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RESOURCE PAPER FOR DANCE TEACHERS

Dance Physical Fitness

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INTRODUCTION

The aim of this Resource Paper is to provide educational information about the importance of physical fitness to dancers and dance teachers. We acknowledge that over the past decades, the term fitness has become more inclusive, recognizing several biopsychosocial areas such as mental, social, and emotional fitness. For this resource, we will focus on physical fitness with the majority of cited research examining Eurocentric concert-style dance genres at the semi-professional and professional level. Findings from these studies may

not be wholly applicable to all dance forms and more research is needed to explore a wider group of cultural dance forms.

WHAT IS PHYSICAL FITNESS, AND WHY IS IT BENEFICIAL?

Dance calls upon all aspects of physical fitness. Good physical fitness is key to reducing the risk of injury, enhancing performance, and ensuring longer dancing careers. A physically fit dancer is one who has the ability to meet the demands of a specific physical task at an optimal level. The goal of improving dancers' physical fitness is to minimize the difference between the dancer's individual maximal abilities and their performance requirements.[1-3]

The formal dance class has long been considered the cornerstone of training, providing all the technical, physical, and aesthetic requirements of dance. However, often dancers are not as prepared and ready as they could be for the demands of training and performance. It has also been found that there is a discrepancy in the physical intensity level between training, rehearsal, and performance. This means that training methods, which are generally based on tradition, are not sufficient to help prepare dancers for the higher, more physically demanding aspects of performance.[4] Considering these studies, and with improved understanding of the artistic AND athletic needs of dancers in different genres, it is important that dancers encorporate fitness training into their schedule to help better prepare them physiologically for the demands of current choreographic work.

WHAT TYPES OF PHYSICAL FITNESS ARE MOST IMPORTANT FOR A DANCER AND WHY?

While research indicates that some dance styles require certain elements of physical fitness more explicitly than others, in a well-rounded dance training program it is necessary to consider all the components of physical fitness.

The components of physical fitness are:
Aerobic fitness – associated with moderate, longer-term levels of activity.
Anaerobic fitness – associated with high intensity, maximal, short bursts of activity.
Muscle strength – the ability of a muscle to produce a maximal force on one occasion.
Muscle endurance – the ability of a muscle to produce continuous movement.
Muscle power – the explosive (speed-related) aspect of muscular strength.
Flexibility – the range of motion at a joint in association with the pliability of a muscle.
Neuromuscular coordination – associated with balance, agility, coordination, and skill.
Body composition – the make-up of body weight by percentage of muscle and fat.
Rest – a period of no activity, to allow for recovery and regeneration.

It may be suggested that unless dancers are physiologically prepared to the same extent as they are artistically, their physical conditioning may potentially be a limiting factor in their development. Furthermore, ignoring the physiological training of today's dancers could eventually hamper the development of the art form. It is the continual responsibility of dance teachers and artistic staff to develop their knowledge and

understanding of the physiological demands of dance and be aware of the options for either integrating physical fitness training into the technique class itself or providing it through supplementation (e.g., cross training).[1,5]

In a study with full time contemporary dance students, a year of weekly dance fitness classes were completed alongside regular technique training. Students perceived positive physiological adaptations such as reductions in fatigue, improvement in general energy levels, and an improved capacity in their dance classes to sustain technique and jumping ability. The importance of warm up and cool down was also highlighted by the students, along with recognition of the relationship between improved physical fitness and lower risk of injury.[6] More than thirty-five years ago it was stated that the best dancers have an integrated combination of two talents: knowledge of what is to be expressed and the physical and mental tools to accomplish that expression.[7] For example, a concert dancer who is able to jump higher, balance longer, and sustain their energy for a long time, will have a wide range of tools with which to produce desired demands of choreography. Although a topic of continual debate, more recent research suggests that a physically fitter dancer is more equipped to achieve specific aesthetic competence criteria.[1,8]

WHICH ACTIVITIES IMPROVE VARIOUS TYPES OF PHYSICAL FITNESS?

