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# DEVELOPING CORE STRENGTH IN CLASSICAL BALLET DANCERS THROUGH KETTLEBELL TRAINING

## A METHODOLOGICAL EXPERIMENT

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**Abstract**

A functional strength training tool, the kettlebell, has been used by classical ballet students at the Hungarian Dance University in skill development classes since 2021. In addition to the considerable positive subjective feedback on the effects of kettlebell training, it is important to investigate the results of such training in an objective way. The focus of the program that the participants (n=10) took part in was on developing the muscular strength of the trunk, which provides support and stability for the dancer during certain movements, specifically when lifting a partner. In order to quantify the development of core muscle strength, the directional force of the extensor muscles in the back and lumbar spine were measured using a hand-held muscle strength meter. The program covered six weeks, with measurements taken at the beginning and the end. The methodological experiment demonstrated that targeted functional training produces measurable positive changes even at low hourly rates (+10.16%). Regular use of the kettlebell helps dancers to prepare for and execute lifts with precision, as well as to better execute a number of other technical elements.

**Keywords**: classical ballet, development of core strength, kettlebell

## 1. PRESENTATION OF THE KETTLEBELL METHODOLOGY EXPERIMENT

### 1.1 Background of the experiment

In 2021, the Hungarian Dance University introduced the use of cast iron kettlebells in its skill development classes for male ballet students. This functional strength training tool and the methodology used to apply it are primarily, but not exclusively, aimed at developing muscular strength in the trunk. For classical ballet students,

the teaching and learning of lifting techniques begins at the early age of 15. This learning process is based on partner work, which usually involves boys learning the roles and techniques related to lifting and holding. In these lessons, students are required to balance their partners and lift them to different locations, or even raise them above their own head with fully extended arms, sometimes even with the use of only one hand. In classes covering classical ballet lifting techniques, there is currently insufficient attention paid to the development of students' muscular strength. This often results in injury, and sometimes, although the student has good technique, they are unable to lift their partners due to lack of strength.

The technical elements of kettlebell training and classical ballet lifting techniques are very similar in terms of movement patterns, dynamics, and functions. During the lifts, the trunk and shoulders play important roles regarding the kinetic energy transmitted from the lower to the upper limbs. The kettlebell swing and stand-up movements also impact other areas of competence that are of particular importance for classical ballet, such as jumping height, sense of balance, and resting heart rate (Grigoletto et al., 2020). Movements involving the control of the kettlebell weight in multiple directions can be easily adapted to situations involving the lifting and holding of a moving body (Ujvári, 2022). Adequate body awareness is very important for ballet dancers: they need to be constantly aware of the spatial position of their own body and that of their partner. Adequate muscular strength of the trunk is necessary both for the stability of the body and for the most successful execution of lifting techniques. Training with the kettlebell increases body awareness, as the exercises must be executed by following strict technical rules and exceptional precision and dynamics. The use of the kettlebell in dancer training has been the subject of articles in international dance magazines (Haywood, 2022). With this previous research in mind, the authors aimed to look beyond simple positive feedback on the use of kettlebells by dancers and objectively examine changes in core muscle strength over a period of time resulting from the integration of a specific set of exercises into the participants' dance training. An additional aim of conducting this methodological experiment was to provide a realistic picture of the positive yields of different strength training sessions, targeted and appropriately administered, in dance training.

### 1.2 Introduction to kettlebells and specific training methodology

The kettlebell is a spherical cast-iron barbell with a handle that can be used to perform specific strength training exercises. Although its origins can be traced back to antiquity (Chaos, 2021), the modern kettlebell is considered to have its origins in modern Russia and is still part of the bodybuilding culture today (Tsatsouline, 2018). Its use was also widespread among circus performers at the turn of the 19th and 20th centuries. In the last century, it played a prominent role in the physical training of various military units (Jones, 2019). Since the early 2000s, it has also begun to spread into the world of commercial fitness. Today, the kettlebell can be found in the average gym. The tool comes in different sizes, ranging from 4 to 98 kg. The 16 kg kettlebell is used as a general point of reference below (*Figure 1*) (Tsatsouline, 2018).


