
Testing for High Intensity Dance Fitness

Emma Redding, Ph.D., Laban, London, UK

There has been much concern recently about dancers' fitness, and many educators are now realizing the benefits of weekly fitness classes in dance training programs. In order to determine whether dancers are getting fitter and whether a fitness training regimen is working, it is useful to monitor improvements in dancers' fitness through regular fitness assessments. These can also help maintain the dancers' motivation by providing tangible feedback about their progress.

The development of activity-specific and precise methods of evaluating an athlete's performance is of interest to many sports scientists. Previously, most fitness monitoring has been undertaken within standardized conditions such as laboratory settings, rather than "in the field." This was to ensure that the tests remained valid, reliable and objective. However, questions often arise as to the relevance of such tests with regard to specificity. The debate between laboratory and field-testing is on-going; while laboratory tests are more likely to yield accurate results, they may be less representative, and while field tests are more relevant and specific, they have the potential for being less accurate. This predicament has led to the development of activity-specific measuring tools in sport, like kayak ergometers and swimming flumes.

There is currently a validated dance-specific exercise method of measuring aerobic fitness (DAFT)¹ which is being used by several dance companies and schools to monitor changes in aerobic capabilities across time. However, dance is an intermittent activity that utilizes both the aerobic (with oxygen) and anaerobic (without oxygen) energy systems and comprises a combination of low, moderate and high intensity levels.^{2,4,5} More specifically, dance class appears to be undertaken at lower to moderate intensities utilizing mostly the aerobic energy system, while dance performance tends to be carried out at higher intensities utilizing both the aerobic and anaerobic systems.⁴ Dance technique classes by themselves however do not sufficiently challenge either the aerobic or anaerobic fitness needs faced in performance situations.

Until our study, there was no validated high intensity dance-specific fitness test available that provided a way of evaluating the ability to dance at the higher intensities representative of stage performance. Dancers' anaerobic fitness has been previously measured using the Wingate Anaerobic Test (WAnT), usually involving a cycle ergometer.^{2,3} While the WAnT is a recognized standard laboratory test, it does not use a mode of exercise that is familiar to dancers. Firstly, dancers are not used to working to volitional exhaustion (probably due to the high skill factor in dance and the fact that choreographers set the intensity by virtue of the choreography).² Secondly, the cycle ergometer is a non-impact mode of exercise that utilizes specific muscle groups repeatedly, which is again something unfamiliar to dancers. The concept of specificity, whereby methods of assessment are designed to allow dancers to be tested in an environment with which they are familiar, should be encouraged in the field of dance science. Today it would be almost unheard of, for example, to test a swimmer on a cycle machine or treadmill.

The purpose of our study was to develop an intermittent high intensity dance-specific fitness test. We designed the test so that educators can measure changes in dancers' heart rate across time, as well as observe visual improvements in performance at these high intensities.

We developed the test over several rehearsals with professional dancers and teachers based at a leading UK dance training institution. The dancers were asked to make a one-minute phrase using movement material that was representative of contemporary dance (sometimes known as "modern dance"). It was important for the intensity to be similar to the intensity levels previously noted in dance performance.^{5,6} This meant that the test tempo/speed, size, and type of movement were taken into consideration. Movement phrases were developed that mimic the intermittent 'stop-start' nature of dance.^{2,4,5} The work-to-rest ratio was set at 1:2 (one minute dancing followed by two minutes resting). It was also important to keep the movement phrase as simple as possible, so that any changes across time would

Table 1 The Dance Fitness Test Protocol

1 minute dancing
2 minute rest
1 minute dancing
2 minute rest
1 minute dancing
2 minute rest
1 minute dancing

Tempo throughout each 1 minute dancing: 106 bpm

be due to an improvement in fitness (i.e., physiologically based) rather than movement economy through practice.

The completed test protocol (Table 1) consists of jumps in first and second position, rolls to the floor, weight transference from feet to hands and back to feet, circular hops with an arm pattern, and a parallel jump forward in space using an arm swing. The phrase is completed three times within one minute at a tempo of 106 beats per minute, and repeated again after two minutes of rest. The sequence occurs four times.

We then asked an additional 16 professional dancers to undertake the fitness test (12 females and 4 males). They performed four trials of the test, following a thorough warm-up. Our results showed that the dancers' blood lactate increased beyond the physiological indicator meaning that the intensity of the test was high enough to stress the anaerobic energy pathways following each trial.

