

UNIVERSITY OF WISCONSIN-LA CROSSE

Graduate Studies

TURN IT ON: RELATIVE EXERCISE INTENSITY AND CALORIC EXPENDITURE
OF QIDANCE

A Manuscript Style Thesis Submitted in Partial Fulfillment of the Requirements for the
Degree of Master of Science in Clinical Exercise Physiology

Megan E. Buermann

College of Science and Health
Clinical Exercise Physiology

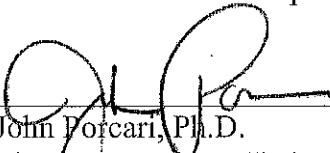
December, 2012

TURN IT ON: RELATIVE EXERCISE INTENSITY AND CALORIC EXPENDITURE
OF QIDANCE

By: Megan Buermann


We recommend acceptance of this thesis in partial fulfillment of the candidate's requirements for the degree of Master of Science in Clinical Exercise Physiology.

The candidate has completed the oral defense of the thesis.



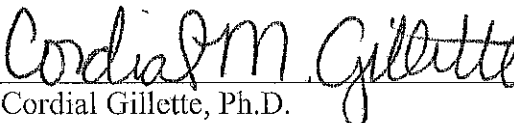
John Forcari, Ph.D.
Thesis Committee Chairperson

4/26/12
Date



Carl Foster, Ph.D.
Thesis Committee Member

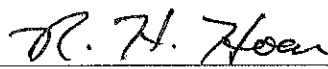
4/26/12
Date



Cordial Gillette, Ph.D.
Thesis Committee Member

4/26/12
Date

Thesis Accepted



Robert H. Hoar, Ph.D.
Associate Vice Chancellor for Academic Affairs

5/22/2012
Date

ABSTRACT

Buermann, M.E. Turn It On: Relative exercise intensity and caloric expenditure of QiDance. MS in Clinical Exercise Physiology, December 2012, 51pp. (J. Porcari)

Popular trends in aerobic group classes have emerged over the years. The recent increase in group classes attracts individuals who are exploring other types of exercise that are fun but also provide an adequate workout. The purpose of this study was to determine the relative exercise intensity and caloric expenditure of QiDance in relation to recommended ACSM guidelines. Twenty apparently healthy, college-aged females completed an incremental treadmill test to determine HR_{max} and VO₂_{max}. An individual HR-VO₂ relationship was established for each subject based upon the treadmill test. After treadmill testing, subjects completed a 52-minute QiDance session. HR responses during each minute of the QiDance class were used to estimate VO₂ and caloric expenditure. HR responses during the QiDance class averaged 82% (± 7.5) of HR_{max}. Estimated VO₂ during the QiDance class averaged 69% (± 69) of VO₂_{max}. Estimated caloric expenditure averaged 8.3 (± 0.99) kcal/min, or 433 (± 76.0) total kcal for the 52-minute class. QiDance meets ACSM guidelines for exercise intensity and caloric expenditure during an exercise session. This finding confirms that QiDance may be another option for individuals looking for an effective, yet fun workout.

ACKNOWLEDGEMENTS

A lot of hard work was put into this study and it would not have been possible without the help of amazing people.

First and foremost I would like to thank Dr. John Porcari for assisting me with my Masters thesis. You may not believe it, but I never lost faith in Batuka. Your humor and camaraderie have been an integral part throughout this entire process. I couldn't have made it this far without your guidance and I truly appreciate it.

Secondly I would like to thank my thesis committee, Dr. Carl Foster and Dr. Cordial Gillette. Thank you for being a part of this study. I'm grateful for all that you have done to helping me succeed.

I would like to recognize the incredible individuals in the Human Performance Laboratory who were always there to lend a helping hand. Chris Dodge, thank you for being our saving grace when things went haywire with those pesky metabolic machines. Giancarlo Condello, a huge thanks for always being there during my testing and the QiDance trials. Your friendship has been a great support during this year.

I would also like to thank ACE and everyone who made the QiDance study possible including our QiDance instructor, Jamie Smith. The energy and enthusiasm Jamie brought to the QiDance class was imperative to the success of this study.

To all my subjects, without you this would not have been possible. I can't thank you enough for putting up with all my emails and scheduling in the extra time to participate in my study.

Last but not least I want to thank my classmates for always being there to support one another. You have been my La Crosse family this past year and I love you all!

TABLE OF CONTENTS

	PAGE
LIST OF FIGURES.....	vi
LIST OF APPENDICES.....	vii
INTRODUCTION.....	1
METHODS.....	5
Subjects.....	5
Procedures.....	5
Statistical Analysis.....	9
RESULTS.....	10
Table 1. Descriptive Characteristics of the Study Subjects (N=20).....	10
Table 2. Average Exercise Responses to the QiDance Class.....	11
DISCUSSION.....	13
REFERENCES.....	18
APPENDICES.....	20

LIST OF FIGURES

FIGURE	PAGE
1a. HR-VO ₂ Regression Line Between Treadmill and QiDance for Subject 1.....	6
1b. HR-VO ₂ Regression Line Between Treadmill and QiDance for Subject 2.....	7
1c. HR-VO ₂ Regression Line Between Treadmill and QiDance for Subject 3.....	7
2. Sample Graded Exercise Treadmill HR-VO ₂ Linear Regression Line.....	9
3. Minute-by-minute HR Responses to the QiDance Class.....	11
4. Minute-by-minute VO ₂ Responses to the QiDance Class.....	12
5. Average % of HRmax of Various Forms of Aerobic Group Exercise.....	15
6. Average Energy Expenditure of Various Forms of Aerobic Group Exercise.....	16

LIST OF APPENDICES

APPENDIX	PAGE
A. Informed Consent.....	21
B. PAR-Q.....	24
C. Data Sheet.....	26
D. Photos of QiDance Class.....	28
E. Review of Literature.....	30

INTRODUCTION

Aerobic dance was developed in 1969 by Jacki Sorenson as an alternative to conventional types of exercise such as jogging or walking. Aerobic dance incorporates choreographed routines set to music and includes various movements that target both the upper and lower body muscle groups, thus providing an entire body workout (Foster, 1975; Rixon, Rehor & Bembem, 2006). ACSM has established guidelines to promote cardiovascular fitness. It is recommended that during an aerobic exercise session for apparently healthy adults, exercise intensity should be in the ranges of 64/74-94% of HRmax and 40/55-85% of VO₂max (ACSM, 2006). To maintain or lose weight, it is recommended to burn on average 1,500 or more calories per week, which is 300 kcal per exercise session when exercising five times a week (ACSM, 2010). Since exercise is so beneficial to overall health, it is not only important to incorporate physical activity daily, but to have fun while doing it.

A number of studies have examined the physiological responses to aerobic dance as well as other types of group fitness classes. Foster (1975) documented that the intensity of an aerobic dance routine corresponded to 77% of VO₂max, suggesting that aerobic dance could improve cardiorespiratory endurance. Milburn and Butts (1983) compared the training responses to 7 weeks of aerobic dance or jogging in college-aged females. Both exercise groups demonstrated significant improvements in VO₂max from the beginning to the end of training. Relative VO₂max increased by 10% in the aerobic dance group and by 8% in the jogging group. It was concluded that aerobic dance elicits

very similar cardiorespiratory responses to jogging and may be a more attractive mode of exercise for individuals who are seeking variety in their workouts.

Berry et al. (1992) investigated the cardiorespiratory responses of two forms of aerobic dance compared to treadmill running. Subjects participated in three submaximal exercise sessions, each lasting 20 minutes in duration. The three different exercise sessions included running on a treadmill, an aerobic dance session with dynamic arm movements above the head, and an aerobic dance session with arms positioned below the shoulders. Exercise intensity during treadmill running, aerobic dance with arms above head, and aerobic dance with dynamic arm movements below shoulders were 50.9%, 52.4%, and 50.6% of VO_{2max} , respectively. The results of the study suggested that aerobic dance, with arm movements above the head and below the shoulders, elicit similar physiological responses compared to treadmill running.

Grant et al. (1993) studied the physiological responses to an aerobic fitness class called 'popmobility'. Popmobility is an exercise session performed to music that includes 20 minutes of aerobic dance, followed by 5 minutes of muscular endurance exercises, and 5 minutes of flexibility exercises. The study found that subjects exercised at an average intensity of 76.4% of VO_{2max} and 75.6% of heart rate reserve, respectively. It was concluded that group fitness classes that incorporate aerobic dance meet ACSM guidelines for exercise intensity and are effective at improving aerobic fitness.