*Figure 1.* The 16 kg kettlebell

Because of the increased lever force involved in moving the kettlebell, more effort is required to perform the exercises compared to traditional dumbbells. Adequate hand grips are required to hold the various positions accurately and to perform the exercises correctly. Exercises with kettlebells expose the body to forces in various intermediate directions in addition to the main directions; this models the complex forces that a professional dancer's body is subjected to, for example, when performing a big lift in a pas de deux or landing from a jump. Ballistic exercises (e.g., swinging the kettlebell along a specific trajectory) can also be used to improve strength and explosiveness as well as endurance in both aerobic and anaerobic training conditions. Some research has shown that short-term kettlebell work is effective in increasing both strength and power (William et al., 2012). An additional benefit is that general kettlebell exercises have a measurable and consistent force transfer effect on various other athletic movements (Manocchia et al., 2013). In addition, kettlebell training improves postural responses to sudden distraction and may be effective in reducing postural dysfunction caused by waist pain (Kenneth et al., 2013).

In order to use kettlebells effectively, one must first master the techniques involved in the basic movements. When performing the exercises with weights, it is of paramount importance to practice the movement patterns and execute

them accurately and correctly. Kettlebell exercises can be grouped based on five movement patterns: pushing, pulling, hip thrust, squatting, and carrying (John, 2013). The kettlebell, as a so-called free weight, does not strengthen a particular muscle or muscle group in isolation but acts functionally by activating *agonists* (a muscle or muscle group acting directly on the muscle or muscle group performing the particular movement), *antagonists* (a muscle or muscle group acting in opposition to the muscle or muscle group performing the particular movement), and *synergists* (a coordinated action of muscles or muscle groups assisting each other to produce the particular movement). The variety of specific and basic exercises that can be performed and the different dynamic components of the kettlebell make it a suitable tool for developing endurance and explosive strength.

Due to its intensity, kettlebell training usually takes 30 to 40 minutes. This includes a short warm-up and a couple of minutes of cool-down stretching or relaxation. The short workout time makes it easier to incorporate kettlebell exercises into a dancer's daily skill development regiment. When planning a lesson for kettlebell training, the following sequences or content units should be used in order to plan an optimal session:

- Breathing exercises and self-weighted joint movement exercises;
- Strength activation exercises with light weights and muscle coordination to develop proper posture;
- Technical mastery of the six basic kettlebell exercises (i.e., swing, stand up, lunge, press, squat, and snatch) with guiding and assisting exercises;
- Load work, i.e., strength training;
- Relaxation, including muscle relaxation and breathing exercises (Ujvári, 2022).

When deciding on the size of the kettlebell for the initial exercises, a weight should be chosen with which accurate and safe movement can be achieved. In practice, this means that the weight is able to be moved at a controlled, steady pace throughout the full range of motion for strength exercises. For ballistic exercises, it is important to consider for how long and against how much resistance maximum explosiveness and speed can be maintained while maintaining proper technical execution (Ujvári, 2022).

There are two main styles of official kettlebell use: sport kettlebell and the so-called "hardstyle" kettlebell. The difference is significant, as the former is a competitive sport where the aim is to maximize the number of repetitions of certain exercises, while the latter is a developmental technique aimed at improving the physical development of the body (Tsatsouline, 2013). Our methodological experiment was based on the *StrongFirst* basic hard-style kettlebell program created by the international training organization *StrongFirst*, founded by Pavel Tsatsouline. According to the *StrongFirst* system, strength is the main quality that is developed through practice, and correct technical execution and posture are the primary focus of the exercises. The number of repetitions performed is secondary to proper technical execution. The techniques and exercises of the *StrongFirst* kettlebell training program were developed by the founders of the organization

with safety as a key component rather than a simple consideration. Muscle relaxation and tensing are the two main aspects of physical performance, with tensing being the foundation of strength and relaxation the foundation of speed, endurance, and flexibility (Jones, 2019).

## 2. THE EXPERIMENT

### 2.1 The aim of the experiment

The unspoken aim of the methodological experiment was to present a different perspective in the skills development classes at the university. Within the framework of these classes, dance students perform various body development activities for one to two hours and a half per week, typically with a non-programmatic objective-oriented design. The basic purpose of strength training is to make the student stronger, thereby decreasing the possibility of injury. It is important to note, however, that the goal of strength training should not be to assign exhausting, high intensity exercises in every session (John & Tsatsouline, 2011). Rather, the goal should be to increase performance through quality, programmatic training.

