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Perceived Importance of Resistance Training in Collegiate Dancers

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May, 2017

To the Dean of the Graduate School:

We are submitting a thesis written by Kayla Major entitled **PERCEIVED IMPORTANCE OF RESISTANCE TRAINING IN COLLEGIATE DANCERS.**

We recommend acceptance in partial fulfillment of the requirements for the degree of Master of Science in Sport and Fitness Administration through the Richard W. Riley College of Education.

David Schary, Thesis Advisor

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PERCEIVED IMPORTANCE OF RESISTANCE TRAINING IN COLLEGIATE
DANCERS

A Thesis

Presented to the Faculty

Of the

College of Education

In Partial Fulfillment

Of the

Requirements for the Degree

Of

Master of Science

In Sport and Fitness Administration

Winthrop University

May, 2017

By

Kayla Major

Abstract

Dancers are artistic athletes that use their bodies as their instrument. Dance is a sport that requires significant skill and higher levels of fitness. Unfortunately, dancers are not as physically fit as sport athletes. This may not only increase their risk of injury, but also limit their maximum dance performance. Resistance training offers significant physical and psychological health benefits. But, there is very limited research regarding dancers' resistance training habits. The results of the few studies that exist unanimously suggest that there is no detriment to the aesthetics of dance, rather improvements in dance elements as a result of improved fitness. The purpose of this study was to uncover collegiate dancers' perceived importance of resistance training. Sixty-two collegiate dancers participated in the survey. Demographics were collected and they completed a modified Strength Training and Conditioning Questionnaire. A multiple regression analysis was conducted to determine if the predictor variables gender, dance genre, and year in college influenced their overall perception score. Results indicated gender and year were not statistically significant predictors, and although dance genre was not quite statistically significant it was the closest to significance of the three ($p=.178$). Jazz in particular was the closest dance genre to reaching significance ($p=.089$). Results of this study are important because they are the first of their kind. Insight into the dance communities perceived importance of resistance training could be useful for the development of a resistance training program designed specifically for dance.

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Review of Literature Manuscript

Introduction

Dance is one of the oldest and most universal forms of physical activity. Children as young as two years old begin to dance, and for some it becomes a lifelong commitment. According to the National Dance Education on Higher Education Database (2006), there are approximately 665 postsecondary institutions that offer a dance program in the United States, and there are nearly eighteen million students enrolled in those programs. Dancers use their body as an instrument to entertain through beautiful choreography and movement. There are many different types of dance including ballet, ballroom, contemporary jazz, and tap. Dance is an expressive, functional art form that requires significant skill and conditioning. Sir Peter Wright, the former Artistic Director of Birmingham Royal Ballet referred to his dancers as “performing” or “artistic” athletes because of the increased physical demand on a dancer’s bodies (Liderbach, Schanfein & Kremenic, 2013).

Dancers are artistic athletes because the physical and psychological demands are similar to traditional sport athletes. Ambegaonkar (2001) explained that dancers are highly motivated and dedicated to mastering their craft; and performances, much like athletic competition, require significant strength, power, flexibility and endurance. The physical fitness required of dancers also incorporates body composition, joint mobility and cardiorespiratory fitness. An important component to dancers’ fitness and success is their ability to develop high levels of muscle strength. Unfortunately, dancers, in general, are not as well conditioned as other athletes, particularly in regards to muscular strength

(Koutedakis, Kalinoglou & Metsios, 2005). Many dancers and dance programs lack specificity and periodization within dance training (Ambegaonkar, 2005), which may increase a dancer's susceptibility to injury. Thus, to meet the increased physical demands associated with dance, there needs to be supplementary resistance training to promote improvements in muscular strength, power, and endurance.

Dance Injuries

The prevalence of dance injuries amongst dancers of varying experience and dance type is reported to be as high as 75 to 97 percent (Liederbach et al, 2013) compared to sport athletes for a variety of reasons, including but not limited to long and rigorous hours rehearsing, dancing barefoot or in ballet shoes, dancing on pointe, unusual dietary practices, and insufficient warm ups (Koutedakis et al., 2005). Similar to athletic injuries, dance injuries are usually activity specific, and they tend to occur in the later stages of training and competition. Injuries occur most often during performance seasons when dancers are engaging in more hours of dance per day than usual (Liederbach et al, 2013). The greatest incidence of dance injuries occurred during rehearsals, when new material was being learned and participation in repetitive activities was highest (Liederbach et al, 2013). Therefore, injuries occur most frequently during training phases that include elements of overload, fatigue, and novel movements.

Injury tracking has also revealed trends in the types of injuries dancers sustain, as well as the body areas most frequently injured. Ambegaonkar and Caswell (2005) evaluated the injuries of nearly two-thirds of all students in the dance department in three semesters of developing a Dance Medicine Program at the University of North Carolina

Greensborough (UNCG). During those three semesters, 80 percent of documented injuries were chronic overuse or recurring chronic injuries, and 70 percent of those injuries occurred to the lower extremity. The remaining 30 percent of documented injuries were to the upper extremity, back, or head/face/neck respectfully. Other research has shown the most prevalent injuries among collegiate dancers are musculoskeletal injuries to the lower extremities and the back (Ambegaonkar & Caswell, 2011; Kaiser, Wakefield & Merrill, 2002). It is important to note once injured, dancers' likelihood of becoming re-injured was increased (Ambegaonkar & Caswell, 2005).

One particular group of athletes that bear multiple similarities to dancers are cross country runners. Dancers are similar to cross country athletes primarily due to the reliance of aerobic energy system and increased cardiovascular and muscular endurance. Dancers have to be able to perform in productions of various durations, sometimes without a break or intermission. Both athletes benefit physiologically from training muscular endurance of medium to longer duration, and developing a baseline of muscular strength. Similar to dancers, cross country athletes also run a high risk of re-injury throughout their season (Brumitt, 2009). According to Brumitt (2009), many cross country athletes fail to perform resistance training exercises due to a perceived lack of training time or knowledge. Cross country athletes, much like dancers, are at greater risk of injury to the low back, hips, knees, feet and ankles. Thus dancers' resistance training habits, combined with their knowledge and/or perception of resistance training, may be a primary cause of their increased injury rates.

