Can Taiji be considered an Aerobic Exercise?

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We were part of a exercise physiology study conducted for a thesis. Below are the findings which came out of the study, reproduced here with the kind permission of Ms Lye Yin Fong. It is an extremely interesting read. For those of you who have always had a niggling doubt about the actual physical benefits of keeping up a daily practice of Taijiquan, this is something for your mind to chew over.

Glossary

HR : Heart Rate

HRR : Heart Rate Reserve

VO2 : Oxygen Uptake, or maximal oxygen uptake (VO2 max)

RPE : Ratings of Perceived Exertion

Background: Taijiquan is a popular Chinese health activity. Its curative benefits have been reported widely but in general, many of these claims are without any scientific justification. The study of taiji with the use of science has focused mainly on its effects on strength and balance in the elderly, perhaps because taiji is thought to be inherently a low intensity, slow moving exercise. As a result, few studies have investigated whether this low impact, low velocity exercise can be considered an aerobic exercise to develop and maintain fitness in older adults as well as in other age groups. While the physical act of taiji does meet most of the American College of Sports Medicine (ACSM) recommendations for aerobic exercise, i.e., it is continuous, rhythmic and involves large muscle groups in the upper and lower body, there are some inconsistencies in the literature relating to its exercise intensity. Studies have reported intensities ranging from as low as 35%HRR to as high as 58%HRR. Wide variations in measures used, study design, subject population, exercise duration may account for the varying outcomes. The results of the studies reviewed, however, clearly show that the exercise intensity of taiji is below the optimum training intensity of 60-80%HRR, indicating that the exercise is not sufficiently intense to stress the cardiorespiratory function of most people. This evidence is based on heart rate response to Yang Taiji exercise which is the taiji style used in the studies reviewed. It is possible that HR response to traditional Chen style Taiji may differ from Yang style. Purpose: The purpose of this study was to determine the exercise intensity of Chen style Taiji by measuring heart rate and RPE responses to the exercise. Exercise intensity was expressed as percentage of heart rate reserve (%HRR). Based on ACSM’s classification of physical activity intensity, Chen Taiji would be considered an aerobic exercise with the potential to increase cardiorespiratory fitness if a rating of 12-16 on the RPE scale was achieved and HR value was 60%HRR or higher. Method: Twenty four apparently healthy adults aged 39.6 ± 12.8 years participated in this study. Subjects performed four consecutive sets of the exercise during which heart rate was recorded by Polar S810 HR monitor. Subjects rated their exertion level from Borg’s RPE scale at the end of the exercise. Heart rate was downloaded to PC using Polar Precision Performance 3.0 Software. Data were analysed using the software and SPSS 10.0 for MS Windows. Results: Mean HR value during the 4 sets was 63.6 ± 13.6%HRR which placed taiji in the category of hard intensity exercise. In addition, mean %HRR was > 70% for the 3rd and 4th sets. RPE was 13.3 ± 1.9 which suggested that taiji was a moderate intensity exercise. Total exercise time was 49.6 ± 14.4 min with 30 ± 19.5 min in the training zone (60-80%HRR). Mann Whitney U tests showed no significant differences in HR between younger and older subjects (61.0%HRR vs 61.9%HRR). Conclusions: The results demonstrate that Chen Taiji can be considered an aerobic exercise with the potential to increase cardiorespiratory fitness in healthy adults, whether young or old. Other results and explanations: 1. HR was estimated to be in the training range for at least 20 min during 3 sets or ~ 40 min of the exercise, indicating that 3 sets may be sufficient for a training effect to occur. 2. Mean RPE rating of 13 corresponded to an exercise intensity of moderate which is below the HR estimate of hard. Based on physiological response (HR), 58% of subjects were in the hard intensity range 60-84%HRR. But only 33% rated the exercise hard. Over half of the subjects rated the exercise as moderate (54%). A possible explanation why the RPE method produced a lower intensity estimate compared to physiological estimates like HR could be due to ventilatory influence. Studies have found that ventilatory equivalent for oxygen (Ve/VO2) is lower for taiji compared to other aerobic exercises and, separately, that perceived exertion is influenced by ventilation and relative oxygen uptake while HR is not. It is possible that taiji practitioner’s low ventilation rate attenuated RPE. It is not possible to speculate further as ventilatory responses were not obtained in this pilot study. 3. More than half of the subjects who were observed to ‘fajing’ (releasing of force) in the third set during the form ‘Buddha’s warrior attendant pound the mortar’, demonstrated a significantly higher HR compared to those who chose to stamp without force (U = 16.00, p = 0.002). This result indicates that exertion of force can increase the intensity of taiji and this may be useful in exercise prescription as a means to grade the exercise intensity of taiji. 4. Instructor group (certified) showed a significantly higher HR than the student group (<3 yr experience) (67%HRR vs 55%HRR). For aerobic activities which are dependent on skill, the rate of energy expenditure is highly related to individual’s skill level. The skilful instructors were thought to recruit more muscle groups (e.g. the abdominal and back muscles) in executing forms

compared to beginners. Instructors who generated force during the exercise also had the highest HR among the groups (instructor/no force; student/force; student/no force). The results suggest that the combination of skill and force can increase the intensity of taiji exercise. 5. The study found no correlation between speed of performance and intensity. This is in contrast to traditional aerobic activities such as walking and jogging in which intensity is increased with increased speed. The result could have been affected by wide differences in taiji experience among subjects. Even though subjects were performing at same speed, intensity could differ due to differences in skills. (Perhaps future studies to study relationship between speed and intensity should use experienced practitioners and have them perform at different speeds.) 6. Limitations of study: small sample size and the source of subjects limited to members of a taiji association and their students. Further limitations: fitness level, ventilation response, maximal VO2 and heart rate were not measured and age predicted maximum HR with its potential error was used to calculate heart rate reserve.