PERFORMANCE CHARACTERISTICS OF BALLET MOVEMENTS IN A PHYSIOLOGICAL PERSPECTIF

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Abstract

Ballet is a performing art that requires beautiful, powerful body movements, and often demands high levels of flexibility and physical strength. This research will explore ballet movement characteristics from a physiological perspective, including the influence of ballet movements on muscles, joints, balance, and coordination. This research is based on the fact and conception that there is a strong relationship between physiology and the performance of ballet movement characteristics by analysing ballet movement characteristics using a physiological perspective. Therefore, this study aims to find the contribution of fitness and muscle group strength on ballet movement characteristics. As far as this research has been completed, the results can be seen that training practices by improving physiological aspects will be effective in achieving the ideal performance of ballet movements according to its characteristics. Ballet is a performing art that requires beautiful, powerful body movements, and often demands high levels of flexibility and physical strength. This research will explore ballet movement characteristics from a physiological perspective, including the influence of ballet movements on muscles, joints, balance, and coordination. This research is based on the fact and conception that there is a strong relationship between physiology and the performance of ballet movement characteristics by analysing ballet movement characteristics using a physiological perspective. Therefore, this study aims to find the contribution of fitness and muscle group strength on ballet movement characteristics. As far as this research has been completed, the results can be seen that training practices by improving physiological aspects will be effective in achieving the ideal performance of ballet movements according to their characteristics.

Keywords – Movement characteristics, Ballet, Physiology.

Introduction

One of the foreign dances that has begun to develop in Indonesia is ballet. Ballet is a form or dance technique that developed in European countries, especially originating from the Renaissance period. Ballet is a form of culture in the form of dance and performance art whose development age is quite mature because it began to be known in Italy since the 15th century. The word ballet comes from the Italian 'ballo' which means dance. From Italy, ballet then developed to France, as part of an opera. Ballet in Indonesia was first introduced by the Dutch during the colonial period and since then it has been growing because basically the Indonesian people are a nation that appreciates culture (Edi Sedyawati, 1984).

Ballet moves involve the use of almost all muscle groups in the body. Moves such as plie, tendu and grand battement strengthen the muscles of the legs, thighs and abdomen. Pointe work techniques also engage the muscles of the feet and ankles to support the body in a standing position on the toes (Openshaw, 2007). In addition, hand and arm movements in ballet also involve the muscles of the arms, shoulders and back. Ballet movements also involve an extensive range of joint movements, such as flexion and extension of the knee, ankle and hip

joints. There are also arabesque, attitude, and penche movements that require good body balance, which involves coordination of core and peripheral muscles. Ballet movements require a high degree of coordination between the upper and lower limbs. Arm and hand movements must be in line with leg movements and feet must coordinate with the movement of the body as a whole (Edition et al., 2016; Times, n.d.) The use of almost all muscle groups in the body in ballet makes ballerinas prone to injury. This risk factor is related to the characteristics of movement in ballet.

A contributing factor to injury risk is the physiological demands placed on ballerinas during classes, rehearsals and performances. To date only a few studies have attempted to quantify the cardiorespiratory demands of classes and performances (Time et al., n.d.; M. Wyon, 2005). However, this was limited by the equipment available to the authors for data collection at the time of the study. Despite the limitations, the results of these authors' studies show that ballet is a high-intensity form of exercise and uses muscle groups in the body that have a high potential for injury. Previous studies involving ballet dancers have largely focused on injuries, and associated risk factors such as anatomical characteristics (Reid et al., 2020).

Although the activities or training methods in ballet classes can provide strength, power, localised muscular endurance and flexibility over time, they are mostly aimed at improving movement vocabulary, enhancing skills and developing musicality. In summary, ballet classes focus more on mastering the art form than developing physiological parameters (Rts, 2009). Since the primary method of training dancers is insufficient to develop fitness for performance, it is also hypothesised that when starting a new movement, or changing positions within a movement composition, dancers are not physiologically prepared for the demands of physical conditioning. Furthermore, these dancers may have to perform while their bodies are still in the process of adapting to the new movement. This can lead to fatigue, and a decrease in skill level as well as an increased risk of injury. While it is understood that fatigue can lead to a decrease in poise and skill (Guidetti et al., 2008), and strength and power can also affect performance (Koutedakis et al., 2009), no research has been conducted to determine whether physiological understanding in training patterns can simultaneously improve performance.