AEROBIC TRAINING

The greater a dancer's aerobic capacity is, the longer they can work at moderate heart rates before becoming fatigued. Research suggests that dance will only elicit an improvement in aerobic capacity in a very unfit group of people, or if an aerobic-style dance class is taken. In other words, the average dance technique class is too intermittent in nature for any positive aerobic effect to occur. To improve aerobic capacity, the body needs to work hard enough to bring about change or adaptation within the body. Specifically, a rise in heart rate to approximately 70–90% of maximum (HRmax) will stress the aerobic energy system. This elevation in heart rate has to be maintained between 20 and 40 minutes, three times a week. Continuous movement activities, such as running, aerobics classes, swimming, cycling, and skipping, are good examples of aerobic exercise.[9-12]

The primary goal of the technique class is dance skill acquisition. Developing technical skills and movement efficiency requires a distinct focus from that needed to build a dancer's aerobic capacity. However, technique classes can be modified to involve some degree of aerobic work, using simple repetitive movements. Simple movement repetition helps to challenge the aerobic energy system rather than stress skill acquisition. Warm up could be conducted in a continuous manner at a higher intensity than normal, and center or traveling sequences could be longer in duration, with less rest time in between repetitions, allowing aerobic adaptions to develop. Familiar movement combinations might be performed over consecutive classes, purely for the benefit of continuous physical activity rather than artistic effect.[9,12-15]

ANAEROBIC TRAINING

Anaerobic training utilizes activity that is of a maximal, 'all-out' effort for short periods of time. An exercise-to-rest ratio of 1:3 is recommended for training the threshold at which lactate starts to accumulate in the blood stream, thus hindering muscle function. An exercise-to-rest ratio of 1:5 is recommended for training the source of the fastest muscle actions: high energy phosphates, adenosine triphosphate (ATP) and creatine phosphate (CP). Optimum exercise time for each bout can gradually increase from 10–50 seconds. The intensity of activity for the whole duration should be near maximal heart rate (95–100% HRmax). Rest periods

should be at a low intensity exercise, as this promotes faster recovery. Examples of anaerobic exercises include sprints, quick steps, jumps, fast skipping, and high intensity interval training (HIIT classes).[16]

MUSCLE STRENGTH TRAINING

The role of strength training in dance has frequently been misunderstood. There are still concerns in the dance world that increased muscle strength will negatively affect flexibility and aesthetic appearance.[17] However, supplemental strength training can be beneficial and lead to reduced occurrences of dance-related injuries and benefits such as increased jump height without interfering with key artistic and aesthetic requirements.[1,18-21] For an optimal strength training program, it has been suggested that exercises be specific to the desired outcome. A combination of high intensities (70–100% of maximal effort) and low volumes of work, two to three times a week, aims to increase muscle strength. A full recovery period (5–6 minutes) is essential between sets in this instance.[16,22] Examples of strength training include resistance training with external weights, a partner's body weight, and core stabilization training.[23-25]

MUSCLE ENDURANCE TRAINING

Where muscle strength training typically involves heavy weights/resistance with minimal repetitions for a relatively short amount of time, muscle endurance training involves light weights/resistance with many repetitions for a prolonged time. Each program targets a specific goal. Dancers wanting to increase muscle endurance are prescribed a combination of moderate intensities (60–70% maximal effort) and higher volumes of work, three to four times a week. The rest periods are then shorter (2–4 minutes) so that the next set of exercises begin before full recovery.[16,22] Examples of endurance training include Pilates, and yoga that includes pranayama and asana movements (coordinated movement/pose patterns with the breath).[26]

POWER TRAINING

Jumping is an integral part of most concert dance performances and involves the use of both muscular strength and elasticity. Studies report that plyometric (jump) training has been shown to have a positive effect with dancers. However, plyometric training must be approached gradually and systematically to reduce dance-related injury risk. A good starting point is to design exercises in which dancers are encouraged to jump in a neutral position without emphasizing artistic skill, and to simply focus on jumping higher. Once the dancers have gained greater understanding of how to elevate themselves, they can bring correct dance technique back into the movements while trying to maintain as much height as possible.[27-30] Examples of power training include plyometric exercises, kettlebell training, rhythmic gymnastics-based supplementary training, and HIIT classes.[20,21,24,31]

FLEXIBILITY TRAINING

Flexibility is an important element of physical fitness. It is crucial in complimenting muscular strength, building efficiency in movement, coordination, and reducing dance-related injuries. Holding muscles in a stretched position for a prolonged amount of time causes the muscle fibers to become accustomed to the new length, therefore increasing flexibility. For flexibility training to be beneficial, the specific muscle group being stretched needs to be isolated. For example, when stretching the hamstrings, spinal movement should be reduced. Relaxation and having a calm nervous system are also important. It is advised that stretches happen slowly and gently with coordinated inhalation and exhalation at the moment of maximum stretch (i.e., refrain from holding the breath).[32]