Another group fitness class similar to aerobic dance is NIA, which stands for Neuromuscular Integrative Activity (Konemann, Battista & Porcari, 2008). NIA is a program that incorporates modern and jazz dance influences, as well as martial arts, tai

chi, Aikido, tae-kwon-do, and yoga. It was developed in 1983 by Carlos and Debbie Rosas as a more holistic approach to traditional modes of exercise. The philosophy behind NIA is to promote health, not only through the physical domain, but also through the mind and spirit for people of all shapes and sizes (NiaSharing.com, 2008; Nia, 2011). Konemann et al. (2008) examined the acute physiological and psychological responses to a 55-minute NIA class. The study found that average heart rate during the NIA session was 107 bpm, which corresponded to 57% of HRmax. Average oxygen consumption was 32% of VO₂max. Ickler, Battista and Porcari (2008) studied the physiological and psychological responses to 8 weeks of NIA training. There was no significant improvement in VO₂max after 8 weeks of NIA training. There were significant improvements in balance, right trunk rotation, trunk flexion, hip flexion, and hip extension. Both studies concluded that cardiovascular responses to NIA are low relative to ACSM guidelines and although NIA may not improve cardiorespiratory fitness in trained individuals, it may provide additional health benefits such as improved balance and flexibility for individuals who are less fit (Ickler et al., 2008; Konemann et al., 2008).

More recently, a new type of aerobic dance class, Zumba®, has become extremely popular. Zumba® Fitness is a Latin-inspired dance workout that has grown since its origination by Alberto “Beto” Perez in the mid-90’s. Zumba® is currently being taught in more than 110,000 locations in more than 125 countries (Zumba® Fitness, 2011). Luetzgen and Foster (2011) found that heart rate during a 40-minute session of Zumba® averaged 154 bpm, which corresponded to 80% of HRmax. Oxygen consumption averaged 64% of VO₂max. Additionally, subjects expended an average 378 kcal (9.5 kcal/min) for the 40-minute Zumba® session. Thus, it was concluded that

Zumba® meets ACSM guidelines for improving cardiorespiratory endurance as well as guidelines for the control of body composition (Luetzgen & Foster, 2011).

Similar to Zumba®, QiDance is becoming popular as a new style of aerobic dance (Qignition, 2012). QiDance is a new fitness trend that focuses on energizing workouts set to pre-choreographed routines. QiDance is one component of the fitness company known as Qignition which focuses on fitness and wellness. Its philosophy is to “ignite people’s vital energy to improve their quality of life” (Qignition, 2012).

Qignition, which recently changed its name from Batuka in 2012, was developed by Kike Santander, a multi-Grammy winning recording artist (MSN Malaysia Life & Style, 2011). Qignition utilizes original music from different cultures created by Kike for pre-choreographed QiDance routines (Qignition, 2012). Since QiDance has emerged on the fitness scene, there is no previous research on the effectiveness of QiDance as an exercise program. Thus, the purpose of this study was to research the relative exercise intensity and caloric expenditure of QiDance relative to ACSM guidelines.

METHODS

Subjects

The subjects for this study included 20 apparently healthy, college-aged females (18-25 years of age) recruited from the University of Wisconsin – La Crosse. Subjects were relatively fit (e.g. exercised at least three times per week on a regular basis) and had participated in aerobic dance classes before so that they were familiar with the format of an aerobic dance exercise session. Subjects were recruited through email and oral invitations by the investigator. After approval from the University of Wisconsin – La Crosse Institutional Review Board for the Protection of Human Subjects, subjects provided written informed consent and completed the PAR-Q pre-exercise questionnaire before testing.

Procedures

Prior to testing, pilot tests were conducted on three subjects to determine if the HR-VO₂ relationship during treadmill testing is representative of the HR-VO₂ relationship during a QiDance workout. Subjects performed a graded exercise test utilizing a modified Balke protocol with subjects walking/running at a self-selected speed. Treadmill grade started at 0% and increased by 2.5% every two minutes until the subject reached volitional exhaustion. Respiratory gas exchange was measured utilizing open circuit spirometry (Parvo Metabolic System, Parvo Medics Inc., Sandy, UT). Ratings of perceived exertion (RPE) and HR were recorded every two minutes utilizing the 6-20 Borg scale and radiotelemetry, respectively. Individual HR-VO₂ regression

equations were developed for each subject utilizing the HR and VO₂ responses during the last 30 seconds of each stage during the incremental treadmill test. Subjects also performed a QiDance workout utilizing videos of easy, intermediate, and hard dance routines, while HR and VO₂ were recorded. Figures 1a-c represent the HR-VO₂ regression lines comparing the treadmill test and QiDance for the three pilot subjects. Based upon the pilot study, it was concluded that the HR-VO₂ relationship during the simulated QiDance workout was comparable to the HR-VO₂ relationship during treadmill exercise. Thus, subjects only needed to perform a graded treadmill test in the laboratory to establish the subjects own individual HR-VO₂ regression line to estimate VO₂ and caloric expenditure based upon HR responses during the QiDance workout.

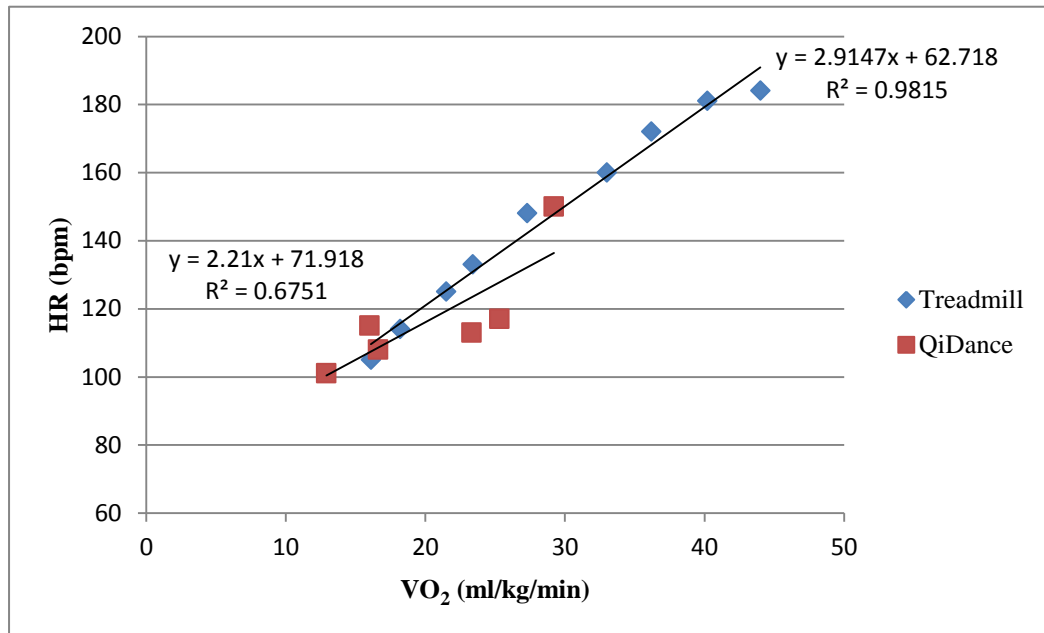


Figure 1a. HR-VO₂ regression line between treadmill and QiDance for subject 1.

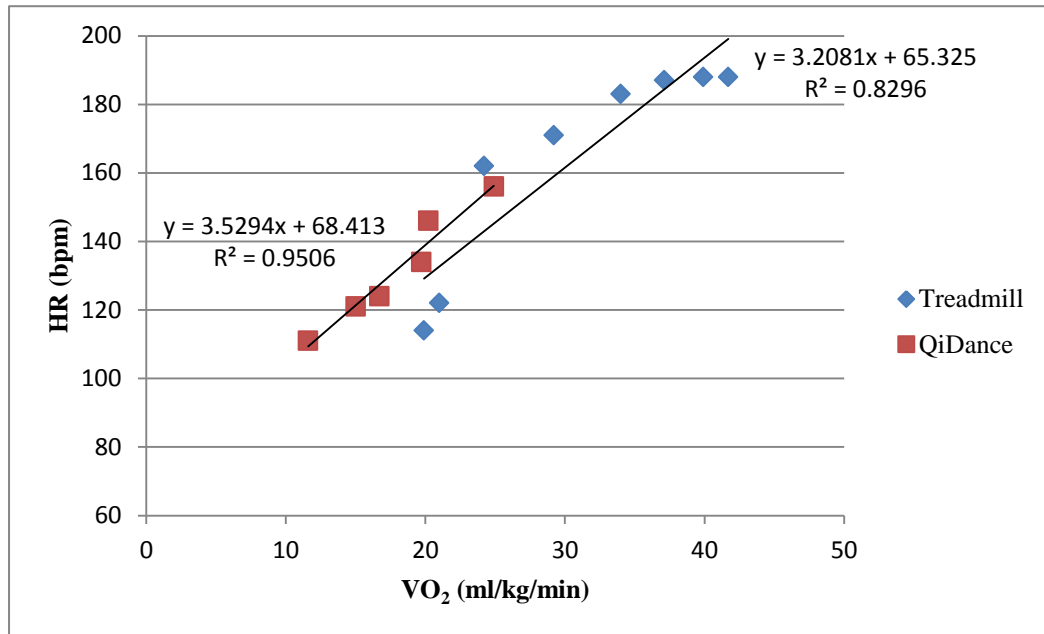


Figure 1b. HR-VO₂ regression line between treadmill and QiDance for subject 2.