To address the recurrent lower extremity injuries with cross country athletes, Brumitt (2009) proposed an injury prevention program that takes a top down approach, including core and hip strengthening exercises. The “core” is a group of muscles (rectus abdominis, transversus abdominis, internal and external obliques) responsible for maintaining neutral position related to posture, and assisting in the generation and transfer of energy from the trunk to distal extremities (Araujo, Cohen, and Hayes 2015). Araujo, and colleagues (2015) studied the effects of core stability training on vertical ground reaction forces during jump landings and found that this type of training improved landing kinetics in female capoeira (a form of Brazilian martial arts with elements of dance and acrobatics) athletes and reduced lower extremity injury risk. Core stability training is utilized by many athletes for injury prevention, rehabilitation, and to enhance sport performance. Similar to the cross country athletes, core strength is pertinent to dancers’ development because a significant amount of their movements require stabilization or force generation from this area of the body. A weak core predisposes dancers to injuries such as low back pain and non-contact knee ligament tears. The core runs from the shoulder joints down to the hip joints. Therefore, hip strengthening becomes just as important to injury free athletic participation as core strengthening.

The completion of effective resistance training programs is imperative to decrease the likelihood of the site-specific injuries many dancers typically suffer. Poor stability of the hip, which is caused by dysfunctional hip musculature, has the potential to create abnormal motions of the leg (i.e., femur, tibia, and mechanics of the patella), which

contribute to lower leg injuries. Athletes with asymmetrical hip strength have a more difficult time maintaining correct lower extremity alignment throughout endurance activities. Research conducted with female cross country runners demonstrated the importance of hip strengthening for leg injury prevention (Brumitt, 2009). Similar sport athletes to dancers (e.g. gymnasts) have also shown neuromuscular control of the lumbo-pelvic-hip complex to be a significant source of dynamic stability (Araujo, Cohen & Hays 2015). Additionally, dynamic stability is important to athletes completing activities requiring jumping and landing, with particular emphasis on landing. Landing technique and peak landing forces are potential indicators of injury risk to the lower limbs (Araujo et al., 2015).

A great deal of research on dancers has focused on jumping and landing technique specifically as it correlates to ACL injury; a leg injury dancers do not sustain frequently. Females have a greater risk of lower limb injury than males, so dynamic stability and landing are especially important concepts for dancers and performing artists to practice (Araujo et al., 2015). However, female dancers have repeatedly demonstrated superior landing skills; thus they have a reduced prevalence in ACL injuries when compared with other athletes. Orishimo, Liederbach, Kremenich, Hagins, and Pappas (2014) examined single leg drop landings and found that female dancers landed with significantly lower knee valgus angle, hip adduction and trunk side flexion than female team sport athletes. This is likely due to dancers' extensive training to land "softly" for aesthetic purposes. Their bodies have been trained to have the necessary neuromuscular control and balance to minimize the likelihood of an ACL injury. Yet, amongst dancers that do suffer from

ACL injuries, the cause is frequently related to fatigue (Liederbach et al., 2013). While dancers are superior to comparable athletes regarding single leg neuromuscular control and balance, bilateral improvements in muscular strength, power, and endurance may be key to reducing the common lower body injuries dancers suffer. Strength and conditioning training sessions beyond technique dance classes may be necessary to make those improvements. Incorporating resistance training into the dancers' fitness routine could be beneficial to reducing lower body injuries.

Physical Benefits of Resistance Training

Dance is a type of aerobic activity, but there are many dance movements that are more anaerobic (e.g. jumps, spins, turns). The cardiovascular system yields the greatest benefit from aerobic training; the heart and lungs learn how to process and deliver oxygen more quickly and efficiently to the body (Sheppard & Triplett, 2015). Anaerobic training does not utilize oxygen, and therefore requires different training methods. Although aerobic training is certainly important to athletes and the development of endurance, aerobic training alone is not sufficient to dancers' long-term development of strength and power. Therefore, anaerobic training is necessary to promote the speed, strength and power dancers need to avoid injury. Resistance training is a convenient and commonly utilized method for athletes to train anaerobically and prevent injury.

Resistance training also combats the loss in lean body mass and resting metabolic rate associated with normal aging (Shaw, Shaw & Brown, 2015). It has its own unique health benefits such as decreasing fat mass while simultaneously increasing lean body mass, increasing bone mineral density, reducing resting blood pressure and

cardiovascular demands to physical activity, and improving lipoprotein-lipid profiles (Shaw et al, 2015). Additional benefits specific to musculoskeletal health consist of a reduction in low back pain and discomfort, inflammation, muscle weakness and fatigue, and an overall reduction in the risk and severity of musculoskeletal injuries (Shaw & Shaw, 2014). For dancers, the most important benefits relate to the musculoskeletal system because it addresses the majority of injuries that result in lost time dancing.

Other than muscles, key structures of the musculoskeletal system include bones, tendons, ligaments, cartilages, and nerves. Bone health is one of the most important components related to the longevity of dancer's careers, since over time the porosity of bone increases, also increasing the risk of fractures. Additionally, dancers may be more likely to develop osteoporosis. Bone has the ability to adapt to the physical stresses/demands placed on it. It responds to many different types of training, but training protocols require increased overload that will illicit bone growth adaptation. Anaerobic training, such as resistance training, can yield great increases in bone mineral density and strength. The increase in bone density and strength is directly related to increased muscular strength resulting from resistance training.