There are many different types of stretching including static (holding), dynamic (moving through the stretch), and proprioceptive neuromuscular facilitation (PNF; a method utilizing alternate contraction and relaxation). It is important to be aware of the advantages and disadvantages of each.[33] For example, ballistic (bouncing) stretches are very dynamic and can lead to muscle soreness and injury. Contrary to the practice of many dancers, stretching to full range should be carried out when the body is warm, preferably after class.[28-30,32,33] Examples of flexibility training techniques include practices such as Hatha, Iyengar, and Vinyasa Yoga, as well as rhythmic gymnastics-based supplementary training.[26, 31]

NEUROMUSCULAR COORDINATION

Dance fitness also involves balance, agility, quick directional changes and shift of weight, coordination, and skill. Out of all the components of physical fitness, it is likely that neuromuscular coordination is addressed most often in the actual dance technique class. Through the use of imagery and visualization, improved neural pathways can help facilitate and develop efficiency in movement. Neuromuscular coordination can positively affect levels of muscle strength by controlling the recruitment of the right number of muscle fibers at the right time. In other words, dancers can become more skillful in using only the muscles required to produce a certain movement and thus sustain sufficient energy levels and reduce fatigue. Research into motor control and motor learning also offers invaluable information that can enhance neural re-patterning, coordination and muscle relaxation.[38] Neuromuscular coordination can also be supplemented via core stabilization training and neuromuscular-based training.[15,23,34]

BODY COMPOSITION

Body composition plays an important role in dancers' health and performance. Appropriate and healthy ratios of lean muscle mass to fat mass are key factors that can contribute to optimizing physical performance. Body composition is often expressed as a percentage of body fat and healthy recommendations suggest that dancers' body fat be at a certain level in order reach their potential. According to the World Health Organization, healthy body compositions range from 17 to 25% for females and below 15% for males (but not too low as a certain amount of fat is essential for daily healthy function). Optimal body composition is going to vary from activity to activity. These percentages are useful indicators to guide strategies according to the characteristics of the individual dance style so that dancers can manage long days of training, rehearsing, and performing. A balance of appropriate energy intake (nutrition) and energy expenditure (physical activity) will help dancers achieve the body composition that is right for them.[35]

REST

The importance of rest in dance training cannot be stressed enough. Proper recovery from physical training has many benefits. Rest helps to accelerate muscle regeneration between training sessions, to decrease fatigue, and to reduce the incidence of injury. Continuous training beyond a certain threshold of physical activity, without sufficient rest, can negatively impact both the health and performance of dancers. This concept refers to overtraining – excessive training that results in no effect or even negative effects on a dancer's performance. When there is an imbalance between habitual exertion (training) and recovery, symptoms such as severe and prolonged fatigue, changes in behavior and a loss of motivation can result. Recommendations to prevent or reverse overtraining include monitoring dance quality versus quantity, eating a balanced diet, keeping well-hydrated, and getting quality sufficient sleep (6–9 hours/night).[36]

GENERAL TRAINING PRINCIPLES

The following variables of exercise training also need to be understood when constructing balanced training plans. Depending on the dancer's training/performance goals, it is often necessary to progress to a higher level of difficulty by increasing the intensity, volume and/or frequency of training over time. Otherwise, the body simply adapts to the scheduled training and physical fitness levels plateau. Also fundamental to training is the concept of overload, which means that the body must be challenged above a certain threshold to provide sufficient stimulus for improvement to occur. Normally encountered stress will maintain but not increase the level of conditioning. For example, if the demands of a dance class are too similar from day to day there will be insufficient overload for desired physiologic improvement to take place. Sport literature describes another principle called specificity, and recommends that to develop motor abilities, training exercises should use similar movement patterns to the particular activity for which it is preparing the athlete/dancer.[15,16]