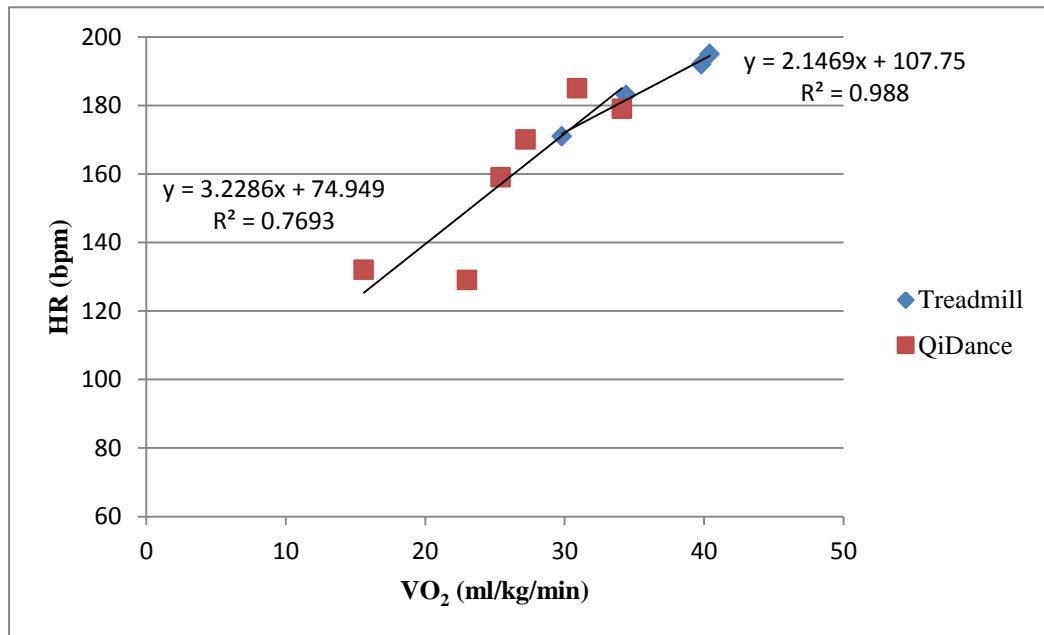


Figure 1c. HR-VO₂ regression line between treadmill and QiDance for subject 3.

Subjects in the research study performed two exercise tests; a maximal oxygen consumption test ($VO_2\text{max}$) in the Human Performance Laboratory and an instructor lead QiDance dance class in the Recreational Eagle Center at the University of Wisconsin – La Crosse. The $VO_2\text{max}$ test was completed on a treadmill using the same modified Balke protocol as the pilot study to determine individual HR- VO_2 relationship for each subject.

After treadmill testing, subjects were given a QiDance DVD to practice the aerobic routine at least three times prior to the QiDance test. All 20 subjects completed a 52-minute QiDance session and were required to attend one class over a two day period. Polar heart rate monitors were worn by all subjects during the QiDance workout. Session RPE was recorded at the end of the QiDance class utilizing the Borg 6-20 scale. HR responses during the QiDance class were downloaded onto Polar computer software. HR at each minute during the QiDance exercise session replaced the “X” in the graded exercise test treadmill regression line equation to estimate VO_2 and energy expenditure. Figure 2 demonstrates the HR- VO_2 regression line for a sample subject.

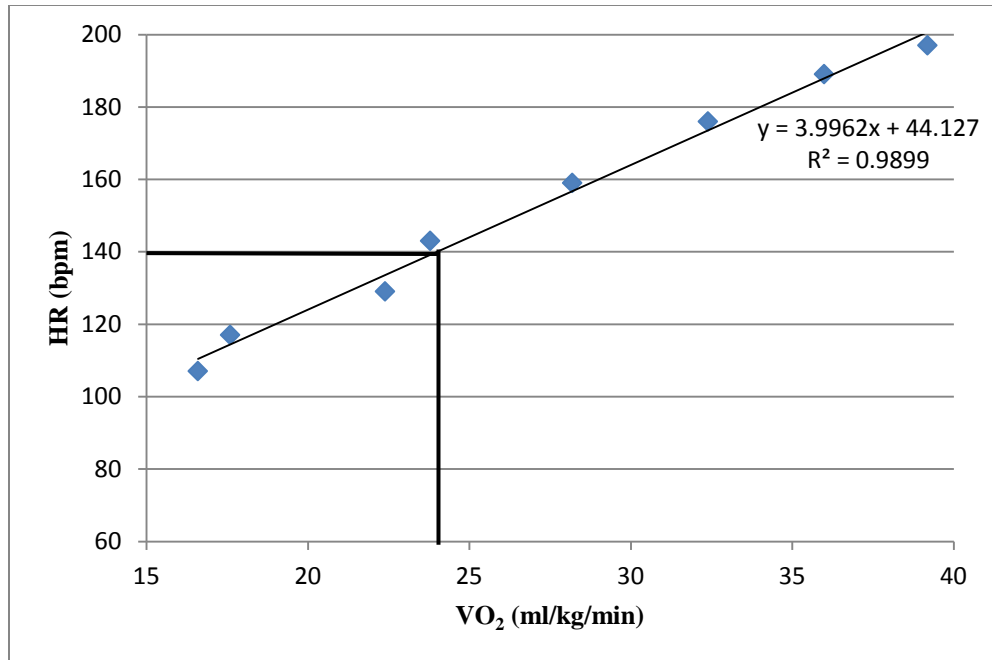


Figure 2. Sample graded exercise treadmill HR-VO₂ linear regression line.

Statistical Analysis

Statistical analysis included standard descriptive statistics to characterize the subjects as well as to determine exercise intensity and energy expenditure of participation in a QiDance exercise session. Energy expenditure was calculated assuming that 1.0 L/min of oxygen consumed is equivalent to 5 kcal/min.

RESULTS

All 20 subjects completed the preliminary VO₂max treadmill test as well as a 52-minute QiDance group exercise class. Descriptive characteristics of the 20 subjects are presented in Table 1.

Table 1. Descriptive characteristics of the study subjects (N=20).

	Mean ± SD	Range
Age	21.2 ± 1.87	18 - 25
Weight (kg)	59.5 ± 7.08	48.2 - 80.9
Height (cm)	163.7 ± 3.97	159 - 173
BMI	22.2 ± 2.46	19.1 - 29.3
VO ₂ max (ml/kg/min)	41.0 ± 4.49	34.9 - 53.3
HRmax (bpm)	192 ± 6.9	180 - 205

The average heart rate, VO₂ and metabolic responses to the QiDance group exercise class are presented in Table 2. Average HR values for the 52-minute QiDance class were between 68 – 95% of HRmax. Average predicted VO₂ was between 47 – 91% of VO₂max. Average kcals/min were between 5.9 – 11.4 kcals/min. Average METS were between 5.2 – 10.4. Average session RPE was 12 – 16. Minute-by-minute HR and VO₂ are presented in Figure 3 and Figure 4, respectively.

Table 2. Average exercise responses to the QiDance class.

	Mean \pm SD	Range
Heart rate (bpm)	158 \pm 10.4	126 - 188
% HRmax	82 \pm 7.5	68 - 95
Predicted VO ₂ (ml/kg/min)	28.2 \pm 3.36	18.1 - 36.3
% VO ₂ max	69 \pm 12.6	47 - 92
METS	8.1 \pm 0.96	5.2 - 10.4
Kcal/min	8.3 \pm 0.99	5.9 - 11.4
Kcal/total	433 \pm 76.0	306 - 591
Session RPE	14.0 \pm 0.89	12 - 16