Dancers need sufficient strength to execute dance movements without causing muscular injuries, however dancers of some dance genres lack strength more than others. Isokinetic measurements, which take into consideration speed and strength of muscle contractions and may be used to identify muscles that are strong or weak, and indicate lower strength values in dancers compared to other athletes and untrained individuals (Koutedakis & Jamurtas, 2004). Among those measured, ballerinas demonstrated the

least muscular strength compared to other types of dancers, having only 77 percent of the weight-predicted strength norms. However, modern dancers tended to be stronger, likely due to their multidisciplinary background outside of dance. Modern dancers display greater strength and athleticism due to participation in other activities (e.g., figure skating, gymnastics, martial arts), whereas ballet dancers are encouraged to focus only on ballet technique development.

Some dance programs may only require dance technique classes in their curriculum, and leave resistance training and conditioning at students' personal discretion. However, dance only training is suboptimal loading of the neuromuscular system, which can result in muscular strength decreases in male and female dancers, despite the type of dance they perform (Koutedakis & Jamurta, 2004). Resistance training is key to correcting imbalances in muscular strength whether it be a bilateral discrepancy between the left and right limbs, or an agonist/antagonist muscle group discrepancy. Studies have shown that the weaker the hamstrings muscles are compared to the quadriceps muscles, the more severe the injury (Koutedakis & Jamurtas, 2004). Introducing hamstring strength training improved knee flexion-extension strength ratios and decreased the time taken off from activity due to various injuries. Assessing and treating muscle imbalances with proper resistance training exercises before the start of the competitive dance season may prevent many of a dancer's muscular injuries.

Resistance training for muscular strength simultaneously leads to increased connective tissue strength and size (Shaw and Shaw, 2014). Connective tissues provide the framework for our bodies; two very important connective tissues to the dance athlete

are ligaments (connects bone to bone) and tendons (connect muscles to bones). Resistance training causes the body to increase collagen production, which causes an increase in connective tissue size and strength. To dancers this training effect may sound threatening to their needed flexibility. However, there is no scientific evidence to suggest that the increase in size or strength from resistance training would negatively affect muscle flexibility. Research does suggest athletes should strengthen the muscles they routinely stretch and stretch regularly after they strengthen because consistent flexibility training may cause connective tissues to loosen and/or elongate (Koutedakis, Kalinoglou & Metsios, 2005). In fact, elongated connective tissues could allow hypermobility (a greater range of motion beyond what is normal) of the joints and predispose dance athletes to injury. Thus, increased connective tissue size and strength could be beneficial because it decreases the likelihood of stretching or tearing ligaments and tendons. In addition, as lower body bone and muscle strength increase, the incidence of tibia/fibula stress fracture, muscle strain, and ankle and knee ligament sprain related injuries decreases (Pescatello, 2014).

Resistance training that targets specific body areas may be the key to reducing the likelihood those areas will become (re)injured, however, to complete such training without overtraining requires precise programming. Resistance training programs for the athletic population pay special attention to the principles of specificity, overload, and progression to ensure training goals are met and injuries are reduced (Sheppard & Triplett, 2015). Designing a successful resistance training program requires the recognition and manipulation of seven program design variables throughout the sport

season (Sheppard & Triplett, 2015). For traditional sport athletes, strength and conditioning sessions are a well-documented, mandatory component of athletic development during pre-season, in-season, and post-season. Currently there is little research exploring collegiate dancers' resistance training habits, specifically which the type, frequency, and duration of training for the different training seasons. It is well documented in the literature that collegiate dancers complete dance technique classes that are required as part of their academic coursework, and they are encouraged to participate in alternative exercise such as yoga and Pilates (Koutedakis et al, 2007). Nevertheless, dance technique classes and alternative activity classes alone are not sufficient to employ overload and produce enough strength and cardiorespiratory gains to handle the rigors of dance (Koutedakis et al, 2007). Dancer's bodies may become accustomed to the same particular movement patterns necessary for a class or performance, therefore no increases in strength or endurance can be made without changing one of the fitness domains (i.e., duration, frequency, type of training/energy system recruitment).

A common misconception historically within the dance community relates to hypertrophy as a result of resistance training. Resistance training and plyometric training are attributed to a reduction in percentages of body fat, increased muscle strength, and increased muscle tone. However, it is important to note that significant increases in muscle strength may occur without proportional changes in muscle size (Koutedakis, Kalinoglou & Metsios, 2005). Resistance training is followed by changes within the nervous system, beginning with increased fiber recruitment. This suggests that in the early stages of such training, hypertrophy is not a condition for strength gains or the

resulting ability to jump higher and more gracefully (Koutedakis et al., 2005). Resistance training yields far greater benefits to the development of dancers than even the current dance literature acknowledges. Additional research is still needed to fully evaluate the training regimens needed to promote the fitness components necessary for dance while maintaining the aesthetic nature of dance.

Documented Resistance Training in Dancers

Only one study has emphasized the importance of aerobic and resistance training in addition to technique classes for dancers. Koutedakis et al. (2007) examined the effects of three months of aerobic and resistance training on selected performance and fitness related parameters in collegiate modern dance students. A special dance test was designed for this study, which included two pairs of circles on the studio floor. Dancers were instructed to perform a sequence of jumps in reference to the starting point on the circle and failure to do so resulted in point deductions. Two dance instructors and former professional dancers completed the assessment of the dancers' execution of the sequence. Hamstring flexibility and leg strength were also incorporated into the program.

By the end of the program, the exercise groups showed significant increases in dance ability, VO₂ max, flexibility, and leg strength as compared to the control group that participated in only the dance courses required by their educational program. This result is particularly important because it showed that a resistance training program will not hinder the development of dance performance, but can actually improve dance abilities such as jumping, landing and turning. The results showed increased cardiorespiratory function and force production, in addition to resistance training, is also important to

providing the artistic edge during performances that can set dancers apart. Dancers in the control group did not make any improvements in muscular strength over the 12-week period (with completing only the dance courses required in their curriculum). This suggests that the current model of dance education should include specific resistance training, otherwise dance students may not make improvements in fitness that are necessary for improvements in dance.