This research aims to investigate the characteristic demands of ballet movement by designing a reliable method of assessing performance, and determining the strength of the relationship between physiological understanding and performance and injury. This thesis consists of several interrelated studies. The first study examined the actual physiological demands of ballet performance and class/practice, through video analysis and physiological analysis methodology. The next phase of the research involved method development by providing physiological practice in ballet class learning.

The designed and validated method was then used to test the relationship between classical ballet performance and various fitness parameters. Thereafter, a group of dancers began a 10-week intervention programme of fitness training and changes in performance after this period were examined in both the intervention and control groups. Finally, fitness levels before using these methods will be compared with injuries sustained during the intervention, to examine the relationship between fitness levels and injuries. The research will seek answers

as to whether poor implementation of basic physiology is to blame for ballet dancers' high injury rates and poor performance of ballet movement characteristics.

Methodology

The data in this study were collected from 20 ballerinas. 10 ballerinas are members of B Three Semarang studio, 10 ballerinas are members of Semesta Semarang studio. The data collection procedure consisted of three different stages. In the first stage, information regarding how the ballerina's ability to perform the characteristics of ballet movements in performance and assessed by an assessor who is a qualified and certified ballet teacher with more than 10 years of teaching experience. This assessment will be compared with existing judging criteria used in ballet competitions such as the 'Prix de Lausanne'. Aspects of the assessment include whole body coordination; limb and weight control; use of space; accuracy and use of precise placement; technical skill or virtuosity; rhythmic precision; response to dynamics and phrasing; expression and interpretation; and communication and projection.

The second stage was physiological testing. The participants completed a fitness test according to the British Association of Sport and Exercise Science (BASES) guidelines (M. A. Wyon et al., 2010), which covered the following aspects:

Anthropometry

The participants performed 2 separate 'develop a la seconde' movements. These movements incorporate hip flexion, abduction and external rotation, starting from a standing position, according to a protocol recommended for dancers (M. Wyon, 2012). The first movement is performed passively, where the dancer holds their leg to achieve maximum range of motion (Hons et al., n.d.) The second is performed actively, using the dancer's active strength to achieve MROM (see figure 2). These movements are performed on the right foot, and then the left foot. The dancers were photographed during the MROM using a digital camera that produced 4 images; 2 active and 2 passive images.

Figure 1. Develope pasif a la seconde

Figure 2. Develope aktif a la seconde

Figure 3. Vertical jump in the first position

Muscle strength

Standing vertical jump height was measured using a jump measuring device (Jump MD, TKK 5106; Takei Yashiroda, Japan). The participants were barefoot, or wore socks or soft ballet shoes. From a standing 1st position (heels together and feet externally rotated) they were then instructed to perform a 'demi-plié' (bending the knees 90 degrees while maintaining an upright posture) and then jump as high as possible with both feet, while keeping their hands still, either by placing the hands on the waist, or in a bra bass position (see figure 5-3). Dancers are reminded to maintain safe classical technique (externally rotated lower limbs, correct classical posture, and extended legs and feet during the jump - see figure 5-3). The participants were then instructed to perform single-leg jumps with the same technique, with both legs. For each test, the dancers performed 3 repetitions, and the highest score (in cm) was recorded for further analysis.

Muscle endurance

Upper body endurance is measured using the push-up test. Female dancers use a modified position, while male dancers use the regular press-up position (see Figure 5-4). The maximum number of press-ups (arm flexion and extension) performed consecutively in one minute was recorded. 'Core' muscle endurance was tested by maintaining the 'plank' position for as long as possible (see figure 5-5). The plank position (whole body parallel to the floor and supported by forearms) requires isometric contraction of the abdominal and back muscles. The total time, in seconds, that the dancers spent in the required position was recorded.

Figure 4. Press-up position

Figure 5. 'Board' position

The mean scores for each performance criterion, and the overall mean performance scores, for each dancer were compared to the

fitness test results. This was the data prior to the start of the intervention. The third stage of the intervention involved 10 one-hour fitness training sessions over 10 weeks. The sessions were led by two qualified health professionals and followed the same format each time. The sessions aimed to improve local aerobic capacity and muscular endurance using high-intensity training, interval training, and circuit training methods. Once the intervention is complete the participants will perform the same repertoire as before the intervention. Participants will also perform a post-intervention physiological test. The results of the repertoire performance before and after the intervention will be analysed and compared with the results of the physiology test before and after the intervention to interpret the physiological contribution in the performance of ballet movement characteristics.