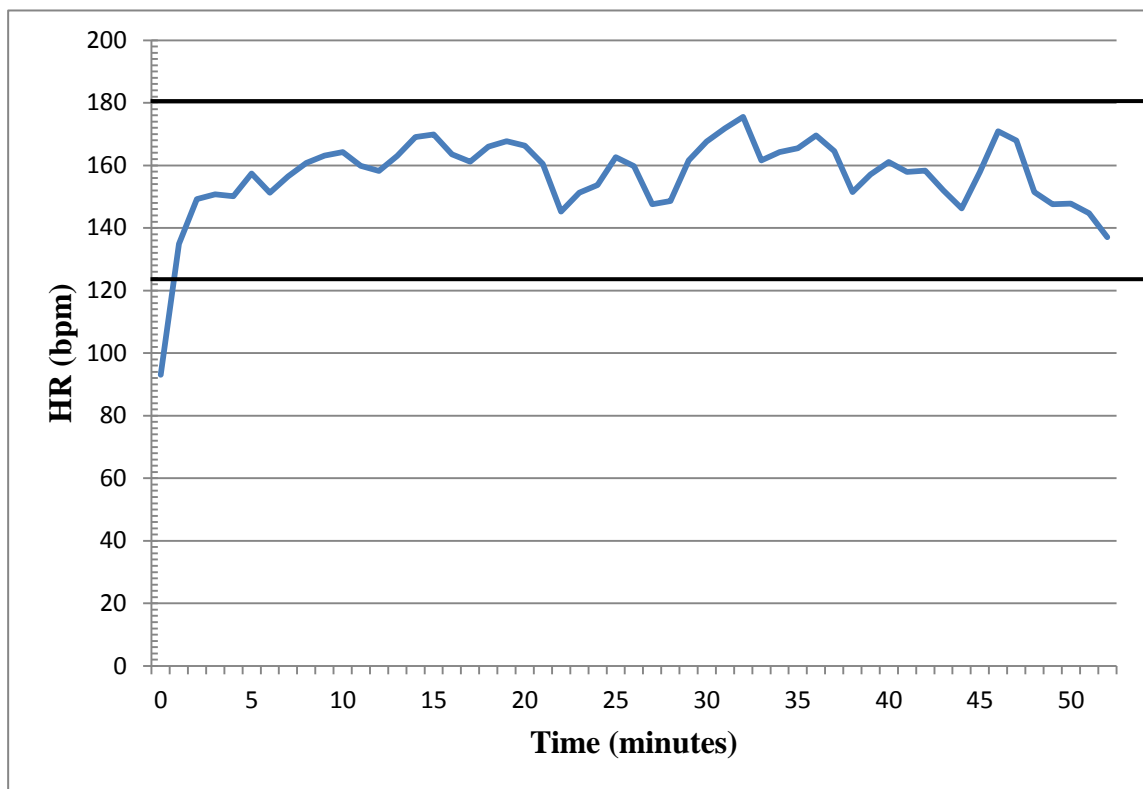


Figure 3. Minute-by-minute HR responses to the QiDance class. The shaded area represents 64 - 94% of average HRmax (ACSM, 2006).

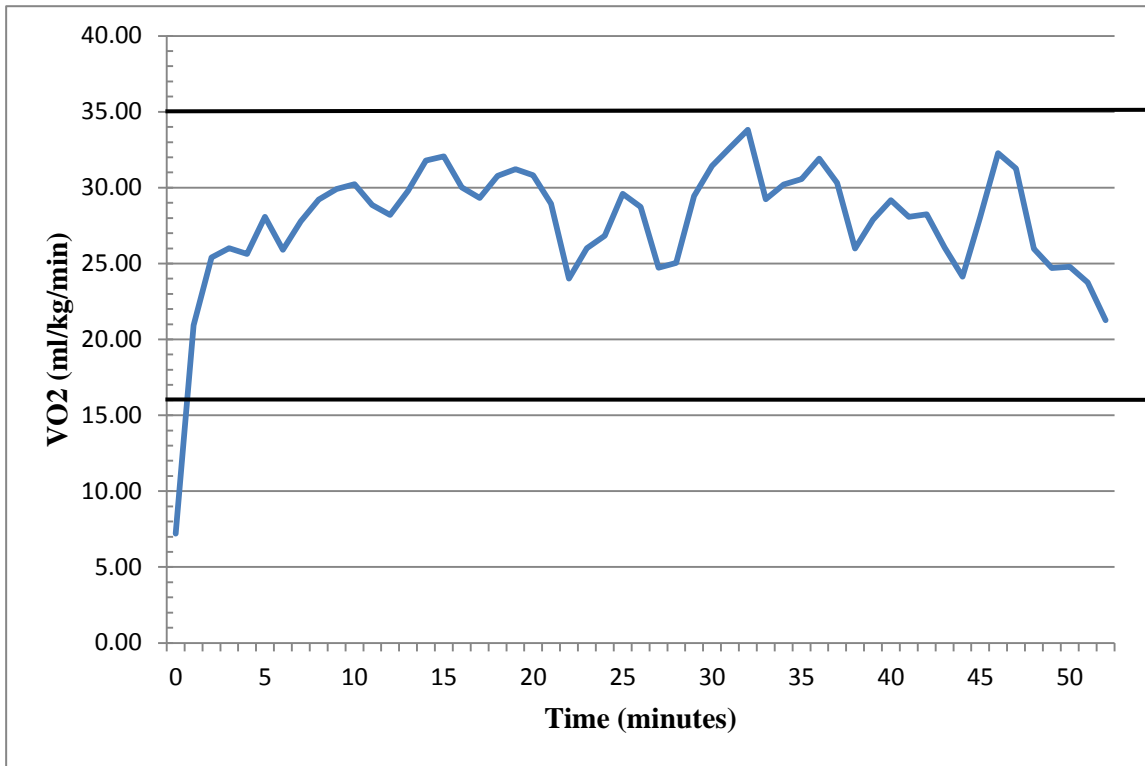


Figure 4. Minute-by-minute VO₂ responses to the QiDance class.
The shaded area represents 40 - 85% of average VO₂max (ACSM, 2006).

DISCUSSION

The purpose of this study was to determine the relative exercise intensity and caloric expenditure of QiDance in relation to recommended ACSM guidelines. To improve cardiovascular fitness, ACSM recommends that apparently healthy adults should exercise between 64/74-94% of HRmax and 40/55-85% VO₂max (ACSM, 2006). In order to maintain or lose weight, it is recommended individuals expend an average of 1,500 or more kcalories per week, which is 300 kcal per exercise session when exercising five times a week (ACSM, 2010). Based upon the above recommendations, the 52-minute QiDance class met ACSM guidelines. Exercise intensity ranged from 68-95% of HRmax and 47-92% of VO₂max with averages of 82% of HRmax and 69% of VO₂max, respectively. The 20 subjects expended between 306-591 kcals during the workout, an average of 8.3 kcal/min. Therefore, QiDance appears to be an effective workout for improving cardiorespiratory fitness, as well as providing weight loss and weight maintenance benefits.

These results indicate that QiDance compares very favorably to other forms of group dance classes. Foster (1975) found that the intensity of an aerobic dance routine corresponded to 77% of VO₂max, suggesting that aerobic dance could improve cardiorespiratory endurance. Grant et al. (1993) studied the physiological responses to an aerobic dance class called 'popmobility'. The study found that subjects exercised at an

average intensity of 76% of VO_2max and 76% of heart rate reserve, respectively.

Subjects expended an average of 7.9 kcals/min.

Other previous studies have also examined the relative exercise intensity of various forms of aerobic group exercise classes. Sutherland et al. (1998) researched the effectiveness of step aerobics and found that subjects performing step aerobics utilizing a 10-inch step exercised at an average exercise intensity of 79% of HRmax and 56% of VO_2max and expended 6.6 kcals/min. It was concluded that step aerobics elicits an appropriate aerobic response that meets ACSM guidelines.

Popular trends in aerobic group classes have emerged over the years. The recent increase in group classes attracts individuals who are exploring other types of exercise that are fun, but also provide an adequate workout. Immel and Porcari (1999) studied the physiological responses of a cardio kickboxing group exercise class. It was found that subjects exercised at an average intensity of 86% of HRmax and 73% of VO_2max , and expended 8.1 kcal/min. It was estimated that including a warm-up and cool-down, a 45-minute cardio kickboxing class would expend approximately 351 kcals. Thus, it was concluded that cardio kickboxing meets ACSM guidelines for exercise intensity and caloric expenditure. In contrast, a study conducted by Koneman et al. (2008) found that NIA group exercise did not meet ACSM guidelines, since subjects only exercised at an average of 57% HRmax and 32% VO_2max , respectively, and expended only 3 kcal/min.

More recently, Zumba® has become a very popular trend in the fitness industry. Luetzgen and Foster (2011) found that a 40-minute Zumba® session provides a workout that averages 80% of HRmax and 64% of VO_2max . Zumba® also expended an average of 9.5 kcal/min, or 378 kcal per 40-minute session.

Figures 5 and 6 provide a comparison of the relative intensity and energy expenditure of various types of aerobic dance and group classes.