A second key study focused on both aerobic and resistance training, Brown, Wells, Schade, Smith, and Fehling (2007) evaluated the effects of plyometric training versus traditional weight training on strength, power, and aesthetic jumping ability in female dancers. The Wingate Anaerobic Power test was utilized with a cycle ergometer, the leg press, leg curl, and leg extension machines were used to evaluate leg strength. For the subjective dance evaluation three dance faculty members were asked to serve as judges of dance student's ability/execution of suspension in the air during a jump, height of the jump, the ability to point the feet in the air, and their overall ability to complete an aesthetically pleasing vertical jump. Results showed participants in the weight training group significantly increased absolute mean anaerobic power, and the plyometric group significantly improved in subjective jump height as well as the ability to point their feet while jumping. There is a saying in the dance community that a dancer who is able to jump higher, balance longer or create the illusion of what needs to be expressed may not necessarily be a better dancer, but he/she will have a greater range of tools to produce desired dance choreography (Irvine & Rafferty, 2011). So it would be in every dancer's best interest to perform these types of training, to give them an "artistic edge" when

competing for certain parts in a piece or performance. Similar to Koutedakis et al. (2007), this result further suggests that resistance training and plyometric training can both be useful training methods for dancers to improve skills essential to dance aesthetics, without compromising their desired physique.

Although the lack of research in resistance training in dancers may reflect the fear that such training would be detrimental to the artistic nature of dance, the results from Koutedakis et al. and Brown et al. (2007) suggest the opposite, that improvements in power, and leg strength were followed by concomitant increases in dance-test performance. Dancers that limit themselves to dance-only training limit the physiological advantages available from resistance training. The program utilized in this key study was a generic training program for men and women of average fitness levels (based on gender and age norm) and dancers benefited from it. Further research should provide a comparison group to evaluate the effectiveness of different resistance training programs. A program that takes into consideration the physical demands of dance and trains the appropriate energy systems would yield the greatest benefits for dancers. The research about effective training programs for various sport athletes exist, but regarding dancers the studies are few.

Psychological Benefits of Resistance Training

Positive mental health is a large factor in the physical manifestation of health (Guszkowska & Pitsudksi, 2015). Not only can resistance training be beneficial to dancers by improving physical fitness, dance technique, and reducing injuries, it also can improve their psychological health. The current model of dance success and dancers'

health appears to be one of mastering the physical and technical side of their sport, while remaining free from injury. However, they must also be psychologically prepared to handle the stressors of dance (Koutedakis et al, 2007). An increased focus on an individual's physical appearance (which is characteristic of dance) can lead to anxiety and increased fear of being negatively evaluated by others based on appearance (Guszkowska, 2015). Increased dissatisfaction with an individual's body is a cognitive construct that directly relates to the formation of an individual's body image. Body image is a multi-dimensional construct including the cognitive, emotional, as well as an affective behavioral aspect of experiencing one's body (Guszkowska, 2015). Research has shown that participation in resistance training may instill participants with a sense of mental resiliency, build self-esteem, and positive body image for dancers (Guszkowska et al., 2015).

The internalized desire to be thin, in addition to external pressures from the media and coaches, have resulted in positive and negative behavior modifications (Robbeson et al, 2015). Negative behavior modifications include the use of recreational drugs, banned supplements, smoking and disordered eating. Eating disorders in dancers is a highly researched topic, and they are commonly linked to physical appearance, such as body shape and mass, which are determinants of body satisfaction, self-worth, self-esteem, and body image for women (Guszkowska et al, 2015). Physical activity is a positive modification associated with improved body image partly because physical activity can be used as a method of reducing and/or controlling body mass, and altering the shape of the body to an ideal shape. An effective method of simultaneously reducing

body fat, modifying body shape, and maintaining lean muscle mass is resistance training (Guszkowska et al., 2015). Therefore, it would be beneficial to dancers to develop resistance training habits early in their careers to decrease the likelihood of experiencing body dissatisfaction. In addition, learning resistance training techniques may help dancers feel as if they have a greater sense of control over safely altering their body shape.

Recently there has been increased research examining how women, and dancers specifically, feel about their bodies (Guszkowska, 2015; Nerini, 2015; Robbeson, 2015). Body mass index (BMI) has been found to be a strong predictor of body dissatisfaction in women and young girls alike; a higher BMI typically translates to an increased percentage of body fat and greater body dissatisfaction (Nerini, 2015). However, women that are physically active are more satisfied with their bodies compared to physically inactive women (Guszkowska, 2015). Dance athletes that have a more positive body image tend to display a better self-esteem and are less inclined to develop negative body modification behaviors (Robbeson, Kruger & Wright, 2015).

Interestingly, the type of physical activity or sport discipline practiced also has a significant influence on body satisfaction. Additional research is needed with younger dancers, but Nerini (2015) showed the type of dance young girls engage in may shape the complex relationship among dance and body dissatisfaction. Ballet dancers perceive more pressure to achieve a certain image and body weight than that of modern dancers, the same concept applies to elite dancers when compared to amateur dancers regarding body image, and developing unhealthy weight related behaviors. Fortunately, the

psychological benefits of resistance training extend to anyone that participates in this type of training, regardless of gender, age, or preferred type of dance.

