

The Effects of Participation in Marching Band on Physical Activity and Physical Fitness in
College Aged Men and Women

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Statement of the Problem

Over the past few decades, improvements in technology have resulted in an increase in the amount of time people spend participating in sedentary activities. More than 80% of adults do not meet the guidelines for aerobic activity and 32.6% of adults do not participate in any leisure time physical activity (United States Department of Health and Human Services, 2011). Physical inactivity is associated with an increase in cardiovascular disease, diabetes, and early death (United States Department of Health and Human Services, 2011). Increasing physical activity is one way to deter these negative health consequences (Garber et. al., 2011).

According to guidelines by the American College of Sports Medicine (ACSM), the recommended amount of physical activity is: 1) 30 minutes of moderate-intensity physical activity on five days per week (150 minutes per week); 2) 20 minutes of vigorous-intensity physical activity on three days per week, or 3) or a combination of moderate and vigorous exercise on ≥ 3 to 5 days per week. Pedometers are effective tools for promoting physical activity and can be used to approximate exercise volume in steps per day. The goal of 10,000 steps per day is often cited, but it appears that achieving a pedometer step count of at least 5,400 to 7,900 steps \cdot d⁻¹ can meet recommended physical activity guidelines (Garber et al., 2011). Participating in the amount of physical activity recommended by the ACSM results in numerous

health benefits including increased capillaries around the heart (aiding in prevention of heart disease), increased bone/muscle mass (aiding in decrease in osteoporosis and sarcopenia) and maintenance of a healthy body weight (Garber et al., 2011). However, despite these benefits, adults frequently identify barriers that prevent them from being physically active. Common barriers to physical activity include lack of time to go to a fitness center, embarrassment to exercise in front of other people, and a lack of knowledge about how to perform proper exercise. Many people are unaware that moderate intensity physical activity provides health benefits and that there are many ways to be physically active besides going to a fitness center.

Despite the misnomer that physical activity has to take place at a fitness center or is limited to traditional activities such as running, there are many other ways to participate in physical activity. Other types of activities include walking a dog, playing catch, hiking, dancing or riding a bike.

Participation in the marching band combines music and physical activity, and may provide a non-traditional approach to improving physical fitness and meeting national guidelines for physical activity, however there is limited research examining these issues. Therefore, the purpose of this study is to: 1) measure the effects of participating in the University of Rhode Island Marching Band on physical fitness and 2) quantify the amount of physical activity accomplished during a typical marching band practice session.

Specific Aims/Hypothesis

1. Marching band members will have a significantly higher VO_{2max} at the end of the season compared to the pre-season.

2. Marching band members will have a lower percentage of body fat at the end of the season compared to the pre-season.

3. The drumline will have a significantly greater improvement in VO_{2max} compared to the brass and woodwinds sections.

4. Band members will meet ACSM guidelines for moderate-intensity physical activity based on percentage of time spent in their target heart rate zone and the number of steps taken during regular practice sessions.

5. The drumline members will spend more percentage of time in their target heart rate zone compared to the brass and woodwinds.

Significance

It is well known that participation in regular physical activity is associated with major health benefits including a lower risk for heart disease, diabetes, osteoporosis, osteoarthritis, and obesity and delayed all-cause mortality (Heyward, 2010; LaMonte et al, 2000 and Kampert et al, 1996). Despite the knowledge that physical activity can lead to great health benefits, most American's are sedentary or inadequately active (United States Department of Health and Human Services, 2011). Technological advances have resulted in increased screen time (eg. computers, television viewing) at work and during leisure time. Over the past few decades there have been attempts to increase physical activity rates by the Surgeon General (1979), Healthy People initiative (1990) and other governmental groups, but inactivity continues to be a major public health problem (United States Department of Health and Human Services, 2011). Many people who do not exercise are unaware that participation in non-traditional activities can be enough to produce health benefits associated with being active.

This study will evaluate the amount of physical activity associated with a non-traditional activity. Marching band has been around for decades with bands playing at sporting events and parades at various levels ranging from middle school to professional. In most cases the marching band has been overshadowed by the sporting events they perform for thus receiving less focus from exercise specialists. Therefore the health benefits of participating in a marching band are largely unknown. Few studies have examined the fitness levels of marching band members and it is not known if participation in band practice meets national guidelines for physical activity.

