

# Dance science: Scientific investigations into the effect of dance specific fitness training and its impact upon pedagogic practices and dance performance

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Dance training has developed eclectically to serve the different approaches to dance performance and making; however, there is a discrepancy between the physiological demands of training and dance performance. It is no longer acceptable to train dancers without due regard for physiological concerns if they are to be prepared appropriately to meet the demands of current choreographic work. Research over the last two decades has examined the physical fitness status of professional and student dancers', but there is still debate about how fit dancers *should* be. There is a discrepancy in the physical intensity level between training, rehearsal, and performance, and the idea of supplementary fitness training has been debated, albeit untested longitudinally with large groups of dancers. The purpose of this study was to examine the effect of a one-year dance specific fitness program on undergraduate contemporary dance students undertaking full-time vocational training and to observe any impact the findings may make upon dance pedagogic practices. Results from the pre- and post-screening assessments show that, following the intervention, there was a significant decrease ( $p < 0.05$ ) in mean heart rates across all five stages of the Dance Aerobic Fitness Test (DAFT), indicating improvement in the dancers' aerobic capabilities. Findings impacted upon the school curriculum, in that the timetable now comprises weekly fitness classes.

*Keywords:* fitness; dance; physiological; intervention; aerobic

Research over the last two decades has examined the physical fitness status of professional and student dancers (Chatfield *et al.* 1990, Cohen *et al.* 1982,

Dahlstrom *et al.* 1996, Novak *et al.* 1978, Rimmer *et al.* 1994), but there is still debate about how fit dancers *should* be. One study (Wanke 2001) assessed the effect of an integrated endurance training program for ballet dancers (n=16) across a ballet season and found positive results. Some studies have suggested a discrepancy in the intensity level between training, rehearsal, and performance (Rist 1994, Wyon and Redding 2005, Redding and Wyon 2001), and the idea of supplementary fitness training has been debated, albeit untested longitudinally with large groups of dancers.

The applicability of laboratory tests and training regimes from sports is questionable (Schantz and Astrand 1984, Redding and Wyon 2003), and it is becoming increasingly necessary to gather relevant data and qualitative observations—physiological and psychological—in order to develop specific methods of promoting and assessing dance fitness. The purpose of this study, longitudinal and experimental in design, was to examine the effect of a one-year dance specific fitness program on undergraduate modern dance students undertaking full-time training.

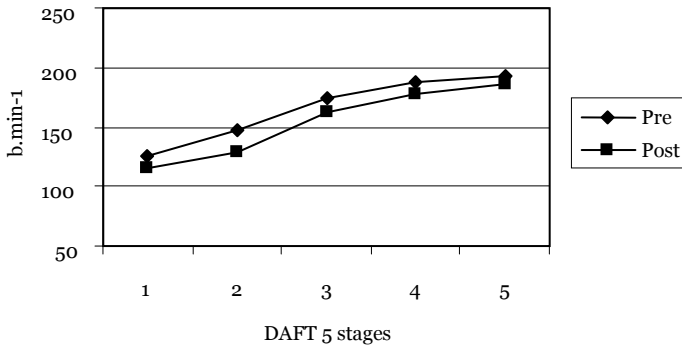
## METHOD

### Participants

Screening information from first year students (n=86) provided initial data on a series of physiological tests, including the Dance Aerobic Fitness Test (DAFT; Wyon *et al.* 2003), the Wingate Anaerobic bike Test (WANt), and the vertical jump height test, which were repeated at the end of the one-year intervention. Students also completed an evaluation questionnaire regarding their personal appreciation of the program. Existing screening information on the previous student cohort (n=85) provided an opportunity to compare physiological changes across the year without the fitness intervention.

### Procedure

A weekly 90 minute fitness class was developed across the year according to principles of periodization and specificity (Bompa 1999). The primary aim was for the structure and content to be responsive to curriculum needs and to engage in a dialogue with technique teachers and therapists. Intensity and duration of exercises were considered. The dancers' heart rates were regularly monitored to ensure that the intensity level was appropriate to elicit a training response. Functional fitness training preceded more dance-based movement that increasingly replicated vocabulary from technique classes. For example, plyometric training was introduced, initially using basic parallel foot



*Figure 1.* Mean heart rates of dancers undertaking dance specific fitness training before and after the one year intervention.

positions, and later modified to include turned out positions that more closely mimicked the type of jumps seen in dance. Upper body strength exercises gradually progressed to incorporate partner lifting of varying speeds and complexities. During the final phase, a circuit type structure reflected the variety of activity and speed of succession that would be encountered in a dance class.

