.50)	.137
GLU (mg/dL)	83.9 ± 7.5	0.00 (-3.92 to 3.92)	1.00
Flexibility (cm)	52.0 ± 6.8	1.34 (-2.96 to .29)	.099
Balance: eyes closed (sec)	27.9 ± 24	7.90 (-19.64 to 3.84)	.170
VO_2max (mL/kg/min)	41.3 ± 7.7	.19 (-1.42 to 1.05)	.750
1-RM Leg Press (lbs)	440.2 ± 148.7	90.64 (-129.99 to -51.30)	.000
1-RM Bench Press (lbs)	90 ± 54.6	4.23 (-8.10 to -36)	.035
Curl ups (reps)	33.9 ± 16.7	16.00 (-28.69 to -3.31)	.017
Push ups (reps)	24.6 ± 8.4	3.08 (-5.16 to -1.01)	.007
Full 30yr CVD risk (%)	10.6 ± 7.9	-.658 (-.35 to 2.5)	.127
Hard 30yr CVD risk (%)	5.3 ± 4.4	-.41 (-.14 to 1.6)	.094

*Note: confidence interval (CI), systolic blood pressure (SBP), diastolic blood pressure (DBP), resting heart rate (RHR), total cholesterol (TC), high density lipoprotein (HDL), low density lipoprotein (LDL), triglycerides (TRIG), blood glucose (GLU), maximal oxygen uptake (VO_{2max}), one rep max (1RM), cardiovascular disease (CVD).

Chronic cardiovascular and metabolic responses to TRX Suspension Training

The chronic cardiovascular and metabolic responses to the TRX Suspension Training program are presented in Table 3 for all individuals who completed the intervention (N = 15). One individual was unable to complete post-program testing due to an injury unrelated to the TRX Suspension Training program. At 8-wk, paired t-tests revealed a significant decrease in waist circumference (t (11) = 2.704, p<0.05), body fat % (t (13) = 5.498, p<0.05), resting systolic blood pressure (t (13) = 2.978, p<0.05), and resting diastolic blood pressure (t (13) = 7.308, p<0.05), indicating a positive effect on body composition and cardiovascular health. Paired t-tests revealed a significant increase in 1-RM leg press (t (13) = -4.977, p<0.05), 1-RM bench press (t (12) = -2.382, p<0.05), curl ups (t (14) = -2.04, p<0.05), and push ups (t (11) = -3.276, p<0.05), indicating a positive effect on muscular strength and muscular endurance.

Paired t-tests revealed no significant difference in baseline to post-program weight (t (14) = -

.207, p>0.05), resting heart rate (t (13) = .607, p>0.05), total cholesterol (t (14) = 1.712, p>0.05), LDL (t (11) = .287, p>0.05), triglycerides (t (12) = -1.594, p>0.05), blood glucose (t (14) = .000, p>0.05), flexibility (t (13) = -1.779, p>0.05), balance eyes-closed (t (13) = -1.453, p>0.05), and VO_2max (t (14) = -.325, p>0.05).

Magnitude based inferences (Table 4) revealed TRX Suspension Training to be 88.8% clinically beneficial in improving flexibility, 82.1% clinically beneficial in improving balance with eyes-closed, 86% clinically beneficial in improving Full 30yr CVD risk, and 89.2% clinically beneficial in improving Hard 30yr CVD risk.

Table 4. Results of magnitude based inferences for TRX Suspension Training.

Variable	Mean Difference, 90% CI	Qualitative Outcome
Flexibility (cm)	1.8 ± 1.8 (0 to 3.6)	Likely beneficial, very unlikely harmful, use.
Balance w/ eyes closed (sec)	1.5 ± 1.8 (.3 to 3.2)	Likely beneficial, very unlikely harmful, use
Full 30yr CVD risk (%)	1.6 ± 1.8 (.1 to 3.4)	Likely beneficial, very unlikely harmful, use
Hard 30yr CVD risk (%)	1.8 ± 1.8 (0 to 3.6)	Likely beneficial, very unlikely harmful, use

*Note: cardiovascular disease (CVD)

Discussion

Physical inactivity is an important risk factor for the development and progression of CVD[10]. Nevertheless, according to 2013 data in adults ≥18 years the age-adjusted proportion who reported engaging in moderate or vigorous physical activity that met current physical activity guidelines for Americans was 50.0%[10]. This is perhaps due in part to a lack of enjoyment experienced from participation in traditional forms of physical activity (such as walking, running, swimming, and cycling). One possible way to increase the number of individuals involved in regular physical activity is to emphasize that the health benefits of traditional exercise can often be found in alternative forms of exercise. TRX Suspension Training is a popular alternative form of physical activity. Results from the present study provide two preliminary lines of evidence supporting TRX Suspension Training as an ideal alternative exercise modality:

1. Participation in a TRX Suspension Training class elicited cardiovascular and metabolic responses that fulfill exercise intensity guidelines for improving ***and*** maintaining cardiorespiratory fitness[3-4]. Mean exercise intensity was 59.9% of HRR, 45.9% of VO_2R, and 5.8 METs, respectively. Overall energy expenditure for a TRX Suspension Training class was ~400 kcal/class.
2. Participation in an 8-wk TRX Suspension Training program

improved muscular fitness and positively modified several major CVD risk factors including reductions in waist circumference, body fat, and both systolic and diastolic blood pressure.