Erdmann, Graham, Radlo, & Knepler, (2003) completed a study of fifteen high school marching band members to determine the energy cost of marching. Heart rate was measured while the participants completed five 3-minute stages of treadmill marching with and without instruments as well as while playing their instruments. They found that energy demand for high school marching band ranged from 4.0 and 6.5 METS, which is considered moderate intensity (Heyward, 2010). Wenta (2011) studied marching band members who were participating in a summer band camp. Participants kept a food log and used an accelerometer during practice to keep assess caloric expenditure. Wenta found that band members had a negative average energy balance of $-661 \text{ kcals} \pm 785 \text{ kcals}$ per day.

Cowen (2006) used pedometers and activity logs to measure physical activity in marching band members. The study found that on marching days, band members completed 13,987.8 steps compared to non-marching days which had a total step count 8337.5 steps. When comparing these values to values recommended by Tudor-Locke et al (2008) it was established that on marching band days, the members were quantified as “highly active” ($\geq 12,500$ steps) compared to being “somewhat active” (7500 to 9999 steps) on non-marching days. Both the marching and non-marching days met the criteria set by the ACSM (Garber et. al., 2011).

However, due to the dose-response relationship between physical activity and health, greater more benefits gained marching days.

Edwards (2008) used a mobile metabolic cart to measure VO_2 and heart rate in a tenor player (drumline) during a practice. He found that just by putting the drums on, the heart rate and VO_2 increased because the body was working harder due to the nearly 30% addition to the band member's body weight. Edwards also found an increase in heart rate in response to hearing the band start playing even though the subject was not moving. Edwards hypothesized that the musician is used to responding to the music so when he heard it, his body responded as if he was moving, even though he was not doing anything. During practice, VO_2 reached $40 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ and heart rate was above 200 beats per minute. In this case, the marching band member was engaged in vigorous-intensity exercise during a given practice however since the study was only done on one subject, subsequent studies should be done to help get more concrete data.

Previous marching band studies have not measured at improvements in cardiorespiratory fitness or body composition across a marching band season or between different sections of marching band. Also, very few studies have measured the intensity and amount of physical activity completed during a typical marching band practice. This study is significant in that it will examine the training effects of band participation in cardiorespiratory fitness and body composition. The study will also examine the quality and quantity of physical activity completed during band practice to determine if it meets national guidelines.

This study will use the best tests and newest technology to measure cardiorespiratory fitness, body composition and physical activity. We will use a maximal exercise test to determine $\text{VO}_{2\text{max}}$, the gold standard for measuring cardiorespiratory fitness (Myers, Prakash, Froelicher, Do, Partington, & Atwood, 2002). $\text{VO}_{2\text{max}}$ is determined by measuring gas exchange while

performing a maximal exercise test using established protocols such as the Bruce treadmill protocol (Heyward, 2010).

Body composition will be determined using air displacement plethysmography (Bod Pod[®]). It requires much less subject compliance than hydrostatic weighing and takes less time (Heyward, 2010). Demerath et al. (2002) found the reliability of children to be $r = .9$ and adults to be $r = .96$ compared to hydrostatic weighing. Vescovi et al (2001) found only small differences in average body density ($\leq 0.002 \text{ g} \cdot \text{cc}$) thus illustrating the validity of the Bod Pod[®] as a measure of body composition.

In this study, physical activity will be measured using two techniques: 1) the amount of time spent completing moderate or vigorous exercise as measured by heart rate; and 2) step count. For health benefits, an individual should participate in moderate intensity physical activity for at least thirty minutes per day five days per week, where moderate-intensity is defined as 64-76% of maximum heart rate (Garber, 2011).

Heart rate will be measured using Suunto heart rate monitors which track exercise over long periods of time. Data collected from the monitor will be downloaded and examined using the Suunto software one program to determine the amount of time band members spend doing moderate and vigorous exercise during practice. Steps will be measured with a Digiwalkers pedometer. Alahmari et al (2011) found that when the step count from the Digiwalkers was correlated to the distance covered (reliability was $r = 0.86$)

Methods:

Subjects. Subjects for this study will be twenty-four male and female URI marching band students aged 18-24 years. There will be eight members from the drumline, eight from the

brass section and eight from the woodwind section, with the goal of a 4:4 ratio of males to females within each section.

Subjects will be recruited from those who were enrolled in University of Rhode Island Marching Band during the fall 2011 semester and plan to participate during the fall semester of 2012. Freshmen will not be included in the study since they will not be at the university during recruitment and pre-testing phases. Subjects will be recruited using several mechanisms including: 1) promotional flyers e-mailed to members of the marching band (See appendix); 2) the marching band Facebook group; and 3) oral announcement announcements at drum major auditions. An orientation session will be held for potential subjects to familiarize them with procedures, explain what will be done during the study, and answer any questions about the study. All subjects will provide written informed consent and complete a medical history questionnaire (see appendix) designed to identify any individual who may have medical conditions that would prevent participation in this study.