Women involved in aesthetic sport disciplines (e.g., cheerleading, dance, and gymnastics) tend to be more dissatisfied with their appearance than women who participate in other sport disciplines and those that are inactive. When lean athletes, such as dancers, compare themselves to sport athletes, they tend to report greater dissatisfaction with their body image despite their lean, thin physique (Nerini, 2015). This suggests that dance athletes are more inclined to compare themselves to similar sport ideal models more than the general population (Nerini, 2015). This may be problematic to positive mental health/ body image because the research has repeatedly demonstrated dancers do not compare to similar sport athletes in measurements of various fitness components, but rather to the general (non-athletic) population (Koutedakis and Jamurtas, 2004). A disconnect may exist between dancers' perceptions of resistance training and satisfaction with their bodies, despite the ability of consistent resistance training to positively impact their body composition.

While athleticism is a key aspect of dance, body image and the aesthetics of the human body are also important when it comes to the overall health of the dance athlete. There is ample research that demonstrates the positive benefits of resistance training to psychological issues dancers are inclined to encounter, such as body dissatisfaction and poor body image. So if the limited research that exists suggests resistance training has the ability to effectively benefit the young dance athlete physically and psychologically, the

question is raised why is there so little research documenting the resistance training habits of dancers?

Dancers' Perceptions of Resistance Training

Presently the limited amount of research devoted to resistance training in the dance population leaves many questions unanswered. It is unknown if dancers perform resistance training, how often they do so, or what their methods are. Uncovering collegiate dancers and dance instructors' perceptions would help explain the importance of (or lack thereof) resistance training. Considering the gap in the literature, it would be beneficial to understand dancers' perceptions of resistance training's (in)ability to impact their performances, dance success/career and injuries.

Similar research has been conducted; Poiss, Sullivan, Paup, and Westerman (2004) evaluated the perceived importance of weight training to NCAA Division III men and women athletes. Eleven different sports athletes from four separate institutions were studied in three different phases of training. Results indicated that the men were significantly more likely to consider resistance training more essential to their training than female student-athletes, so they trained more days per week for a greater amount of time in their traditional and non-traditional seasons of training than did their female counterparts. These results could mirror dancers' perceptions of resistance training based on gender roles within the sport. Male dancers are commonly involved in partner lifts, which may encourage a heightened perception of the need to complete resistance training. But, this could translate into the opposite regarding female dancer's perceptions of resistance training; female dancers may feel as if resistance training is less important to

their role as a dancer because they are the partners typically being lifted. Although the literature debunks the misconception that resistance training cannot be completed in the absence of hypertrophy, female dancers may still fear that an increased body mass will make them more difficult to lift and less aesthetically pleasing to viewers. Fearing the unknown realm of resistance training may result in a dancer's decreased time spent resistance training.

For many years, women athletes were not expected to incorporate strength training in their overall training for their sport. This may be why some coaches and athletes still believe that women who engage in rigorous strength training will develop large, masculine, bulging muscles and compromise their femininity (Poiss, Sullivan, Paup & Westerman, 2004). However, there is growing research to support the need for strength training to the development of all athletes, including female athletes. Women and men respond to strength training in very similar ways. On average women display about two-thirds the strength and power of men, but female muscle tissue is very similar in force output to male muscle tissue and demonstrates proportional increases in strength performance (Koutedakis, Kalinoglou & Metsios, 2005). There is also no evidence to suggest women should train any differently than men (Koutedakis et al, 2005) the same misconceptions regarding the influence of gender on resistance training habits.

Poiss et al. (2004) did not reveal any significant differences in the perceived importance of resistance training based on sport, but within the dance community, perceptions may be different depending on the type of dance. As previously discussed, dancers' body image significantly differed between ballet dancers and modern dancers,

which could be an indicator of differing perceptions regarding resistance training. Ballet dancers historically have been characterized by slenderer, less muscular bodies compared to modern dancers so they may be less likely than their more muscular counterparts to believe resistance training is important to their success, and/or engage in that type of training. Future research should examine if the dance type affects dancers' perceptions and resistance training behaviors. There is a lot of knowledge to be gained about the role of resistance training in dance culture.

Conclusion

Uncovering dancers' perceptions of resistance training may serve as a precursor to establishing specificity and periodization in dance training. Research into the perceived importance of resistance training in the dance community is important because it has the potential to uncover the reason(s) why dancers avoid and/or omit this particular type of training. By clearly defining the factors that affect the perceptions of resistance training, the opportunity becomes available to address the concerns and/or reservations that may currently be present within the dance community. It is with great hope that future research into these perceptions serve as a step towards the successful development of an accepted and beneficial resistance training protocol for dance students. An effective resistance training program could be influential to the reduction of the high injury and re-injury rates prevalence amongst dancers. In addition to injury prevention, the proper resistance training program could lead to increased strength, endurance, neuromuscular control, and psychological wellbeing – all of which are key to improving dancers' skills as aesthetic athletes.

Incorporating resistance training into the collegiate dancers' training routine could lead to more well-rounded dancers with longer lasting and more fulfilling dance careers. By equipping dancers with a properly designed resistance training program, instructors and trainers can reduce the risk for injury, improve performance, and provide all dancers with the opportunity to develop a life-long habit that will continue yield positive physical and psychological health benefits.

Methodology

Design and Participants

A cross sectional design was utilized with 62 undergraduate dance students, males $n=6$, females $n=58$. 64 students began the survey but two participants were missing data so their responses were not included. Participants were 18 years or older, enrolled at colleges with dance programs in the southeastern region of the United States. Demographic information collected includes age, year in school, and primary dance genre/type. Additional demographic information can be viewed in Table 1.

Instrumentation

As seen in Figure 1, a modified version of the Strength Training & Conditioning Questionnaire (STCQ) was used to gather general dance training information, resistance training information, and individual perceptions on general dance training and resistance training (Poiss, Sullivan, Paup & Westerman 2004). Modifications include terminology tailored to reflect dance (instead of “sport”), and the “Increased Win Percentage” questions were excluded.