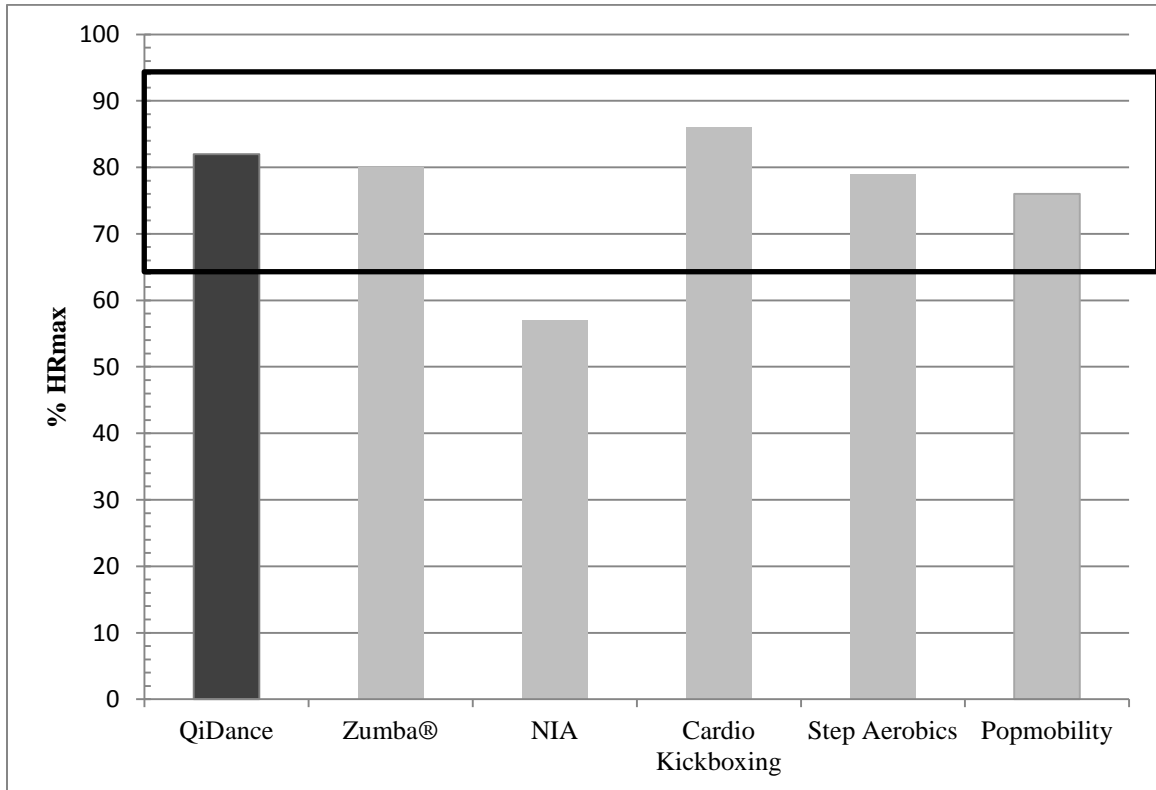


Figure 5. Average % of HRmax of various forms of aerobic group exercise. The shaded area represents 64 - 94% of average HRmax (ACSM, 2006).

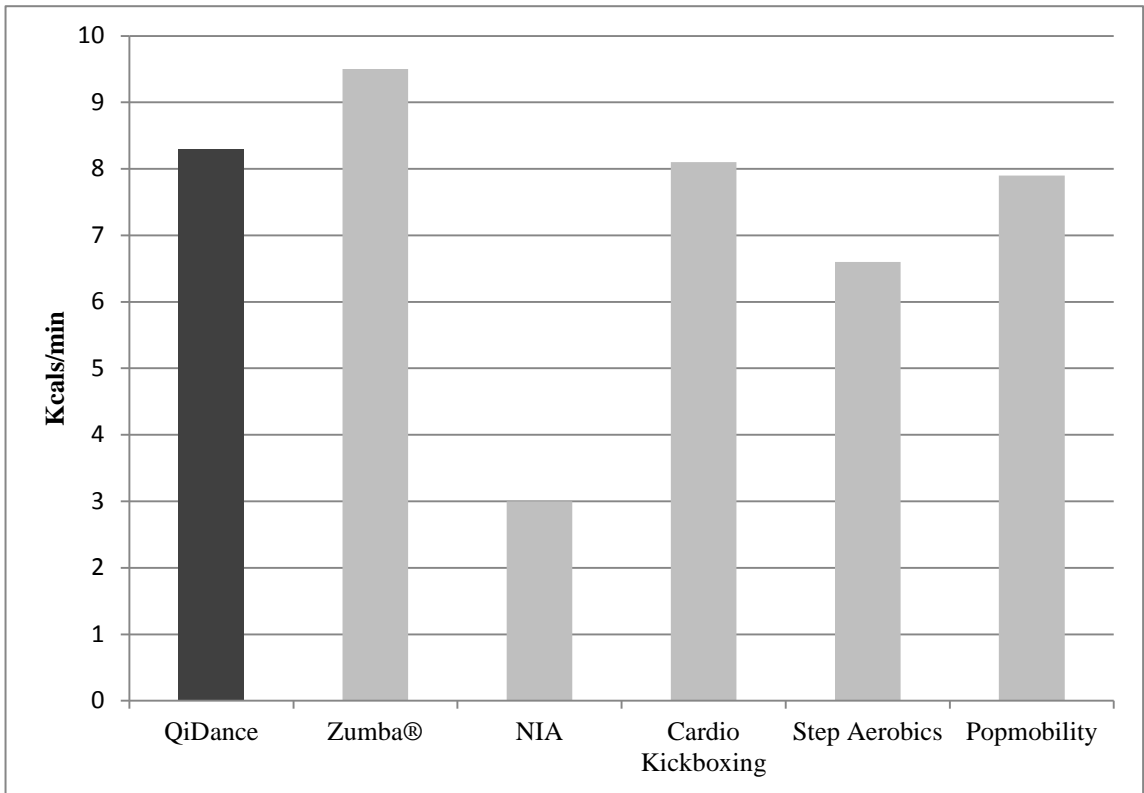


Figure 6. Average energy expenditure of various forms of aerobic group exercise.

Limitations to this study included the inability to directly measure VO_2 during the QiDance workout. It was felt that wearing the portable metabolic equipment would inhibit the subjects from effectively performing the choreographed dance workout. Another limitation was the variation in skill of the participants. Subjects were required to practice the QiDance workout at least three times prior to testing. However, even after practicing, some subjects were more skilled than others, which could have affected HR responses during the test. Additionally, some subjects had more overall experience with aerobic dance classes than others.

This study was actually the first QiDance group class in the United States led by a certified QiDance instructor. As more trends in exercise, particularly group classes

become popular, it is important to investigate the relative exercise intensity of alternative types of aerobic dance. It was found that a single QiDance class meets ACSM guidelines for exercise intensity and caloric expenditure and thus may be another option for individuals looking for an effective, yet fun aerobic workout. Future studies may want to determine the physiological benefits consequent to a 8-12 week period of QiDance training.

REFERENCES

1. American College of Sports Medicine. (2006). *ACSM's Guidelines for Exercise Testing and Prescription*. 7th ed. Baltimore, MA: Lippincott, Williams & Wilkins.
2. American College of Sports Medicine. (2010). *ACSM's Guidelines for Exercise Testing and Prescription*. 8th ed. Baltimore, MA: Lippincott, Williams & Wilkins.
3. Berry, M.J., Cline, C.C., Berry, C.B. & Davis, M. (1992). A comparison between two forms of aerobic dance and treadmill running. *Medicine & Science in Sports & Exercise*, 24(8), 946-951.
4. Foster, C. (1975). Physiological requirements of aerobic dancing. *Res. Quart.* 46, 120-123.
5. Grant, S., Armstrong, G., Sutherland, R., Wilson, J., Aitchison, T., Paul, E. & Henderson, S. (1993). Physiological and psychological responses to a university fitness session. *British Journal of Sports Medicine*, 27(3), 162- 166.
6. Ickler, J., Battista, R. & Porcari, J.P. (2008). *Physiological and psychological benefits consequent to 8 weeks of NIA training*. Unpublished graduate thesis. University of Wisconsin – La Crosse, Department of Exercise and Sport Science.
7. Immel, D.D., Porcari, J.P. (1999). *Physiological responses to cardio kickboxing in females*. Unpublished graduate thesis. University of Wisconsin – La Crosse, Department of Exercise and Sport Science.
8. Konemann, K., Battista, R. & Porcari, J.P. (2008). *The acute physiological and psychological responses to the NIA Technique*. Unpublished graduate thesis. University of Wisconsin – La Crosse, Department of Exercise and Sport Science.

9. Luetzgen, M.L. & Foster, C. (2011). *The physiological effects of participating in a 40-minute Zumba® fitness session*. Unpublished graduate thesis. University of Wisconsin – La Crosse, Department of Exercise and Sport Science.
10. Milburn, S. & Butts, N.K. (1983). A comparison of the training responses to aerobic dance and jogging in college females. *Medicine and Science in Sports and Exercise*, 15(6), 510-513.
11. MSN Malaysia Life & Style. (2011). *Batuka, the new dance craze: Spanish fitness craze shimmies its way to international audience*. Retrieved from <http://lifestyle.malaysia.msn.com/Wellbeing/Fitness/article.aspx?cp-documentid=4757271>.
12. Nia. (2011). *What is Nia?* Retrieved from <http://nianow.com/practice>.
13. NiaSharing.com. (2008). *Nia the Technique*. Retrieved from <http://www.niasharing.com/>.
14. Qignition. (2012). *QiDance*. Retrieved from <http://www.qignition.com/qidance>.
15. Rixon, K.P., Rehor, P.R. & Bemben, M.G. (2006). Analysis of the assessment of caloric expenditure in four modes of aerobic dance. *Journal of Strength and Conditioning Research*, 20(3), 593-596.
16. Sutherland, R., Wilson, J., Aitchison, T. & Grant, S. (1998). Physiological responses and perceptions of exertion in a step aerobics session. *Journal of Sports Sciences*, 17, 495-503.
17. Zumba® Fitness. (2011). *About Zumba® Fitness*. Retrieved from <http://www.zumba.com/en-US/about/>.

APPENDIX A
INFORMED CONSENT

University of Wisconsin – La Crosse
Department of Exercise and Sport Science Informed Consent

Turn It On: Relative Exercise Intensity and Caloric Expenditure of QiDance

Why have you been asked to take part in this research?

