Revisions

1. On the IRB synopsis, number 8, I added the extra benefits of participating in the research.
2. On the flyer, I changed the testing location from Texas State University- San Marcos, to the new testing location at Pure Bikram Yoga’s Downtown location. This will provide less driving for subjects. The facility has given me permission to test here as stated on my letter of support.
3. On the flyer, I deleted the comment about referring friends and family. I think this will make the flyer clearer.

The Cardiopulmonary Benefits of Bikram Yoga

1. A minimum of 30 adult males and females, 18 years of age or older and considered at low risk for atherosclerotic cardiovascular disease based on the American College of Sports Medicine (ACSM) guidelines (ACSM, 2010) will be used as test subjects. Prior physical activity levels or experience with yoga will not be a criterion for inclusion in this study. This study is intended for apparently healthy adults exhibiting no signs or symptoms suggestive of heart, metabolic (diabetes), and pulmonary disease. A comprehensive health-history survey (see appendix A) will be administered to identify volunteers who: 1) have heart disease, diabetes, chronic obstructive pulmonary disease (including severe asthma), 2) have experienced recent musculoskeletal injuries, 3) are pregnant (or think they are pregnant); and 4) have more than one risk factor for atherosclerotic cardiovascular disease. Any subject that falls into one or more of these categories will be excluded from the study.
2. Subjects will be recruited from a 60-day program offered by Pure Bikram Yoga in Austin, Texas. The primary investigator will provide all particpants with a written consent form outlining the procedures for the laboratory tests. Informed consent will be obtained from all participants prior to enrollment into the study. It is important to note that the subjects have voluntarily paid and signed up for the 60-day program. I am merely investigating the pre and post-changes.
3. Subjects will be asked to participate in testing on two separate occasions: a) before starting the 60-day program; and b) within one week of completing the 60-day program. Before each test, subjects will be asked to: 1) drink plenty of fluids over the 24-hour period preceding the test; 2) avoid food, tobacco, nicotine, alcohol, and caffeine for at least 3 hours prior to the test; 3) avoid strenuous physical activity the day of the test; and 4) get at least 6 hours of sleep the night before the test (ACSM, 2010) (see appendix B).

During pre-testing, subjects will complete a consent form (see appendix C) and a short survey (see appendix D) and be measured for height and weight (in light clothing, but without shoes) using a calibrated physician’s scale (Detecto Scale Co., Jerico, New York). After 10 minutes of seated rest, blood pressure (Baumanometer Standby Model, W.A. Baum Co, Inc., Copiague, NY) and resting heart rate (Polar FT4 heart rate monitor, Finland) will be measured while the subject is in a seated position. Then, participants will undergo a battery of pulmonary function tests to measure Forced Vital Capacity (FVC), Forced Expiratory Volume in the first second (FEV1.0), Peak Expiratory Flow Rate (PEFR), Maximum Voluntary Ventilation (MVV), Maximum Expiratory Pressure (MEP), and Maximum Inspiratory Pressure (MIP). FVC, FEV1.0, and PEFR will be administered in the seated position to minimize any risk of fainting according to the guidelines of the American Thoracic Society/European Respiratory Society (ATS/ERS) guidelines (Miller et al., 2005). MVV will be administered in the standing position after 3 good FVC, FEV1.0, and PEFR trials have been attained (Miller et al., 2005). Prior to both tests, the administrator will demonstrate the technique for the subject. A nose clip will be placed on the subject and the subject will be instructed to make an airtight seal around the hand-held spirometer and not to block the spirometer with the tongue. The subject will perform at least three normal tidal breaths. When ready, the administrator will tell the subject to begin. For FVC, FEV1.0, and PEFR testing, subjects will be instructed to inhale as quickly and deeply as possible followed by a forceful exhalation for at least 6 seconds. The subject will be instructed to maintain an upright posture. There will be one to two minutes of rest between each trial and the best trial will be collected for data. For the MVV test, subjects will be instructed to inhale and exhale as quickly and rapidly as possible for 15 seconds. The best 12 seconds of data will be recorded. Two minutes of rest will be given between trials.

MEP and MIP will be measured next with the subject in a seated position according to the ATS/ERS Statement on Respiratory Muscle Testing (ATS/ERS, 2002). The test administrator will first demonstrate how the subject will perform the MIP and MEP tests. The subject will make an airtight seal around the Vacumed respiratory force pressure gauge (model number 1505-120, Ventura, CA). MIP will be recorded from residual volume and MEP will be recorded starting at total lung capacity (TLC). Subjects will need to sustain each effort for at least 1 second. One to two minutes of rest will be given between trials and the maximum value of three maneuvers that vary less than 5% will be recorded. Throughout all testing, enthusiastic coaching will be given.

Maximal oxygen consumption (VO2max) and maximal heart rate (HRmax) will be measured using a graded exercise test on a Monark Ergomedic 894E stationary bike. After a 3-5 minute warm-up period, the exercise test will begin at 60 W and the subjects will maintain a 60 revolution•min-1 (rpm) pace. Every two minutes, work will be increased by 30 W for males and 15 W for females. Heart rate will be measured by the Polar FT4 heart rate monitor. Expired air will be analyzed throughout the tests with a PARVO Medics metabolic analyzer (Salt Lake City, UT). VO2, VCO2, and respiratory exchange ratio (RER) will be determined from 60-second averages. Heart rate will be recorded at the end of each minute. Calibration will be performed before each test using a certified gas mixture (O2= 16% and CO2= 4%, Scott Medical Products, Plumsteadville, PA). Peak VO2 will be considered VO2max if either VO2 levels off with an increase in workload or age-predicted maximal heart rate (206.9- (.67\*age)) is achieved and the RER exceeds 1.15 (McArdle, Katch, & Katch, 2010). If VO2max is not achieved, then subjects will be asked to return 48 hours later for re-testing. These procedures will be repeated within one week of the end of the 60-day program.

