
Supplementary Muscular Fitness Training for Dancers

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Dancers today face choreographic demands that stretch the boundaries of both artistry and the physical body. To cope with the increasing demands on technique, virtuosity, and versatility, many dancers are looking outside the traditional technique class for ways to improve their physical fitness. Simultaneously, the scientific literature is investigating everything from baseline fitness levels among dancers to specific training interventions to improve results. However, the dancers themselves are often under-educated regarding appropriate methods to enhance fitness.

Physical fitness can be divided into several components: cardiovascular fitness; neuromuscular coordination; flexibility; body composition; muscular endurance (repeated muscle contraction over a period of time, such as a series of *relevés*); muscular strength (creating a high degree of force once, such as lifting a partner); and muscular power (creating force very quickly, such as in *grand battements* or jumps). While technique class alone can be very good for developing the kinds of neuromuscular coordination, muscular endurance, and flexibility needed for dance, it rarely stresses the other components of physical fitness enough to elicit improvements. Research has found that class is generally conducted at a lower intensity than rehearsal, and neither class nor rehearsals reach the physiological intensity of performance.¹ This means that class and rehearsal don't provide enough overload (stressing the body beyond that to which it is accustomed) to prepare the dancer for performance. This can lead to dancers simply trying to "get through" the performance physically, leaving little energy for artistic interpretation.

Moreover, a high proportion of injuries occur when a dancer is fatigued. Increasing fitness may delay the onset of fatigue, thus providing some measure of protection.

Supplementary conditioning can fill the intensity gap between class, rehearsal, and performance. Supplementary conditioning can mean a number of things--Pilates and yoga, running and strength training. It does not necessarily have to happen outside the dance classroom, as programs have been developed to combine the two.² Because so many options exist, it can be difficult to choose the most appropriate. Moreover, some dancers are reluctant to engage in any training that they perceive might compromise aesthetic quality. They fear strength training in particular may lead to bulky muscles and lost flexibility. However, there is little evidence to support this notion.

In an effort to understand the effects of conditioning geared towards improving muscular strength and muscular power, we conducted a study comparing two training protocols for the lower body. We wanted to know if either protocol would improve objective measures of strength and power, as well as whether supplementary training could improve a subjective measure of jumping ability. Additionally, we wanted to know if these kinds of training changed the dancer's body weight or body fat percentage, from which we could determine if there were any changes in muscle mass.

We chose to compare two types of lower-body training commonly used among athletes: traditional strength training on weight machines, and "plyometric" training, which is a type of conditioning that uses explosive jumps. Traditional strength training involves pushing or pulling an external resistance, such as weights attached to a pulley. Plyometric training involves first stretching a muscle (such as the calves in a *plié*), then explosively contracting the same muscle (such as jumping out of the *plié*). The pre-stretch allows a more forceful contraction, but only if the contraction occurs very quickly after the stretch. We chose these two types of training because strength and power are key components of jumping in dance.

Adapted from: Brown AC, Wells TJ, Schade ML, Smith DL, Fehling PC. Effects of plyometric training versus traditional weight training on strength, power, and aesthetic jumping ability in female collegiate dancers. *J Dance Med Sci.* 2007;11(2):38-44. With Permission.

Methods

To study how supplemental strength and power training affected dancers, we designed an intervention study. We recruited 18 female intermediate/advanced university-level dancers and split them into three groups. Two of the groups were “experimental” groups; one of these was the plyometric group, and the other was the weight-training group. The third set of dancers was our “control” group, meaning they participated in no extra physical activity outside of their normal dance classes and rehearsals.

We tested each of the subjects twice, once before the intervention period and once after, and we tested a number of objective variables. Maximal strength was tested on three machines: knee extension (quadriceps); knee flexion (hamstrings); and leg press (combination of gluteals, hamstrings, and quadriceps). Muscular power was tested in two ways: vertical jump height, and lower-body power as measured via a maximal 30-second sprint on a stationary bicycle. We measured body weight and percentage of body fat. A subjective *petit allegro* dance evaluation was also administered, which evaluated jump height, ability to point the feet while jumping, *ballon*, and overall jumping ability. The test was judged by experienced dance faculty.