Procedures/Design. This study has two components. Changes in cardiorespiratory fitness and body composition will be measured before and after the marching band season. Additionally, the quantity and intensity of physical activity that takes place during a typical practice will be determined.

Subjects will report to the Human Performance Laboratory in Independence Square on two occasions for approximately one hour. Pre-season testing will be conducted the week before the URI marching band begins band camp (late August) and post-season testing will be conducted during mid-November. Height, weight, resting heart rate, resting blood pressure percent body fat, and VO_2 max will be determined at both testing sessions.

During the marching band season, the quantity and intensity of physical activity accomplished during a routine band practice will be measured on three occasions using a Suunto heart rate monitor strapped to the chest and a pedometer worn on at the waist. Throughout the study, subjects can go about their normal daily routines.

Measures. During the baseline assessment age, gender, and section of the band the subjects are in will be recorded.

Anthropometrics. Height and weight will be measured without shoes. Height will be measured to the nearest .5 centimeters using a wall mounted stadiometer. Weight will be measured in kilograms to the nearest .1 kilograms using the Bod Pod[®] electronic scale. Body mass index will be calculated using the formula body mass (kg) divided by height (m²).

Maximal exercise testing. All subjects will perform a maximal aerobic capacity test on a treadmill utilizing the Bruce treadmill protocol to measure maximal oxygen consumption (VO_{2max}) (Heyward, 2010). The protocol begins at a speed of 1.7 mph and a 10% grade, with the speed and grade increasing every three minute stage until the subject reaches volitional fatigue. To determine VO_{2max}, expired gases will be analyzed for oxygen and carbon dioxide concentrations and volume using a Parvo Medics metabolic cart calibrated according to manufacturer specifications. Breath-by-breath data will be collected continuously and averaged over 30-second periods. Heart rate will be continuously monitored using a polar heart rate monitor. The rating of perceived exertion will be recorded at each stage using the Borg's 6-20 scale (Borg, 1998). A test will be considered maximal when two of the following four criteria are met: a plateau in the rise of oxygen consumption with a further increase in work, a respiratory exchange ratio value of 1.1 or higher, heart rate within +/- 10 beats per minute of age predicted maximum or an RPE value of 17 or greater.

Body Composition. Percent body fat will be measured whole body air displacement plethysmography (Bod Pod[®] Body Composition System, Life Measurement Instruments Concord, CA).

Physical Activity. Physical activity during marching band practice will be measured using heart rate and steps. Heart rate will be measured using the Suunto heart rate monitor (Suunto Oy, Vantaa, Finland). The monitor is worn around the chest, is lightweight and records heart rate (R-R intervals) at set intervals (eg., 10 second, 30 second, 1 minute). Heart rate will be measured throughout the entire practice and stored in the monitor. At the end of practice, data will be downloaded, and total time spent in moderate (64-76% of maximum heart rate) or vigorous (77-95% of maximum heart rate) intensity exercise will be determined using Suunto One Software. The Digiwalker pedometer, a small device that clips to the waistband, will be used to monitor the number of steps taken during a routine band practice session. Physical activity will be measured during three practices for each subject, and the mean of the three trials will represent the number of minutes doing moderate or vigorous intensity exercise and the number of steps taken during practice.

Statistical Analysis. Means and standard deviations will be calculated for all variables. Changes in cardiorespiratory fitness and body composition will be examined using a paired t-test. A time by group (2 x 3) repeated measures ANOVA will also be used to compare changes in cardiorespiratory fitness and body composition among the three different sections of the band (drumline, brass, woodwinds). The amount of time spent in moderate or vigorous physical activity and the number of steps taken during practice will be compared to national recommendations. ANOVA will be used to determine differences among the three band sections

in the percent of time in their target heart rate zone and step count. Significance levels will be set at $p < 0.05$ level for all analyses. All analyses will be done using SPSS software.

Location/Resources

Reference materials from the University of Rhode Island will be consulted for information on maximal exercise testing, maximal oxygen consumption, body composition, heart rate, pedometers, marching band, physical activity and the Bruce Protocol. Measurement heart rate, blood pressure, height, weight, maximal oxygen consumption, and body composition will take place at the Human Performance Laboratory in Independence Square at the University of Rhode Island, Kingston Campus. Measurements of physical activity (heart rate, step count) will take place at the practice field at the Fine Arts Center at the University of Rhode Island, Kingston Campus. Statistical analysis will be performed using the computers in the Human Performance Laboratory in the Department of Kinesiology. Laboratory and other supplies will be funded by the Honors Program grants and the Department of Kinesiology. The Director of the URI Marching Band, Dr. Brian Cardany, has provided a letter of support for this study (appendix). Dr. Deborah Riebe will serve as the faculty advisor. Two Graduate Assistants in the Department of Kinesiology will assist with testing.