Results also showed that the test is reliable and valid, as seen by the consistency in heart rate across trials. The dancers were working near their maximum capacities, as their results from the dance fitness test were comparable to the scores they obtained during a standard maximal oxygen uptake treadmill test.

Previous research⁷ has found that dancers often perform at 80% of their maximum, which is at least the case in this study. Interestingly, in all but one case the dancers seemed to push themselves harder when dancing than running on the treadmill (probably because of their familiarity with the movement), which further substantiates the argument for more activity-specific assessments for greater accuracy.

It is important to be aware that the range of contemporary dance performances can be quite diverse; one contemporary dance performance may be high in intensity while another is lower in intensity. Further research is needed to determine the energy demands of the range that exists in contemporary dance. However we think it would be fair to suggest that contemporary dancers need to be both aerobically and anaerobically fit in order to be prepared for the many different demands of the genre.

Previous research has shown a discrepancy between class, rehearsal and performance in terms of cardiovascular demands.⁴ A dance fitness test such as this can be used for both testing and training purposes as part of a dancer's training regimen, to ensure that both the higher intensity demands and the gap between class and performance are addressed. Observations can be made across time, not

only through quantitative means such as heart rate but also through qualitative means, such as the observation of movement proficiency.

One of the main reported causes of injury in dance is fatigue, and a high level of physical fitness will delay the onset of fatigue.^{7,8} A test of this kind will help provide information about a dancer's physiological capabilities through relevant and applicable means. As a result, effective dance training programs may be devised to help reduce the risk of injury.

There is an argument for dance genre specific fitness tests. Given that the research in sports science recommends activity-specific testing techniques in sport, perhaps the diversity shown between dance genre styles may also warrant genre-specific ways of assessing physical fitness in dance. Dance science is a relatively new area of research, and there is a need for more research into dance-specific field tests. The Research Committee of the International Association for Dance Medicine and Science has been advocating standardized techniques for measuring dancer capabilities.

The development of the dancer's physical fitness seems traditionally to be more a by-product of skill acquisition than focused fitness training. Fortunately, supplementary fitness training is now being recommended in dance training to prepare the dancer for the demands of rehearsal and performance.^{9,10}

The results of this study indicate that the high intensity dance-specific test is a reliable and valid means of assessing and monitoring the cardiovascular fitness of dancers.

The test allows dancers to be assessed within an environment they are used to (the studio), with a mode of exercise that is relevant (dance), and at an adequate intensity to be representative of some contemporary dance performance.

Acknowledgement

This article was adapted from: Redding E, Weller P, Ehrenberg S, Irvine S, Quin E, Rafferty S, Wyon M, Cox C. The development of a high intensity dance performance fitness test. *J Dance Med Sci.* 2009;13(1):3-9.

References

1. Wyon M, Redding E, Abt G, Head A, Sharp C. Development, reliability and validity of a multi-stage dance specific aerobic fitness test (DAFT). *J Dance Med Sci.* 2003;7(3):80-4.
2. Chatfield SJ, Byrnes WC, Lally DA, Rowe SE. Cross-sectional physiologic profiling of modern dancers. *Dance Res J.* 1990;22(1):13-20.
3. Rimmer JH, Jay D, Plowman SA. Physiological characteristics of trained dancers and intensity level of ballet class and rehearsal. *Impulse.* 1994;2:97-105.
4. Wyon M, Head A, Sharp NCC, Redding E, Abt G. Oxygen uptake during modern dance class, rehearsal, and performance. *J Strength Cond Res.* 2004;18(3):646-9.
5. Cohen JL, Segal KR, McArdle WD. Heart rate response to ballet stage performance. *Phys Sportsmed.* 1982;10(11):120-33.
6. Schantz PG, Astrand PO. Physiological characteristics of

- classical ballet. *Med Sci Sports Exerc.* 1984;16(5):472-6.
7. Brinson P, Dick F. *Fit to Dance?* London: Calouste Gulbenkian Foundation, 1996.
 8. Koutedakis Y, Myszkewycz L, Soulas D, et al. The effects of rest and subsequent training on selected physiological parameters in professional female classical dancers. *Int J Sports Med.* 1999;20(6):379-83.
 9. Rist RA. Children and exercise: training young dancers, a dance medicine perspective. *SportCare Journal.* 1994;(6)1:5-7.
 10. Rafferty S, Redding E, Irvine S, Quin E. The effect of a one-year dance-specific fitness training program on undergraduate modern dance students: an experimental study. *J Dance Med Sci (Abstract).* 2007;11(1):16.