Acute cardiovascular and metabolic responses – comparison between TRX Suspension Training and other activities

Exercise intensity is arguably the most critical component of the exercise prescription model. Failure to meet minimal threshold values may result in lack of a training effect, while too high of an intensity could lead to over-training and negatively impact adherence to an exercise program[11]. Results from the present study indicate participation in TRX Suspension Training exercise can be classified as "moderate" according to various organizations definition of physical activity intensity[3-4]. For example, moderate exercise intensity in relative terms has been defined as 40-59% of HRR/VO_2R[4]. Participants in the present study exercised at workloads during the TRX Suspension Training class that elicited HRR (59.9%) and VO_2R (45.9%) values that fall within the moderate relative intensity category.

In the 2008 US physical activity guidelines report[12] and elsewhere[13], moderate-intensity physical activity in absolute metabolic terms has been classified as 3 to 6 METs. In the present study, the MET response to TRX Suspension Training exercise averaged 5.8. Thus, participants in the present investigation exercised at workloads during the TRX Suspension Training class that elicited metabolic responses within the accepted moderate-intensity range. This is an important finding given the fact that moderate-intensity exercise has been widely recommended for health benefits[3-4,12]. Additionally, MET values described in the present study compare favorably to more traditional land-based aerobic exercise values and non-traditional exercise values. For instance, treadmill and over ground brisk walking at 4.0 miles per hour is an equivalent moderate-intensity physical activity at 4.9 METs. Likewise, an 80-kg individual cycling between 50 and 100 Watts will elicit a MET value ranging from 4.0 to 6.0 METs[4]. More recently, Dalleck and colleagues[14] reported that participation in a Zumba Gold exercise class also elicited an absolute moderate-intensity metabolic response at 4.3 METs.

For the improvement and maintenance of cardiorespiratory fitness, the ACSM has recommended a target energy expenditure of 150 to 400 kilocalories per day (kcal/day)[4]. From a practical perspective, results from the present study highlight that participation in a 60-min TRX Suspension Training class yields a mean energy expenditure of ~400 kcal that satisfies the ACSM recommendations for daily energy expenditure. This volume of energy expenditure is comparable to other non-traditional alternative activities. For instance, Bausch et al.[15] reported that participation in 1-hr session of Nintendo Wii Sports elicited a mean energy expenditure of ~250 kcal/session. More recently, Weatherwax and colleagues[16] reported that participation in a 40-min Ultimate Frisbee match elicited a total energy expenditure of ~475 kcal/match.

Chronic cardiovascular and metabolic adaptations to TRX Suspension Training

The results of the current study demonstrate that TRX Suspension Training confers similar health benefits when compared to those achieved from traditional aerobic training. Indeed, participation in a 60-min TRX Suspension Training class, 3 days/wk, for 8-wk resulted in significant improvements in resting systolic blood pressure (-8.4 mmHg) and diastolic blood pressure (-9.0 mmHg), body fat (-1.6%), and waist circumference (-1.5 cm) over the duration of the study. Collectively, the improvements in cardiometabolic risk factors resulted in a clinically beneficial reduction in 30 year CVD risk. Moreover, various metrics of muscular fitness (i.e., bench and leg press 1-RM, curl up, pushups) were also improved in the present study. It has been reported that increased muscular fitness is associated with a reduced risk of all-cause mortality[17]. Furthermore, in a previous meta-analysis[18] it was reported that aerobic exercise training will elicit average reductions in resting systolic blood pressure and diastolic blood pressure of 3 to 4 mmHg and 2 to 3 mmHg, respectively. The decreased resting systolic blood pressure (-8.4 mmHg) and diastolic blood pressure (-9.0 mmHg) measurements observed in the present study are consistent in magnitude with those previously reported in the literature. Next to low cardiorespiratory fitness, hypertension has been implicated in the second highest number of overall deaths amongst American adults, according to one study[19]. As such, the reductions in systolic and diastolic blood pressure in the present study represent a positive impact on overall cardiovascular health, as it has been demonstrated that blood pressure decreases of as little as 2 mmHg are associated with a 6% decrease in stroke mortality and a 4% decrease in coronary artery disease[20]. Overall, results from the chronic intervention are encouraging and support the potential for regular participation in TRX Suspension Training to prevent CVD, CVD mortality, and mortality from all-causes.

Methodological Considerations

Possible limitations to the present study merit discussion. The present study investigated the acute and chronic cardiovascular and metabolic responses to a representative sample of healthy men and women participating in a TRX Suspension Training class led by a single TRX Suspension Training instructor. The cardiovascular and metabolic responses to TRX Suspension Training would likely vary to a certain extent across classes with different structures and instructors. Additionally, the chronic cardiovascular and metabolic responses to TRX Suspension Training may be more pronounced with a longer training period beyond the 8-wk duration of the present study. Future research might also examine other possible TRX Suspension Training adaptations including enhanced psychological health (e.g., reduced stress).

Conclusion and Practical Application

To our knowledge, this is the first study to investigate the acute and chronic cardiovascular and metabolic responses to TRX Suspension Training. Findings from the present study support the activity of TRX Suspension Training as a feasible alternative to traditional exercise modalities for adults that elicits metabolic responses within the accepted moderate-intensity range. Moreover, regular participation in TRX Suspension Training improves muscular fitness and positively modifies several major CVD risk factors including reductions in body fat, systolic and diastolic blood pressure, and waist circumference. Overall, these findings are important for exercise physiologists, health and fitness professionals, and others who design exercise programs and promote physical activity in the adult population.

Competing interests

This investigation was supported financially by the American Council on Exercise (ACE). The American Council on Exercise (ACE) was not involved in development of the study design, data collection and analysis, or preparation of the manuscript. There are no other potential conflicts of interest related to this article.

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