SUMMARY OF PHYSICAL FITNESS TRAINING METHODS

The primary aim for a supplementary dance fitness class is for the structure and content of the class to be responsive to dancers' training needs. Intensity and duration of exercises need to be considered. It is also recommended that recovery techniques become a part of the overall training program, alternating between work and rest. The dancers' heart rates and/or perceptions of how hard they feel they are working (rate of perceived exertion) can be monitored regularly to ensure that the intensity level is appropriate to elicit a training response.[37] Functional physical fitness training should precede more dance-based movement that increasingly replicates vocabulary from technique classes. For example, for classical ballet, plyometric training can be introduced, initially using basic parallel foot positions, and later modified to include turned out positions, which more closely mimic the type of jumps desired in ballet. Upper body strength exercises can gradually progress to incorporate partner lifting of varying speeds and complexities. During the final phase, a mixture of all physical fitness parameters can be structured into a circuit-type class, reflecting the variety of activity and speed of succession that would be encountered in a dance class or performance.[1,14,15]

HOW CAN PHYSICAL FITNESS BE MEASURED?

The applicability of laboratory tests and training regimes from sport to dance is perpetually debated. What is becoming increasingly more clear is the need to gather relevant data (physiological and psychological) to develop specific methods of promoting and assessing dance fitness.[11]

Heart rate measures are key to evaluating aerobic capacity. The fitter a dancer is, the slower the heart needs to beat to pump an adequate volume of blood to the rest of the moving body. The gold standard laboratory test to measure aerobic capacity is the maximal oxygen uptake test (VO_2max), which involves running, swimming, or cycling, while the highest level of oxygen that can be sustained in the body is measured.[12] The dance specific aerobic fitness test (DAFT) is a submaximal multistage test that correlates to particular levels of physical fitness capabilities. Rather than running on a treadmill, the dancer's heart rate is measured while performing simple choreographed movements that gradually increase in intensity.[1,4]

Measuring anaerobic fitness can prove challenging because the anaerobic energy systems are utilized for such a short period of time (e.g., the first 30–60 seconds of maximal intensity exercise). Laboratory tests include the Wingate Anaerobic bike Test (WAnT), which measures lower limb power, while pedaling on a stationary bike as hard as one can for 30 seconds, against a resistance that is proportional to one's own body

weight. A test that is more specific to dance is the vertical jump height test, which assesses how high the dancer can jump and therefore evaluates explosive muscular power in the lower extremity. The high intensity dance specific fitness test provides a means of assessing and monitoring dancers' capacity to dance at near maximal intensities. This test allows dancers to be assessed in an environment they are accustomed (the dance studio), using a mode of exercise that is relevant (dance), and of adequate intensity that is representative of performance.[1,38,39]

Various isokinetic machines (computerized equipment with speed and resistance capabilities) and dynamometers (e.g., handgrip) can measure specific muscular strength and endurance. Flexibility and joint mobility can be assessed using flexometers and goniometers, which measure joint angles in the body.[1,38]

Body composition can be measured in a variety of ways. Skinfold measurements assess subcutaneous fat at specific areas of the body whereas bioelectrical impedance measures total body weight by way of an electrical current that flows through the body, where lean muscle tissue conducts better than fat.[1,40]

ARE THERE ANY IMPORTANT CONSIDERATIONS TEACHERS NEED TO MAKE?

While technique classes focus on neuromuscular coordination, the length of a typical dance class may not be adequate to meet all of the dancer's physical conditioning needs. The amount of space available, the numbers of students, and the time required for teaching and providing feedback also have an impact on work rate. Therefore, to achieve efficient and optimal development of dance skills, conditioning work alongside technique class is recommended.[1,9,13]

Researchers state that regardless of performance level, talent, form of dance, gender, or age, all dancers have to use some or all of the elements of physical fitness during their practice. It is important to remember that particular groupings of dancers may have varying abilities and physical knowledge, so care must be taken to construct safe and appropriate training regimens. For example, adolescent dancers can experience a rapid decrease in proprioception (internal body awareness), coordination, and strength due to maturation and growth. For vocational dance students, fatigue can contribute to injury occurrence, so the emphasis of physical fitness training should be on both aerobic conditioning and rest/recovery. However, sessions should include a balance of muscular strength, endurance, and power training as well.[2,14]

CONCLUSION

Assessing, observing, and researching the specific characteristics of dance support dancers and their teachers to improve training techniques, to employ effective strategies to minimize dance-related injury, and to determine better standards of health and physical conditioning. As we understand and develop more appropriate dance training methodologies, dancers can reap the benefits of enhanced performance, reduced injury and ultimately longevity in their careers.

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