A 5 point Likert scale was used to score the STCQ, 5 -strongly disagree, 4- disagree, 3-undecided, 2-agree, 1-strongly agree. To determine a total perception score, the sum was taken of all responses with the exception of questions 24, 25, and 26 (questions were negatively phrased, opposite of the phrasing of all other questions). Scores were reflective of an inverse relationship, the higher the score, the lower the perceived importance.

Procedure

All participants were required to review an informed consent form and provide their consent before they were allowed to proceed to the survey. Prior the distribution of the study, Institutional Review Board approval was obtained. The survey was distributed online via Qualtrics software (Qualtrics, Provo, UT) to the department chairs and/or deans of dance programs. Students were allotted the first ten minutes of class time to complete the survey. In the event students are absent or unable to complete the survey during that time, they were encouraged to complete the survey at their leisure. Three e-mail reminders were distributed to students at the rate of one reminder per week if they did not completed the survey at one time. A two day grace period was allowed to complete the survey after the window closed. Three reminder e-mails were are also distributed to the department chairs and deans, one per two week time frame until the survey window closed.

Statistical Analyses

Descriptive statistics were calculated for the sample. A multiple regression analysis was used to measure the effect of each predictor variable on the dancer's overall perceptions of resistance training. The predictor variables include gender, type of dance performed, and year in college. All analyses will be performed using SPSS version 22 (Pyrczak Publishing, Glendale, California 2012).

Journal Manuscript

Introduction

Dance is one of the oldest and most universal forms of physical activity. It is an expressive, functional art form that requires significant skill and conditioning. Dance involves a foundation of various jumps, spins, and turns so it combines aerobic conditioning (e.g. running) with anaerobic skills (e.g. jumping). Dancers are artistic athletes because the physical and psychological demands are similar to traditional sport athletes. Important components of their fitness include muscle strength, endurance, power and flexibility. Unfortunately, dancers generally are not as well conditioned as sport athletes. Koutedakis and Jamurtas revealed dancers (particularly ballet) have lower strength values than other athletes and even untrained individuals (2004). This poses a problem because it potentially increases their risk of becoming injured.

Research shows dancers report a high prevalence of injuries (Liederbach, Schanfein and Kremenec, 2013). They may be more susceptible to becoming injured due to long and rigorous hours rehearsing, dancing barefoot or in special shoes (ballet or tap), dancing on pointe, unusual dietary practices, and/or insufficient warm ups (Koutedakis, Kalinoglou and Metsios, 2005). Most frequently injuries occurred to the low back and lower extremities (hip, knee, and ankle) however, upper extremity injuries have been reported as well (Ambegaonkar & Caswell, 2011; Kaiser, Wakefield & Merrill, 2002). Once dancers become injured, the likelihood of becoming reinjured is increased. But, there is the opportunity to end that cycle, and improve the health of the dance athlete, with resistance training.

Resistance training has the potential to benefit dancers physically and psychologically. Physically it reduces the loss in lean muscle mass and resting metabolic rate, associated with normal ageing (Shaw, Shaw & Brown, 2015). Over time the porosity of bone increases and the risk of developing osteoporosis and bone fractures increases. Resistance training protocols that require increased overloading of the muscles and bones over time yield significant increases in bone mineral density and strength. Resistance training can also decrease fat mass, while increasing lean muscle mass, reduce resting blood pressure, and improve lipoprotein-lipid (cholesterol levels) profiles. Implementing a preventative resistance training program that focused on strengthening and plyometric training (rapid force production) could be advantageous to dance athletes. Stronger, healthier bodies have the potential to increase the longevity of dancers' careers.

Positive mental health is a large contributing factor to the physical manifestation of health (Guszkowska, 2015). The psychological benefits of resistance training are vast. Dancers tend to have an increased focus on physical appearance due to the aesthetic component of their performances. However, this focus can lead to anxiety and a heightened fear of being negatively evaluated by others. Body dissatisfaction directly relates to the development of body image and body image has the potential to impact self-esteem. Female dancers are at a higher risk of experiencing body dissatisfaction than women of the general population. But, research shows that women that are physically active are less likely to experience body dissatisfaction than women who are not physically active (Guszkowska & Pitsudski, 2015). Resistance training is a positive body

modification tool that dancers can use to reduce their body fat, increase their lean muscle mass, alter their body shape and thus improve their satisfaction with their image.

Despite the evidence of the ability of resistance training to positively impact dancers' physical and mental health, there is very limited research available regarding their resistance training habits and/or successful training programs tailored for dance. Koutedakis et al (2007) studied the effects of three months of aerobic and resistance training on dance performance, flexibility and leg strength. Results showed the dance students that completed the training programs were able to jump higher, land, and turn more gracefully. Completion of the resistance training program did not hinder their dance or flexibility development in any way, but rather the increase in leg strength contributed to their success. This one key study is a prime example of the benefits dancers stand to reap by implementing supplementary resistance training.

A second similar study compared the effects of plyometric training versus traditional weight training on strength, power, and jumping ability on female dancers (Brown, Wells, Schade, Smith & Fehling, 2007). Participants in the weight training group increased their mean anaerobic power and the plyometric group significantly improved jump height and the ability to point their feet. Jumps are highly aesthetic components of dance that have to be executed properly to avoid injury and appear graceful. The ability to point the feet is also an important aesthetic component of dance performance. Overall, participants in both groups completed the training programs successfully and gained valuable fitness and/or dance skills.

Although there are only a few documented studies, all of the results consistently demonstrate resistance training benefits the dance athlete. Resistance training can reduce injuries, increase strength and improve dancer's body image but there is very little research documenting their resistance training habits. Additional research is needed to determine the culture surrounding this type of training in the dance community. The purpose of this research is to determine the perceived importance of resistance training to collegiate dancers and the variables that impact their perception. Uncovering their perceptions may serve as precursor to implementing a resistance training program tailored to dancers' needs.