Finding and Discussion

The results of the data collection were assessed by a certified ballet examiner with more than 10 years of experience. The assessment was conducted using a protocol designed around ten performance aspects, each of which was separately rated on a 0-10 Likert scale, with a total score of 100. Raters were instructed to view the participant's performance only once before scoring on a specially designed scoring sheet. The performance assessment criteria conducted by a professional ballet teacher was done with the following assessment grid:

Table 1. Assessment guide for movement control

Scores	Description
0-1	Very bad. There is no control on any of the movements.
2-3	Bad. Little control over movement.
4-5	Some areas are controlled better than others.
6-7	Overall controlled movement.
8-9	Very good. Movement is well controlled
10	Perfect. No room for improvement

The results of the performance assessment conducted before and after the intervention as well as the results of physiological tests on the research subjects can be seen in the following table.

Table 2. Performance assessment results.

Variables	Pra Interve ns.	Post Interve ns.
Koordinasi	3	6
Akurasi Gerakan	5	7
Tingkat Keterampilan	5	6
Fleksibilitas	2	6
Kekuatan Otot	3	5
Keseimbangan	3	5

The findings from this study show that ballerinas with physiological training in mind had higher performance scores in the area of 'coordination' thus supporting that this physiological aspect should be considered during training. Although aerobic capacity was not found to be a significant predictor of high performance scores, this may be due to the nature of the performances assessed in this study. The majority of the works assessed were short snippets that would not be as aerobically demanding as a full-length classical ballet. Upper body endurance was also not found to be significant. Again, the duration of the assessed performances may have influenced this, as the performances were not long enough to demand adequate endurance capacity. It could also be argued that while the press-up test may be a specialised activity for contemporary dancers, ballet dancers do not perform the same amount of upper body work; studies have shown that female ballet dancers only very rarely engage in supporting movements, while male dancers can perform an average of 1-2 lifts per minute. Upper body strength may also not have been a predictor factor in the current study due to the choreography performed,

where most of the lifting is done with assistance, where female dancers jump during lifting, as is often the case in classical ballet (Twitchett et al., 2011).

It is reasonable to assume that the results of the current study may have been influenced by methodological limitations, such as the relatively small number of participants, mainly males, the performances assessed, and the amount of subjectivity that may exist when assessing dance performances. However, within the limitations of this study, it was concluded that flexibility, power and strength may influence the performance of ballet movement characteristics. Further research into this is recommended to be conducted on a larger sample of professional dancers, along with research to investigate the effects of additional training programmes on ballet performance.

Conclusions

The main findings of this study showed that the intervention group's ballet movement ability improved significantly. Training the aerobic system, as in this study, will have a positive effect on performance, by moving the anaerobic threshold to a higher oxygen consumption allowing more work to be done before this threshold or before becoming fatigued. This additional physiological aspect does not disadvantage the dancers and is further evidence to support its inclusion in training sessions. The ballet movement ability of the intervention group improved significantly. Training the aerobic system, as in this study, will have a positive effect on performance, by moving the anaerobic threshold to a higher oxygen consumption allowing more work to be done before this threshold or before becoming fatigued. This additional physiological aspect does not disadvantage the dancers and is further evidence to support its inclusion in training sessions. From a physiological perspective, classical ballet movements have a significant effect on the body's muscles, joints, balance and coordination. Regular practice in ballet can improve overall physical strength, flexibility, balance and coordination. An in-depth understanding of the characteristics of classical ballet movements from a physiological perspective can provide a more comprehensive view of the impact of these ballet movements on the human body.

It is recognised that this study had a small sample size and low volume of exercise exposure compared to previous literature (Bartel & Cameron, 2002), but this does not detract from the fact that the fitness intervention had a positive effect on the participants' dance performance. Further research is recommended, with a larger and more varied sample of dancers to determine whether, and how, fitness changes do improve classical ballet performance. On a practical level, this study provides some evidence that additional training in physiological aspects should be incorporated into ballet students' training schedules as fitness training can improve the effectiveness of technique training.

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