All subjects will complete 60-days of Bikram Yoga between the dates of January 1st and March 13th at Pure Bikram Yoga, a studio certified by the Bikram Yoga College of India. Each 90-minute session will consist of a set series of 26 postures performed in a heated (105°F) and humidified (40% relative humidity) studio. All classes will be taught by a Bikram yoga certified instructor. The first 60 minutes of class will consist of standing and balance poses, and the last 30 minutes will involve seated poses. For a detailed description of all poses practiced during Bikram yoga, refer to Bikram’s Beginning Yoga Class (Choudhury, 2000). All postures will be performed twice.

Attendance will be tracked using a sign-in sheet (see Appendix E). To be included in final data analysis, subjects must attend a minimum of 48 classes (80% attendance). The subjects’ physical activity and diet outside of Bikram yoga will not be monitored, but they will be asked to maintain diet and refrain from participating in any other forms of exercise.

1. Injuries to healthy subjects during exercise testing are uncommon. However, the chance for injury is acknowledged and precautions will be taken to prevent injuries. There exists the possibility of adverse changes during the exercise testing. These changes could include abnormal blood pressure, fainting, disorders of heart rhythm, stroke, and very rare instances of heart attack or even death. There is the possibility of dizziness and nausea immediately following the exercise performances. Also, there is the possibility of muscle strain. Muscle soreness may be present for 24-48 hours following the exercise tests.
2. A comprehensive health-history survey (see appendix A) will be administered to identify volunteers who: 1) have heart disease, diabetes, chronic obstructive pulmonary disease (including severe asthma), 2) have experienced recent musculoskeletal injuries, 3) are pregnant (or think they are pregnant); and 4) have no more than one risk factor for atherosclerotic cardiovascular disease. This questionnaire will be completed and reviewed before the first day of testing. If a medical emergency occurs during testing, emergency services will be contacted. The primary investigator will assist with all emergency situations until EMS arrives on scene. If a minor emergency occurs, the laboratory is located in the same building as the Athletic Training Lab with on-site accredited Athletic Trainers available to provide support if needed. The primary investigator also has certification in CPR and has experience working with research conducted by other professors in the Health and Human Performance Department at Texas State University.
3. Participation in the program will help the subject gain knowledge of their exercise capacity in relation to the general population and a better understanding of their level of fitness for certain sports and recreational activities. This knowledge may aid in planning a future physical conditioning program or in evaluating the effects of recent physical activity habits. The subject will also gain a better understanding of their pulmonary ventilation and be able to see the improvements after yoga training. The results of this study may also help promote Bikram yoga in the medical/exercise community if we find that Bikram yoga significantly improves aerobic fitness and/or pulmonary function.
4. No compensation will be given for participation.
5. Although there is a chance for injury involved in all exercise testing, the potential benefits of this study may help other members of the general public decide if Bikram yoga is an effective exercise. Participation in the program will also help the subject gain knowledge of their exercise capacity in relation to the general population. They will also gain a better understanding of their level of fitness. This knowledge may aid in planning a future exercise program. The subject will also gain a better understanding of their pulmonary ventilation and be able to see the improvements after yoga training.
6. All testing and training will take place at Pure Bikram Yoga in Austin, Texas. Appendix F shows the approval letter from Pure Bikram Yoga.
7. This study will help fulfill the requirements to attain a master’s degree in Exercise Science at Texas State University-San Marcos. This project is sponsored by Dr. Lisa Lloyd in the Department of Health and Human Performance.
8. Appendix G
9. Not applicable
10. The results of this study will be available to the Texas State University-San Marcos community. If published, the results will become available to the public.

References

American College of Sports Medicine. (2010). *Guidelines for Exercise Testing and Prescription* (8th ed.). Philadelphia: Lippincott, Williams and Wilkins.

American Thoracic Society/European Respiratory Society. (2002). ATS/ERS statement on respiratory muscle testing. *American Journal of Respiratory and Critical Care Medicine*, 166, 518-624. doi: 10.1164/rccm.166.4.518

Choudhury, B. (2000). *Bikram’s beginning yoga class* (2nd ed.). New York: Penguin Putnam Inc.

McArdle, W.D., Katch, F.I., & Katch, F.I. (2010). Individual differences and measurement of energy capacities. *Exercise physiology: Nutrition, energy, and human performance* (7th ed.) (pp. 225-247). Baltimore, MD: Lippincott Williams & Wilkins.

Miller, M.R., Hankinson, J., Brusasco, V., Burgos, F., Casaburi, R., Coates, A., et al. (2005). Standardisation of Spirometry. *European Respiratory Journal* 26: 319–338. doi: 10.1183/09031936.05.00034805

**Appendix H- Flyer to Recruit Subjects for Testing**