Design and Participants

A cross sectional design was utilized with 62 undergraduate dance students, males $n=6$, females $n=58$. 64 students began the survey but two participants were missing data so their responses were not included. Participants were 18 years or older, enrolled at colleges with dance programs in the southeastern region of the United States.

Demographic information collected includes age, year in school, and primary dance genre/type. Additional demographic information can be viewed in Table 1.

Instrumentation

As seen in Figure 1, a modified version of the Strength Training & Conditioning Questionnaire (STCQ) was used to gather general dance training information, resistance training information, and individual perceptions on general dance training and resistance training (Poiss, Sullivan, Paup & Westerman 2004). Modifications include terminology tailored to reflect dance (instead of “sport”), and the “Increased Win Percentage” questions were excluded.

A 5 point Likert scale was used to score the STCQ, 5 -strongly disagree, 4- disagree, 3-undecided, 2-agree, 1-strongly agree. To determine a total perception score, the sum was taken of all responses with the exception of questions 24, 25, and 26 (questions were negatively phrased, opposite of the phrasing of all other questions). Scores were reflective of an inverse relationship, the higher the score, the lower the perceived importance.

Procedure

All participants were required to review an informed consent form and provide their consent before they were allowed to proceed to the survey. Prior the distribution of the study, Institutional Review Board approval was obtained. The survey was distributed online via Qualtrics software (Qualtrics, Provo, UT) to the department chairs and/or deans of dance programs. Students were allotted the first ten minutes of class time to complete the survey. In the event students are absent or unable to complete the survey during that time, they were encouraged to complete the survey at their leisure. Three e-mail reminders were distributed to students at the rate of one reminder per week if they did not completed the survey at one time. A two day grace period was allowed to complete the survey after the window closed. Three reminder e-mails were are also distributed to the department chairs and deans, one per two week time frame until the survey window closed.

Statistical Analyses

Descriptive statistics were calculated for the sample. A multiple regression analysis was used to measure the effect of each predictor variable on the dancer's overall perceptions of resistance training. The predictor variables include gender, type of dance performed, and year in college. All analyses will be performed using SPSS version 22 (Pyrzack Publishing, Glendale, California 2012).

Results

Of 64 responses, two responses were not used due to a large amount of missing and/or incomplete data. Of 62, males ($n=6$) constituted 9.4% of participants, females ($n=58$) and 90.6% of participants. Almost half of the sample, 49.2%, identified their

dance genre as modern/contemporary, followed by ballet (31.7%), jazz (12.7%) and hip hop (3.2%) consecutively. Additional demographic information can be viewed in Table 1.

Results indicate predictor variables gender ($p=.017$), dance genre ($p=.08$), and year in education ($p=.019$) are not statistically significant indicators of the total/sum score of perceived importance of resistance training. Of those predictor variables, dance genre is the strongest indicator of perceived importance of resistance training to dancers.

Within the dance genres, jazz in particular approaches statistical significance ($p=.089$).

Discussion

The purpose of this study was to uncover collegiate dancers' perceptions of resistance training, and identify the predictor variables that influence it. The results show that gender, dance genre and year in college are not strong indicators of dancers total perception score. However, dance genre, and jazz particularly, are almost statistically significant indicators. This result reasserts that dance overall, including all genres, requires an aesthetic component that makes it unique in comparison to sports. It was hypothesized that ballet would be the dance type that would be the strongest indicator of dancers' perceptions because there is a heightened awareness/ desire to maintain a certain physique (slimmer, not quite as muscular). But, many jazz dancers have a foundational background in ballet so it is logical that dancers practicing this type of dance may serve as a more accurate predictor of the perceived importance of resistance training.

It was also hypothesized that gender would be a significant predictor because traditionally males tend to find resistance training more important than females (both athletes and the general population) (Poiss et al, 2004). Within dance, males are usually responsible for partner lifts which requires significant strength and power. Therefore,

male dancers might find resistance training more important in their training routine and success as a dancer than female dancers that are typically encouraged to be slimmer and weigh less. This hypothesis was not substantiated by the results.

Lastly, it was hypothesized that the year in school, or level of education might be a significant predictor variable in dancers perceived importance of resistance training because dancers with more experience may adhere to the more traditional model of “dance only” training. The younger, novice dancers are more likely to place greater importance on resistance training because of the heightened awareness within more recent years, of the vast health benefits as a result of this type of training. This hypothesis was not substantiated by the results.

Strengths

This research is important in that it is the first of its kind. There are no other documented cases in which the dance communities’ perceptions of resistance training have been recorded. The results from this study may not have been statistically significant but they provide insight into the unknown. Knowing the culture surrounding resistance training in dance is potentially a very useful tool. Determining genre is an important predictor allows dance instructors and fitness professionals to target those dancers that do not perceive resistance training to be as important to their health and success in dance. Education regarding the benefits of resistance training and creation of a program that would develop their fitness for their particular dance type would be a positive investment in time and effort for the dance athlete. Research regarding dancers’ perceptions serves as precursor to the development of a resistance training program tailored for dance. The research articles about the completion of resistance training in

dance are scarce, although unanimously in favor of dancers' completing supplementary resistance training beyond their dance technique classes. Additional research regarding perception and current resistance training habits are warranted.

This research also provided an idea of where dancers are now in terms of current participation in resistance training. Results show that on average dancers are completing either strength (defined as any training done with body weight, barbells, dumbbells, equipment or machines), conditioning (defined as any activity increasing the breathing/heart rate such as running) or both strength and conditioning sessions beyond what they complete in their technical classes, about four times a week.