The purpose of this study is to determine the exercise intensity and caloric expenditure of QiDance. QiDance is a program that incorporates all aspects of health, focusing on fitness and mental well-being. QiDance, formally known as Batuka, evolved from the Brazilian Batucada, which is a celebration of dance, rhythm, and music. The QiDance program was designed by multi-Grammy winner Kiki Santander, who also provides original music for pre-choreographed QiDance routines. You have been asked to participate in this study because you are a healthy, relatively fit female between the ages of 18 and 25 years.

How many people will be in this study and how long will it last?

There will be approximately 20 subjects participating in this study. You will be required to participate in two different exercise trials, each lasting approximately 1 hour.

What will happen if you agree to be part of this study?

If you agree to participate in this study you will be required to attend two separate exercise sessions.

The first trial will involve an incremental treadmill test to determine your maximal aerobic capacity as well as your maximal heart rate. The treadmill speed and grade will start out low and be increased every 2 minutes until you can no longer continue. During the test you will wear a snorkel-like mouthpiece to collect your expired air and a chest strap to measure heart rate.

For the second trial, you will perform a 50-minute instructor-led QiDance session. You will be required to wear a chest strap to measure your heart rate.

What are the possible risk and discomforts associated with this study?

Possible risks include muscle soreness and fatigue which is common when doing any sort of exercise. However, these effects of exercise are temporary and will lessen after a few days. Risk of serious injury or cardiovascular complications (e.g., heart attack, stroke, or death) are extremely rare amongst apparently healthy participants.

What are the possible benefits associated with this study?

Benefits from participation in this study will include gaining knowledge about your personal aerobic fitness level. Your participation in this study will also benefit the researchers in further understanding the relative exercise intensity and caloric expenditure of new trends in aerobic dance, such as QiDance.

Do you have to participate?

Participation in this study is completely voluntary and you may discontinue your participation in this study at anytime without penalty.

What are the costs if any for participation?

There are no costs to you for your participation in this study.

What are the rights and confidentiality during this study?

All data collected during both the incremental treadmill test and the QiDance session will be kept confidential by using number codes for each subject. If this study becomes published or presented, your individual data will not be personally identifiable.

Questions regarding the procedures of this study may be directed to Megan Buermann (320-290-1898), the principal investigator, or her advisor Dr. John Porcari (608-785-8684), a Professor in the Department of Exercise and Sport Science. Questions regarding the protection of human subjects may be addressed to the UW-La Crosse Institutional Review Board for the Protection of Human Subjects (608-785-8124).

Subjects understanding:

Have all your questions regarding how the research study might affect you been answered?

Yes / No (Circle one)

If you are interested in participating in this study, please sign your name below. **You will not be penalized or treated differently for not deciding to participate in this study.**

Participant's Name: _____

Participant's Signature: _____ Date: _____

Researcher's Signature: _____ Date: _____

APPENDIX B

PAR-Q

PAR-Q and YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 to 69, the Par-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly. Check YES or NO.

YES	NO	
<input type="checkbox"/>	<input type="checkbox"/>	1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?
<input type="checkbox"/>	<input type="checkbox"/>	2. Do you feel pain in your chest when you do physical activity?
<input type="checkbox"/>	<input type="checkbox"/>	3. In the past month, have you had chest pain when you are not doing physical activity?
<input type="checkbox"/>	<input type="checkbox"/>	4. Do you lose your balance because of dizziness or do you ever lose Consciousness?
<input type="checkbox"/>	<input type="checkbox"/>	5. Do you have a bone or joint problem (for example, back, neck, knee, or hip) that could be made worse by a change in your physical activity?
<input type="checkbox"/>	<input type="checkbox"/>	6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
<input type="checkbox"/>	<input type="checkbox"/>	7. Do you know <u>any other reason</u> why you should not do physical activity?

**if
you
answered**

YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want—as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful to you.

NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

DELAY BECOMING MUCH MORE ACTIVE:

- If you are not feeling well because of a temporary illness such as a cold or a fever – wait until you feel better; **or**
- If you are or may be pregnant – talk to your doctor before you start becoming more active.

PLEASE NOTE: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informed use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completion of this questionnaire, consult your doctor prior to physical activity.

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

“I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction.”

NAME: _____

SIGNATURE: _____ DATE: _____

SIGNATURE OF PARENT: _____ WITNESS: _____
or GUARDIAN (for participants under the age of majority)

NOTE: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.

ParQ_0805

APPENDIX C

DATA SHEET

Modified Balke Protocol Data Sheet

Subject's Name: _____ Date: _____

I.D. Number: _____ Age: _____ Weight: _____ Height: _____

Stage	Time(min)	Speed(mph)	Grade (%)	HR	VO2	RPE
Resting	0	0	0			
1	0 - 2		0			
2	2 - 4		2.5			
3	4 - 6		5			
4	6 - 8		7.5			
5	8 - 10		10			
6	10 - 12		12.5			
7	12 - 14		15			
8	14 - 16		17.5			
9	16 - 18		20			
10	18 - 20		20.5			

APPENDIX D
PHOTOS OF QIDANCE CLASS



APPENDIX E
REVIEW OF LITERATURE

REVIEW OF LITERATURE

Numerous health benefits are associated with physical activity (American College of Sports Medicine, 2010). Regular physical activity is associated with lower levels of cardiovascular disease, hypertension, osteoporosis, type 2 diabetes, and obesity. The American College of Sports Medicine (ACSM) and the Centers for Disease Control (CDC) issued physical activity guidelines in 1995 which recommended that “every U.S. adult should accumulate 30 minutes or more of moderate physical activity on most, preferably all, days of the week” (ACSM, 2010). However, sedentary behavior still remains a major issue. New recommendations were issued indicating that healthy adults ages 18 to 65 should participate in 30 minutes of moderate physical activity five days per week or 20 minutes of vigorous activity three days per week. Any increase in physical activity on a weekly basis will likely help prevent or control disease associated with weight gain (ACSM, 2010).

Adoption of a sedentary lifestyle is increasing as new technological advancements emerge; less energy is needed to perform many activities of daily living. Twenty-four percent of adults in the United States reported participating in no leisure-time activity in 2005 (Haskell et al., 2007). Only 49% of adults in the U.S. reported meeting the ACSM recommendations for physical activity in the same year (Haskell et al., 2007). By staying physically active and meeting ACSM guidelines, adults can reduce their risk for developing chronic disease and premature mortality that is associated with a sedentary

lifestyle. Replacing normal sedentary activities with physical activities can be a manageable way to increase energy expenditure and can be a major component of any tactic to lose weight. It is imperative for health professionals to encourage physical activity that is manageable and appealing at the same time (Haskell et al., 2007).

Aerobic dance is often viewed as an enjoyable and innovative substitute to typical types of exercise such as jogging (Rixon, Rehor & Bemben, 2006). With new trends in aerobic dance, it is important to examine the effectiveness of these new modes of exercise. For the purpose of this study, we researched the relative exercise intensity and caloric expenditure of QiDance in relation to ACSM guidelines, and compared QiDance to other previous studies on different types of aerobic dance. Our hypothesis was that the energy cost and intensity of QiDance will meet ACSM guidelines for improving cardiovascular fitness and caloric expenditure.

Development of Aerobic Dance and Associated Benefits

Aerobic dance has become a fun, alternative way to exercise since its origination in 1969 (Rixon et al., 2006). Jacki Sorenson developed “aerobic dancing” as a different form of exercise that incorporates choreographed routines targeting both the upper and lower muscle groups for a total body workout (Foster, 1975). Foster (1975) examined the intensity of aerobic dance and found that it averaged 77% of VO_2 max, which meets ACSM guidelines for exercise intensity. Therefore, an aerobic dance workout, three times a week for an hour session each time, would be an efficient means to improve cardiorespiratory fitness (Foster, 1975).

Milburn and Butts (1983) compared the training responses to 7 weeks of aerobic dance or jogging in college-aged females. Both exercise groups demonstrated significant

improvements in VO_2max from the beginning to the end of training. Relative VO_2max increased by 10% in the aerobic dance group and by 8% in the jogging group. It was concluded that aerobic dance elicits very similar cardiorespiratory responses to jogging and may be a more attractive mode of exercise to individuals who are seeking variety in their workouts.

Berry et al. (1992) conducted a study with nine healthy females (25.6 ± 4.6 years of age) who had previously participated in aerobic activities, including aerobic dance or other activities such as swimming, cycling and running. Subjects participated in three submaximal exercise sessions each lasting 20 minutes in duration. The three different exercise sessions included running on a treadmill, aerobic dance session with dynamic arm movements above the head, and an aerobic dance session with arms positioned below the shoulders. Average percentage of VO_2max during treadmill running, aerobic dance with arms above head, and aerobic dance with dynamic arm movements below shoulders were 50.9%, 52.4%, and 50.6% respectively. Average percentage of HRmax for all three submaximal tests was 72% of HRmax . There was no significant difference in exercise intensity based upon % VO_2max or % HRmax between the submaximal tests. The study concluded that aerobic dance, with arm movements above the head and below the shoulders, elicits similar physiological effects in regards to exercise intensity when compared to treadmill running. Thus, aerobic dancing is effective as a mode of exercise to improve cardiovascular fitness.