The experimental groups, in addition to their regular dance schedules, participated in six weeks of supplemental training. Both groups trained twice a week for about 45 minutes each session. Both groups followed a progressive training plan, meaning that as time went on and improvement was seen, the exercises got harder. The plyometric group performed four different jump-training exercises: “drop jumps,” which involved stepping off a box then explosively jumping straight up; “step-ups,” consisting of placing one foot on top of a box and exploding straight up for 8 repetitions, then switching legs and repeating; “box jumps,” which simply meant jumping onto a box, stepping off and repeating, and “froggies,” or performing several horizontal long jumps in a row. The program was progressed by increasing the box height and the intensity at which the dancers executed the jumps. The weight-training group performed four lower-body exercises on weight machines, targeting the gluteals, hamstrings, quadriceps, and calf muscles. Progression was achieved by increasing the amount of weight lifted.

Results

We evaluated the results to see if there were any changes following the supplemental training, and if so, if the groups responded differently. Both experimental groups showed improvement. The plyometric group and the weight-training group both increased their maximal leg press strength and their perceived jump height on the subjective dance evaluation. However, there was no difference between the two groups on the magnitude of either change. The leg press measured the strength of the hips and thighs, which can translate to squatting movements and jumps. Indeed, both groups showed a perceived increase in their *petit allegro* jump height. Relatedly, the plyometric group increased

their objective vertical jump height, showing that their leg muscles could more powerfully propel them upwards.

The weight-training group improved their lower-body power on the stationary bike, their hamstring strength, and their perceived ability to point their feet in the air on the subjective dance test. The stationary bike test showed that this group was better equipped to sustain powerful movement over a 30-second period following the training intervention. Their improvement in pointing their feet while jumping was likely due to the strengthening of their calf muscles during their training, showing that strength improvements can assist technique development.

There were no significant changes in either body weight or percent body fat in any group. This indicates that neither program caused any aesthetically deleterious gains in muscle mass. Most strength gains during the first month of training are from improved neural patterning. Additionally, hypertrophy (an increase in muscle size) generally occurs through training at a lower intensity and higher volume than the programs we used. A number of intervention studies for dancers have similarly found that supplemental training need not create a bodybuilder-type frame, but can rather enhance the abilities of dancers while maintaining their aesthetic principles.³⁻⁵

Interestingly, neither experimental group improved in the subjective measures of *ballon* or overall jumping ability. It is likely that while strength or power training can be useful for improving some aspects of jumping, technical improvements such as *ballon* and creating an aesthetically pleasing jump, are best developed through rigorous dance instruction.

Finally, the control group did not show changes on any of the strength, power, anthropometric, or dance measures. This indicates that six weeks of dance classes and rehearsals alone was not enough to improve strength, power, or jumping ability in high-level university dancers.

Suggestions for Teachers

The results of this study indicate that training outside the dance technique class is not only beneficial, but perhaps essential to furthering strength and power in highly-developed dancers. Teachers can use this information to recognize the scope of technique class, and make recommendations to students who need further fitness development. Here are a few suggestions:

1. Supplemental training should occur at an intensity that is higher than the typical technique class. A scale of perceived exertion from one through ten may be useful. For instance, if the dancer feels she is working at a six or seven during the most strenuous part of technique class, she should undertake supplemental training at least at an eight.
2. The type of supplemental conditioning should be geared towards the dancer's weaknesses. If the dancer has difficulty with slower movements, she may lack strength. If she needs work moving more quickly, she should train for power.

3. Strength-building exercises can be included by pairing dancers up and asking them to provide manual resistance for each other. Please see the suggested reading list for specific ideas.
4. Plyometric-type exercises can be incorporated into class by asking dancers to complete several jumps in sequence while focusing on explosiveness instead of technique. Images such as “exploding like a rocket ship” or “reaching for the stars” may be useful. Beware using these techniques with dancers of little training, however. Explosive movements must be integrated gradually to allow the muscles to adapt to the high forces they produce.
5. Supplemental conditioning should take place well before any scheduled performances. The higher intensities can temporarily cause fatigue, and the body requires time and rest to adapt. Roughly two weeks should separate the end of a conditioning program and the beginning of a performance period.

Summary

While physical fitness is not the only requirement of a great dancer, it is a crucial component. Improvements in fitness give the dancer a wider base from which to operate, rendering her more versatile. Moreover, when dancers don't have to be concerned with the physical demands of the dance, they can be free to bring their full artistry to the forefront. This study showed that six supplemental strength and power training was able to improve muscular fitness measures

in dancers without compromising aesthetic components.

References

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Additional Suggested Readings

1. Irvine S, Redding E, Rafferty S. Dance Fitness. International Association for Dance Medicine and Science, Resource Papers. 2011. Available at: <http://www.iadms.org/display-common.cfm?an=1&subarticlenbr=186>
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