### **Data treatment and analysis**

All data were entered into SPSS (v.12). Means and standard deviations were calculated for all variables. Dependant t-tests were used to monitor changes in heart rate and jump height data collected from the pre- and post-testing.

## **RESULTS**

Results from the pre- and post-screening assessments show that, following the intervention, there was a significant decrease ( $p < 0.05$ ) in mean heart rates across all five stages of the DAFT test (Figure 1), indicating improvement in the dancers' aerobic capabilities. In addition, it appears that this particular group of students displayed lower heart rates at every stage, compared with the group of first year students from the previous year who did not engage in regular fitness training (Table 1).

The females in the intervention group improved their jump height ( $p < 0.05$ ), while the males did not. Participant responses to the evaluation

*Table 1.* Mean heart rates across each stage of the DAFT for three different groups of dance students. There was a significant difference between the two groups at every stage ( $p < 0.05$ ).

	<i>Stage 1</i> <i>(b.min<sup>-1</sup>)</i>	<i>Stage 2</i> <i>(b.min<sup>-1</sup>)</i>	<i>Stage 3</i> <i>(b.min<sup>-1</sup>)</i>	<i>Stage 4</i> <i>(b.min<sup>-1</sup>)</i>
First year students with <i>no fitness</i> at end of year 1 (n=38)	122 ±13	153 ±15	179 ±14	190 ±13
First year students post <i>fitness</i> end of year 1 (n=50)	115 ±12	129 ±23	162 ±13	177 ±11

questionnaire suggest that the students *are* motivated to participate in their fitness classes. Responses focused on students' increased knowledge with respect to physical preparation for their dance skills training, the importance of application of the theoretical aspects of their fitness course, and the new perspective they have of dancers as athletes as well as creative artists.

## DISCUSSION

Results from the DAFT test show that aerobic fitness improved over the one-year period, supporting findings of previous studies (Wanke 2001). When comparing the DAFT heart rate data to that of the dancers who did not participate (from the previous Year 1 cohort), there appears to be an overall reduction at each stage, indicating that it is the fitness training intervention that has contributed to this effect.

Comments from the evaluation questionnaire show that students have gained knowledge and skills that they do not acquire at any other point in their dance training and are capable of applying this knowledge and understanding to their wider physical development. The most frequent physiological self-observed effects were reductions in fatigue, improvement in general energy levels, and improved capacity in dance classes to sustain technique and jumping ability. The importance of warm-up and cool down was commonly cited and the recognition of the relationship between fitness and injury prevention was highlighted. In psychological terms, preliminary analysis of the comments reveals that students have found fitness valuable as a relaxation tool. They explain that they feel more positive and confident in general and find a reduction in stress, tension, and frustration. Reasons include the holistic approach, the absence of competition in the fitness class, and the increased knowledge, awareness, and value of relaxation techniques as an

element of fitness. Motivation appears to be increased, although it is still debatable whether this is specific to fitness classes or can be transferred to other areas of training.

This study was the first of its kind in that it assessed the effect of supplementary fitness training in dance across one year. Findings impacted upon the school curriculum. The timetable now comprises weekly fitness classes. The dance-specific fitness team aimed to counteract some possible injury risk factors, such as lack of strength and jumping ability, through the introduction of dance-specific strength work using partnering and plyometric jump training. Also specific short term demands have been addressed. For example, groups of students have followed a prescribed training plan to prepare for a three week historical project, dealing with specific pieces from Limon, Graham, and Cunningham repertory. It is hoped that this dance-specific fitness training will have a more far-reaching effect than functional sports fitness and provide a stimulus for students that can enhance the complete training experience. It is also envisaged that other dance training institutions will consider adopting a similar model so that findings can be shared and more effective training programs for dancers devised.

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