Grant et al. (1993) studied the physiological responses to an aerobic fitness class called 'popmobility'. Popmobility is an exercise session performed to music that includes 20 minutes of aerobic dance, followed by 5 minutes of muscular endurance

exercises and 5 minutes of flexibility exercises. This study found that subjects exercised at an average intensity of 76.4% of VO_2 max and 75.6% of heart rate reserve, respectively. It was concluded that group fitness classes that incorporate aerobic dance meet ACSM guidelines for exercise intensity and are effective at improving aerobic fitness.

Popular variations of group exercise that have evolved over the years include spinning (indoor cycling), water aerobics, TAEBO, Step, and added resistance aerobics (Pump). Rixon et al. (2006) compared the exercise intensity of Pump, Step, Bodycombat, and spinning classes. Relative exercise intensity based upon exercise heart rates demonstrated that Pump, Bodycombat, Step and spinning all fell within ACSM recommendations for improving cardiorespiratory endurance.

It is also recommended that during an exercise session (30-45 minutes in duration) 5.5-6.6 kcal/minute should be expended to allow for a reduction in body fat. Each of the four aerobic classes tested met this recommendation and are thus potentially useful in reducing body fat. If these classes are incorporated into a regular exercise program at least three times per week, then Pump, Bodycombat, Step and spinning should contribute to weight loss and weight maintenance (Rixon et al., 2006).

More recently, the popularity of aerobic dance as a form of exercise is increasing worldwide. Improvements associated with aerobic dance include cardiorespiratory endurance, agility, flexibility and balance as well as improvements in oxidative stress and the immune system. Leelarungrayub et al. (2011) studied the effects of a 6-week aerobic dance intervention on cardiovascular fitness and blood oxidative stress in 24 sedentary Thai women. There was a significant improvement in VO_2 max for all subjects post-

intervention. After 6 weeks of aerobic dance, markers of oxidative stress, such as malondialdehyde (MDA), which can damage cells and tissues, significantly decreased from pre-intervention. Results also revealed a significant increase in interleukin-2 (IL-2), which seems to relate to T-cell production, which in turn improves the immune system by increasing anti-infection activity. During the study, exercise intensity was moderate, averaging 75% of HRmax. Aerobic dance of longer duration (45-60 minutes) should be promoted as a healthy means of exercise, not only for cardiorespiratory benefits, but for improvements in markers of oxidative stress as well as improvements to the immune system.

ACSM Guidelines for Exercise Prescription and Other Free Range Exercises

ACSM has established guidelines to promote cardiovascular fitness. It is recommended that during an aerobic exercise session for apparently healthy adults, exercise intensity should be in the ranges of 64/74-94% of HRmax and 40/55-85% of VO₂max (ACSM, 2006). To maintain or lose weight, it is recommended to burn on average 1,500 or more calories per week, which is 300 kcal per exercise session when exercising five times a week (ACSM, 2010). Since exercise is so beneficial to overall health, it is not only important to incorporate physical activity daily, but to have fun while doing it. The current investigation of QiDance not only compared the effectiveness of QiDance as an exercise modality to ACSM guidelines for cardiovascular fitness, but also compared QiDance to other popular trends in aerobic exercise, including step aerobics, cardio kickboxing, spinning (indoor cycling), Boot Camp, NIA, Hooping and Zumba®.

Step Aerobics

Sutherland et al. (1998) researched the effectiveness of step aerobics using three various bench heights. The study included 10 healthy females with an average age of 22 years. All subjects who participated in this study had previous experience in step aerobics. A graded exercise test on a treadmill was performed by all subjects to determine maximal oxygen consumption and maximal heart rate. Subjects then completed three step routines at three different step heights 6 inches (15.2cm), 8 inches (20.3cm) and 10 inches (25.4cm). Results from the study revealed that %VO₂max, %HRmax, and caloric expenditure significantly increased as bench height increased. Average %VO₂max achieved during test trials on the 6 inch step, 8 inch step, and 10 inch step were 45.6%, 51.6% and 56.2%, respectively. Average %HRmax during the three step trials for 6 inch step, 8 inch step, and 10 inch step were 70.2%, 75% and 79.3%, respectively. Average total energy expenditure for each step trial which lasted 38.67 minutes in duration was 210 kcals for the 6 inch step routine, 227 kcals for 8 inch step routine and 255 kcals for 10 inch step routine. This study indicates that the responses to step heights of 8 and 10 inches met ACSM criteria for exercise intensity based upon %VO₂max and %HRmax. It's important to note that on average, subject's initial VO₂max averaged 47.7ml/kg/min. Since exercise intensity is dependent upon the initial fitness status of the subject, the 6 inch step may still benefit individuals with a lower aerobic capacity (VO₂max of 26-43 ml/kg/min). Based upon the findings from this study, step aerobics should be efficient to meet ACSM guidelines for the vast majority of individuals.

Cardio Kickboxing

Immel and Porcari (1999) studied the physiological responses of cardio kickboxing. Subjects were 15 healthy females, ranging in age from 21-46 years. Subjects had previous experience in cardio kickboxing and were classified as beginners (1-3 months of cardio kickboxing), intermediates (4-9 months) and advanced (greater than 9 months). Baseline measurements of maximal oxygen consumption and maximal heart rate were obtained from a graded treadmill test. RPE was also recorded following each 3-minute stage of the graded exercise test utilizing the Borg 6-20 scale. The cardio kickboxing class was 45-60 minutes in duration, which included a 10 minute warm up and 10-15 minute cool-down. During the cardio kickboxing class, VO_2 was measured utilizing an Aerosport metabolic analyzer. Heart rate was measured utilizing a Polar XL heart rate monitor and RPE was recorded every 3 minutes during the cardio kickboxing workout. Average heart rate during the cardio kickboxing class was 86% of HRmax. Average oxygen consumption during the cardio kickboxing class was 73% of VO_{2max} . Average caloric expenditure for the cardio kickboxing workout was 8.1 kcal/min. Caloric expenditure was 351 kcals for the 45-minute cardio kickboxing exercise session. The study concluded that cardio kickboxing is a successful exercise modality to improve cardiorespiratory fitness and maintain or lose body weight based upon ACSM recommendations for exercise intensity and caloric expenditure.

Spinning (Indoor Cycling)

Battista et al. (2008) examined the exercise intensity of indoor cycling. Subjects included 20 apparently healthy and physically active females who were experienced in indoor cycling and had previously participated in indoor cycling classes at least twice a

week for at least 2 months prior to the study. Subjects completed three exercise tests. The first test consisted of an incremental maximal exercise test to fatigue. This test was performed on an electronically braked cycle ergometer. Power output, VO_{2max} , ventilatory threshold (VT), respiratory compensation threshold (RCT) and maximal heart rate were measured. Following the maximal exercise test on a cycle ergometer, subjects completed two indoor cycling classes following video instruction. The first class lasted 45 minutes and the second class lasted 35 minutes in duration. During both indoor cycling tests, VO_2 , HR, and rating of perceived exertion (RPE) were measured. Average exercise intensity during the first and second classes were 74% and 66% of VO_{2max} , respectively. Heart rate responses during both indoor cycling classes paralleled VO_2 responses. Results from the study concluded that indoor cycling meets ACSM guidelines for exercise intensity.

Boot Camp

Porcari, Hendrickson and Foster (2008) examined the effectiveness of a 40-minute boot-camp workout. Boot Camp is a type of instructor-led workout that incorporates exercises that are common in Army basic training such as punches, kicks, squat thrusts and push-ups. Six men and six women aged 19-29 years participated in this study. All subjects completed a graded exercise test on a treadmill to determine baseline measurements of maximal oxygen consumption and maximal heart rate. Subjects RPE were recorded utilizing the 6-20 Borg Scale to measure how hard the subjects' felt that they were working. Subjects were given a copy of the Boot Camp DVD workout to familiarize themselves with the choreography prior to testing. Subjects then completed a

40-minute boot camp workout following video instruction while wearing a Cosmed portable analyzer to measure oxygen consumption and energy expenditure during the testing trial. Both heart rate and RPE were measured every 3 minutes throughout the duration of the testing trial. Results from this study indicated that subjects exercised at an average of 77% of HRmax and 62% of VO₂max. On average, approximately 9.8 kcals were expended per minute. Thus for the 40-minute exercise session, subjects expended 400 kcals. The investigation concluded that Boot Camp may be an effective means to improve cardiovascular fitness as well as maintain or lose body weight based upon ACSM guidelines for exercise intensity and caloric expenditure.