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APPENDIX

Informed Consent

Medical History

Flyer

Letter of Support

The University of Rhode Island
Department of Kinesiology
25 West Independence Way
Kingston, RI 02881

The Effects of Participation in Marching Band on Physical Activity and Physical Fitness in
College Aged Men and Women

CONSENT FORM FOR RESEARCH

You have been invited to take part in a research project described below. The researcher will explain the project to you in detail. You should feel free to ask questions. If you have more questions later, Dr. Deborah Riebe, the person mainly responsible for this study, will discuss them with you. You must be at least 18 years old to be in this research project.

DESCRIPTION OF THE PROJECT:

This study examines the effects of participation in marching band on physical fitness. The purposes of this study are: 1) to measure changes in cardiovascular fitness and body composition as a result of being part of the marching band for one season; and 2) to measure how much physical activity occurs during marching band practice.

WHAT WILL BE DONE:

If you decide to take part in this study here is what will happen:

You will visit the Human Performance Laboratory on two separate occasions – once before the marching band season starts and one near the end of the season. Each visit will last approximately one hour. You may not consume any alcohol or drugs or do any type of exercise 48 hours prior to each session. The sessions in the Human Performance Laboratory will consist of the following:

1. **Body Composition Measurements:** The following physical characteristics will be recorded: age, height, and body weight. Your percentage of body fat will be determined by air displacement plethysmography. For this assessment you will be required to sit in the BOD POD™, an enclosed chamber, for two fifty-second measurements. For this test you will need to wear tight clothing and a hair cap.
2. **Maximal Exercise Test:** You will perform a test of maximal exercise test on a treadmill. The test will begin at a slow walking speed (1.7 mph with a 10% grade). The speed and grade of the treadmill will gradually increase until you signal that you can no longer continue. During exercise how much oxygen you use will be measured. You will wear a mouthpiece (like that worn by a scuba diver) connected to a flexible tube during the entire test. Your body's response to exercise will be monitored at regular intervals. Heart rate will be monitored continuously using a heart rate monitor that will be strapped to your chest. You will also be asked how you feel during the exercise session.

In addition to the testing described above, your heart rate and the number of steps you take will be measured during three regular band practices. Your heart rate will be measured by a heart rate monitor strapped to your chest. The heart rate monitor is made up of a small receiver (1 inch by 3 inches) attached to an elastic strap. The number of steps you take will be measured by a very small device that is worn on the waist band of your pants.

RISKS OR DISCOMFORTS:

There are no known risks for the measurements of height, weight, body composition, or heart rate. It is possible that you could slip and fall while running on the treadmill. Technicians will be stationed next to treadmill to give encouragement and remind you to stay in the center of the treadmill and grab onto the support railings if needed.

The maximal aerobic capacity test will be fatiguing. The possibility exists of certain changes occurring during these tests. They include abnormal blood pressure, fainting, dizziness and nausea, disorders of the heart beat and in extremely rare cases (1 in 10,000) heart attack. Every effort will be made to minimize all risks by medical history screening prior to testing and continuously monitoring heart rate throughout the test. All technicians are CPR and AED certified. There is also the possibility that exercise could result in blisters, muscle/tendon/ligament injury or muscle soreness. If you have any difficulty, the exercise will be terminated for that day.

BENEFITS OF THE STUDY

You will receive reports of your personal measurements, including body weight, body mass index, body fat percent, and cardiovascular fitness level.

CONFIDENTIALITY

Your part in the study is confidential. None of the information will identify you by name. All records will be kept in locked FILE CABINET in Dr. Deborah Riebe's office at the University of Rhode Island. The researchers will be the only people to have access to these records.

IN CASE THERE IS AN INJURY TO THE SUBJECT:

If this study causes you any injury, you should write or call Dr Deborah Riebe at the University of Rhode Island at 401-874-5444. You may also call Vice President for Research, 70 Lower College Road, Suite 2, University of Rhode Island, Kingston, RI, at (401) 874-4328.

DECISION TO QUIT AT ANY TIME:

The decision whether or not to take part in this study is up to you. You do not have to participate. If you decide to take part in the study, you may quit at any time. Whatever you

decide will in no way affect your status as a member of the URI Marching Band. If you wish to quit, simply inform Dr. Deborah Riebe (401-874-5444) of your decision. .