Limitations

A significant limitation was the small sample size, provided more participants/data statistical significance may have been reached for genre and jazz in particular as a predictor variable of the overall score of perception of the importance of resistance training. Another possible limitation is the unequal representation of different dance genres within the sample; the same applies as it relates to gender, and the ratio of female to male dancers that participated. Hip hop and male dancers were the minority, only representing 3.2% and 9.4% of the sample respectively. Lastly, a limitation of this research was the self-report style of providing information.

Conclusion

There is very limited research about the resistance training habits of dance athletes. However, the current studies suggest that completion of a resistance training program is beneficial to dancers' strength, jumping ability, and overall dance performance. There is no research regarding the perceived importance the dance

community places on resistance training. But, their perceptions are important because it has the potential to provide insight into their training habits and what factors influence it. This research is the first of its kind and the results indicate genre may influence dancers' perceptions. Additional research is certainly needed to further investigate this under researched subject area. Future research may include use of the STCQ in conjunction with a resistance training program. The questionnaire could be used to identify individuals with lower scores on the perceived importance scale and have them complete a resistance training program for six to nine weeks. Upon completion of the program, participants should be required to complete the questionnaire again and determine if their perceived importance score changes.

Table 1.*Demographics of Sample*

Variable	Frequency	Percent (%)
Gender		
Female	58	90.6
Male	6	9.4
Year		
Freshman	16	25
Sophomore	16	25
Junior	9	14.1
Senior	18	28.1
Genre		
Modern/contemporary	31	48.4
Ballet	20	31.3
Hip hop	2	3.1
Jazz	8	12.5

Table 2

Descriptive Statistics

	Minimum	Maximum	Mean	Std. Deviation
Gender	1	2	1.09	.294
Age	18	41	21.52	5.276
Genre	1	4	1.73	1.050
Year in college	1	4	2.30	1.330
Training frequency	0	14	4.25	3.126

Table 3.

<i>Multiple Regression Analyses</i>		
Predictor	<i>p</i>-value	Multiple R-squared
Gender	.300	.017
Contemporary/modern	.178	.081
Ballet	.940	--
Jazz	.089	--
Hip hop	.153	--
Year in college	.777	.019

Significance 0, .001, .01, .05, .1,1

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Appendix A

Resistance Training & Conditioning Questionnaire

For the purpose of this questionnaire, resistance training is defined as any training that is done with body weight, barbells, dumbbells, resistance equipment, or machines.

For the purpose of this questionnaire, conditioning is defined as any activity that increases the breathing and heart rate, such as running, skipping, jumping, sprinting, and hopping.

Demographic Information

1. Your Age: _____
2. Male _____ Female _____
3. What year are you in school?
Freshman _____ Sophomore _____ Junior _____ Senior _____
4. What do you consider to be your primary type of dance/ dance genre?

5. How many years have you been dancing? _____
6. Please answer the following according to your dance training frequency.
Number of strength training only sessions per week _____
Number of conditioning only sessions per week _____
Number of combined sessions per week _____
7. Please check any of the following that apply to your dance-training environment.
____ I train with my dance class only.
____ I train individually.
____ I train with others not in my dance classes.
8. Please check any of the following that apply to your primary dance type/classes training phases.
____ I only perform resistance training and conditioning for this sport in its off-season (summer).
____ I only perform resistance training and conditioning for this sport during the competitive season.
____ I perform resistance training and conditioning in both the off-season (summer) and during competitive season.

Directions: For each of the following statements, please choose the letters corresponding to the following scale that best describes your opinion: SA- Strongly Agree, A- Agree, U- Undecided, D- Disagree, SD- Strongly Disagree

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Dance Performance Enhancement					
Resistance training is essential to my overall development as a dancer.	1	2	3	4	5
Conditioning is essential to my overall development as a dancer.	1	2	3	4	5
I believe my performance has improved due to my resistance training program.	1	2	3	4	5
I believe conditioning has improved my performance in dance.	1	2	3	4	5
Someone has taught me specific conditioning exercises that can improve my performance.	1	2	3	4	5
Someone has shown me resistance training exercises that will help me improve my performance.	1	2	3	4	5
I believe resistance training has increased my muscular strength.	1	2	3	4	5
I believe conditioning has increased my movement speed.	1	2	3	4	5
I believe conditioning has	1	2	3	4	5

increased my jumping ability.

Reduced Risk of Injury

I feel that resistance training can decrease my risk of sustaining injuries associated with dance.	1	2	3	4	5
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I feel that my risk for injuries in dance is lower due to my conditioning program.	1	2	3	4	5
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Someone has taught me specific resistance training techniques so I can avoid injury while training.	1	2	3	4	5
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I believe that conditioning puts me at a higher risk of sustaining injury.	1	2	3	4	5
--	---	---	---	---	---

I am aware of the risks of resistance training.	1	2	3	4	5
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I am aware of the risks and potential hazards of conditioning.	1	2	3	4	5
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Physical Advantage over Competition

I feel resistance training gives me an advantage over my competition.	1	2	3	4	5
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I feel that conditioning gives me an advantage over my competition.	1	2	3	4	5
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I believe that I am in better physical condition than my competition due to my conditioning program.	1	2	3	4	5
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I believe that I am as strong or stronger than my competition due to my resistance training program.	1	2	3	4	5
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Appendix B

Recruitment E-mail

Hi,

My name is Kayla Major and I am a graduate assistant athletic trainer. I am collecting research involving the resistance training habits and perceptions of resistance training to collegiate dancers. If you are receiving this email it is because you are the program director/department chair or dean of college dance program, or a collegiate dancer and I am interested in your opinion. Faculty, please forward this information to your dancers so they can complete the survey. Please take a moment to read over the informed consent document before proceeding to the survey. The survey should only take about ten minutes to complete. I ask that you answer honestly and do not linger on any one question, but that you answer completely. I truly value your thoughts and opinions and I appreciate you taking the time to assist me in my research.

Best Regards,

Kayla Major G.A., ATC