NIA

Another group fitness class similar to aerobic dance is NIA, which stands for Neuromuscular Integrative Activity (Konemann, Battista & Porcari, 2008). NIA is a program that incorporates modern and jazz dance influences, as well as martial arts, tai chi, Aikido, tai-kwon-do, and yoga. It was developed in 1983 by Carlos and Debbie Rosas as a more holistic approach to traditional modes of exercise. The philosophy behind NIA is to promote health, not only through the physical domain, but also through the mind and spirit for people of all shapes and sizes (NiaSharing.com, 2008; Nia, 2011). Konemann et al. (2008) examined the acute physiological and psychological responses to a 55-minute NIA class. The study found that average heart rate during the NIA session was 107 bpm, which corresponded to 57% of HRmax. Average oxygen consumption was 32% of VO₂max. Ickler, Battista and Porcari (2008) studied the physiological and psychological responses to 8 weeks of NIA training. There was no significant

improvement in VO_2 max after 8 weeks of NIA training. There were significant improvements in balance, right trunk rotation, trunk flexion, hip flexion, and hip extension. Both studies concluded that cardiovascular responses to NIA are low relative to ACSM guidelines and although NIA may not improve cardiorespiratory fitness in trained individuals, it may provide additional health benefits such as improved balance and flexibility for individuals who are less fit (Ickler et al., 2008; Konemann et al., 2008).

Hooping

Hooping is a new trend that has surfaced recently in the fitness industry (Holthusen & Porcari, 2010). “Hooping hoops” include a greater amount of weight as well as a larger diameter, which provides more of a challenge than conventional hula hoops. Holthusen and Porcari (2010) researched the effectiveness of hooping as a workout. Subjects included 16 apparently healthy females who varied in hooping abilities from beginner to advanced levels. Subjects completed a hooping video that was 35 minutes in duration while wearing a portable oxygen analyzer to record VO_2 . Subjects also wore a heart rate monitor to measure heart rate. Both VO_2 and heart rate were recorded every minute during the exercise session. Caloric expenditure was further determined based upon VO_2 data during the testing trial. During the entire 35 minutes of hooping, on average, subjects exercised at 84% of HRmax. Subjects also expended an average of 7 kcal/min for a total of 245 kcal per 35-minute class. It was concluded that hooping meets ACSM guidelines for exercise intensity.

Zumba®

More recently a new type of aerobic dance, Zumba®, has become extremely popular. Zumba® Fitness is a Latin-inspired dance workout that has grown since its origination by Alberto “Beto” Perez in the mid-90’s. Zumba® is currently being taught in more than 110,000 locations in more than 125 countries (Zumba® Fitness, 2011). Luettgen and Foster (2011) tested the exercise intensity and energy expenditure of a 40-minute Zumba® fitness session. Average heart rate during the 40-minute session of Zumba® was 154 bpm, which corresponded to 80% of HRmax. Average estimated VO₂max during the 40-minute Zumba® session corresponded to 64% of VO₂max. During the workout subjects expended an estimated 9.45 kcal/min. Thus, 40-minutes of Zumba® would expend 378 kcals per 40-minute session. It was concluded that Zumba® meets ACSM guidelines for both exercise intensity as well as guidelines for energy expenditure per exercise session.

QiDance

Similar to Zumba®, QiDance is on the rise as a new style of aerobic dance (Batuka, 2011; Qignition, 2012). QiDance is a new fitness trend that focuses on energizing workouts set to pre-choreographed routines. QiDance is one component of the fitness company known as Qignition. Qignition focuses on fitness and wellness. Its philosophy is to “ignite people’s vital energy to improve their quality of life” (Qignition, 2012).

Qignition, which recently changed its name from Batuka in 2012, was developed by Kike Santander, a multi-Grammy winning recording artist (MSN Malaysia Life & Style, 2011). Qignition utilizes original music from different cultures created by Kike for

pre-choreographed QiDance routines (Qignition, 2012). There are four main components to the wellness program including Qidance, Qiforze, Qinaia, and Qistryke (Qignition, 2012). Each of these components are said to attract each type of fitness style including “the dancer, the muscle builder, the yogi, and the warrior within” (Qignition, 2012). Qignition, (formally Batuka) was recently introduced to the United States at the International Health, Racquet and Sportsclub Association (IHRSA) International Convention in March, 2011 (MSN Malaysia Life & Style, 2011). Qignition is currently expanding to North America as fitness personal are being trained in Qignition choreography (MSN Malaysia Life & Style, 2011; Qignition, 2012).

Conclusion

Physical activity is a major component of overall health. Exercise on a daily basis can reduce the risk of developing various chronic disease associated with a sedentary lifestyle. The guidelines for exercise intensity and caloric expenditure established by the ACSM are important to consider when participating in various types of exercise. QiDance is an emerging trend in the aerobic dance industry which is why it is important to investigate the exercise intensity and energy expenditure of QiDance relative to ACSM guidelines.

REFERENCES

1. American College of Sports Medicine. (2006). *ACSM's Guidelines for Exercise Testing and Prescription*. 7th ed. Baltimore, MA: Lippincott, Williams & Wilkins.
2. American College of Sports Medicine. (2010). *ACSM's Guidelines for Exercise Testing and Prescription*. 8th ed. Baltimore, MA: Lippincott, Williams & Wilkins.
3. Battista, R.A., Foster, C., Andrew, J., Wright, G., Lucia, A. & Porcari, J.P. (2008). Physiological responses during indoor cycling. *Journal of Strength and Conditioning Research*, 22(4), 1236-1241.
4. Batuka. (2011). *What is Batuka?* Retrieved from <http://www.batuka.com/>.
5. Berry, M.J., Cline, C.C., Berry, C.B. & Davis, M. (1992). A comparison between two forms of aerobic dance and treadmill running. *Medicine & Science in Sports & Exercise*, 24(8), 946-951.
6. Foster, C. (1975). Physiological requirements of aerobic dancing. *Res. Quart.* 46, 120-123.
7. Grant, S., Armstrong, G., Sutherland, R., Wilson, J., Aitchison, T., Paul, E. & Henderson, S. (1993). Physiological and psychological responses to a university fitness session. *British Journal of Sports Medicine*, 27(3), 162- 166.
8. Haskell, W.L., Lee, I.M., Pate, R.R., Powell, K.E., Blair, S.N., Franklin, B.A., Macera, C.A., Heath, G.W., Thompson, P.D. & Bauman, A. (2007). Physical activity and public health: Updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Medicine & Science in Sports & Exercise*, 39(8), 1423-1434. Doi: 10.1249/mss.0b013e3180616b27.

9. Holthusen, J.A. & Porcari, J.P. (2010). *Relative exercise intensity and caloric expenditure of hooping*. Unpublished graduate thesis. University of Wisconsin – La Crosse, Department of Exercise and Sport Science.
10. Ickler, J., Battista, R. & Porcari, J.P. (2008). *Physiological and psychological benefits consequent to 8 weeks of NIA training*. Unpublished graduate thesis. University of Wisconsin – La Crosse, Department of Exercise and Sport Science.
11. Immel, D.D. & Porcari, J.P. (1999). *Physiological responses to cardio kickboxing in females*. Unpublished graduate thesis. University of Wisconsin – La Crosse, Department of Exercise and Sport Science.
12. Konemann, K., Battista, R. & Porcari, J.P. (2008). *The acute physiological and psychological responses to the NIA Technique*. Unpublished graduate thesis. University of Wisconsin – La Crosse, Department of Exercise and Sport Science.
13. Leelarungrayub, D., Saidee, K., Pothongsunum, P., Pratanaphon, S., Yankai, A. & Bloomer, R.J. (2011). Six weeks of aerobic dance exercise improves blood oxidative stress status and increases interleukin-2 in previously sedentary women. *Journal of Bodywork & Movement Therapies*, 15, 355-362. Doi: 10.1016/j.jbmt.2010.03.006.
14. Luetgen, M.L. & Foster, C. (2011). *The physiological effects of participating in a 40-minute Zumba® fitness session*. Unpublished graduate thesis. University of Wisconsin – La Crosse, Department of Exercise and Sport Science.
15. Milburn, S. & Butts, N.K. (1983). A comparison of the training responses to aerobic dance and jogging in college females. *Medicine and Science in Sports and Exercise*, 15(6), 510-513.
16. MSN Malaysia Life & Style. (2011). *Batuka, the new dance craze: Spanish fitness craze shimmies its way to international audience*. Retrieved from <http://lifestyle.malaysia.msn.com/Wellbeing/Fitness/article.aspx?cp-documentid=4757271>.
17. Nia. (2011). *What is Nia?* Retrieved from <http://nianow.com/practice>.
18. NiaSharing.com. (2008). *Nia the Technique*. Retrieved from <http://www.niasharing.com/>.

19. Porcari, J.P., Hendrickson, K. & Foster, C. (2008, September/October). Drop and Give Me 20! *ACE Fitness Matters*, 14(4), 6-9.
20. Qignition. (2012). *QiDance*. Retrieved from <http://www.qignition.com/qidance>.
21. Rixon, K.P., Rehor, P.R. & Bemben, M.G. (2006). Analysis of the assessment of caloric expenditure in four modes of aerobic dance. *Journal of Strength and Conditioning Research*, 20(3), 593-596.
22. Sutherland, R., Wilson, J., Aitchison, T. & Grant, S. (1998). Physiological responses and perceptions of exertion in a step aerobics session. *Journal of Sports Sciences*, 17, 495-503.
23. Zumba® Fitness. (2011). *About Zumba® Fitness*. Retrieved from <http://www.zumba.com/en-US/about/>.