RIGHTS AND COMPLAINTS

If you are not satisfied in any way with this study is performed, you may discuss your complaints with Dr. Deborah Riebe at (401-874-5444) or with Kristen Leander (860)836-4823 or Joseph Vallee (401)368-7607, anonymously if you choose. In addition, if you have questions about your rights as a research participant, you may contact the office of the Vice President for Research, 70 Lower College Road, Suite 2, University of Rhode Island, Kingston, RI, at (401) 874-4328.

You have read the Consent Form. Your questions have been answered. Your signature on this form means that you understand the information and you agree to participate in this study.

Signature of Participant

Signature of Researcher

Typed/Printed Name

Typed/Printed Name

Date

Date

Please sign both consent forms, keeping one for yourself

Name _____ Date _____

AHA/ACSM Health/Fitness Facility Preparticipation Screening Questionnaire

Assess your health needs 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 **Other health issues**
- Heart failure
- You have diabetes
- Heart transplantation
- You have or asthma other lung disease.
- Congenital heart disease
- You have burning or cramping in your lower legs when walking short distances.

Symptoms

- You have musculoskeletal problems that limit your
 - You experience chest discomfort with exertion. physical activity.
 - You experience unreasonable breathlessness.
 - You have concerns about the safety of exercise.
 - You experience dizziness, fainting, blackouts. You take prescription medication(s).
 - You take heart medications.
 - You are pregnant.
-

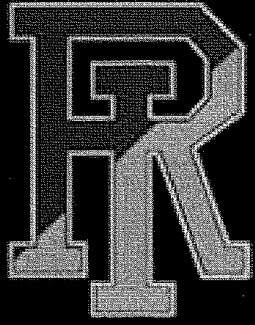
Cardiovascular risk factors

- You are a man older than 45 years.
- You are a woman older than 55 years, you have had a hysterectomy, or you are postmenopausal.
- You smoke, or quite within the previous 6 mo.
- Your BP is greater than 140/90.
- You don't know your BP.
- You take BP medication.
- Your blood cholesterol level is >200 mg/dL.
- You don't know your cholesterol level.

- You have a close blood relative who had a heart attack before age 55 (father or brother) or age 65 (mother or sister).
 - You are physically inactive (i.e., you get less than 30 min. of physical activity on at least 3 days per week).
 - You are more than 20 pounds overweight.
-

None of the above is true.

Balady et al. (1998). AHA/ACSM Joint Statement: Recommendations for Cardiovascular Screening, Staffing, and Emergency Policies at Health/Fitness Facilities. *Medicine & Science in Sports & Exercise*, 30(6). (Also in: ACSM's Guidelines for Exercise Testing and Prescription, 7th Edition, 2005. Lippincott Williams and Wilkins <http://www.lww.com>)
www.acsm-msse.org/pt/pt-core/template-journal/msse/media/0698c.htm

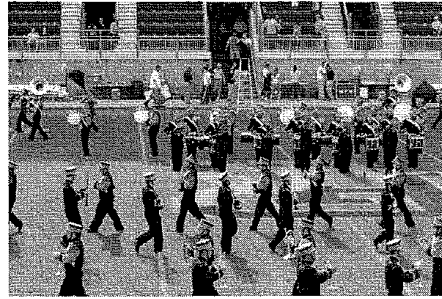


Marching Band Members!
We need you!

Join Our Study!

The Effects of Participation in Marching Band on Physical Activity and Physical Fitness in College Aged Men and Women

Participate in a study designed to find out the fitness levels of marching band members!



WHAT DO YOU HAVE TO DO?:

- Pre and post season maximal treadmill exercise test
- Pre and post season body composition measurement

- Heart rate measurements during 3 practice
- Step count during 3 practices

HOW MUCH TIME WILL IT TAKE?: Two One Hour Appointments in the Kinesiology Department in Independence Square (behind Boss Arena). Other measurements are taken during three routing practice sessions.

WHEN?

Orientation sessions will be held in Spring 2012. The study will take place during the Marching Band season in Fall 2012.



QUESTIONS?

Contact Joe Vallee or Kristen Leander for more information or to enroll in the study!

Joe Vallee
Phone: 860-836-4823
E-mail: kristen_leander@my.uri.edu

Kristen Leander
Phone: 860-836-4823
E-mail: kristen_leander@my.uri.edu



Permission Statement

Dear Dr. Riebe, Kristen Leander and Joseph Vallee,

I, Brian Cardany, director of the URI Marching Band, give my permission that you use marching band members as subjects in this research study. It will be interesting to see what kind of results come about and how they relate to physical fitness and activity.

Dr. Brian Cardany

Director of the URI Marching Band

4/5/12

Date