Quality training has a particular meaning in this context. A ballet student needs to master many different skills in order to become a professional artist. When examining these different physical abilities, it becomes apparent that for many students, there is a strong correlation between the general use of a particular skill and its absolute maximum performance (John & Tsatsouline, 2011). Dance is one of these; even if it is not possible to draw a complete parallel with any one sport, the importance of a wide range of abilities and their development is paramount. The importance of professional involvement (e.g., in the form of coaches or physiotherapists) becomes clear in such cases (John & Tsatsouline, 2011), as interactions between different abilities and their symptoms can occur simultaneously. Therefore, we aimed to keep the students' kettlebell strength training sessions simple, effective, and time efficient (Tsatsouline, 2013).

Based on the *StrongFirst* methodology, the kettlebell strength training sessions averaged 20-30 minutes in length; this ensured that they could conveniently fit into the students' class time as well as alongside their other activities. The program lasted for six weeks and varied between light, medium, and high-intensity training sessions of two kettlebell exercises at a pre-planned periodicity (Tsatsouline, 2000), with students taking part in two training sessions per week, with supervision in the first half of the period and then independently. As part of the methodological experiment, we measured the muscle strength of the lumbar (lumbar) and thoracic (back) spine sections of the participating students before and after the six-week kettlebell training program using a *Hoggan micro FET3* manual muscle strength meter (*Figure 2*) and obtained subjective personal feedback using a ten-question satisfaction questionnaire at the end of the experiment.


*Figure 2.* The *Hoggan micro FET3* power meter

The *Hoggan micro FET3* device can be used to measure the strength of isolated body parts, limbs, or specific muscle groups or muscles. In the present experiment, measurements were taken at two locations in the lumbar and thoracic spinal segments in the extensor (in this case, back extension) direction. Data were recorded in the prone position with an assistant and the person performing the measurement. Students performed the extensor movements of the spine with their hands on the back of the neck.

*Figure 3.* Manual examination of muscle function
(Hislop & Montgomery, 2011, pp. 38–39.)

A prone position was chosen for the measurement of both spinal segments. When measuring the lumbar spine, the student was asked to lift his head, shoulders, and chest as high as he could from the examination table. The measuring instrument was placed over lumbar vertebra 1 (L1), and the participant had to push against it with maximum force (see *Figure 3*).

For the thoracic spine section, the head and upper part of the trunk of the student had to reach beyond the edge of the test table to the nipple line. For the measurement, they had to raise their head, shoulders, and chest to the level of the examination table. The measuring device was placed above thoracic vertebra 1 (Th1), and the student had to push their torso into it with maximum force in the extensor direction (see *Figure 4*).

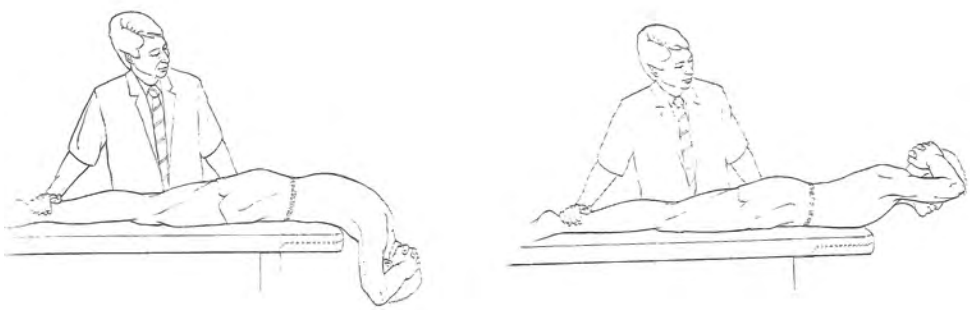

*Figure 4.* Manual examination of muscle function
(Hislop & Montgomery, 2011, pp. 38–39.)

One of the aims of the methodological experiment was to determine the extent to which the performance of a six-week targeted kettlebell training program would result in a change in the muscular strength of the trunk muscles of classical ballet students. We also sought to examine the other pedagogical benefits, beyond the quantifiable results, which could be obtained through working with this specific equipment and methodology.

## 3. PRESENTATION OF THE TARGETED TRAINING PROGRAM

When introducing the tool, it was important to integrate it into the existing daily training in a way that would not upset the established routine but would instead influence the dancers' development in a positive way. The first step was to teach basic kettlebell techniques and to introduce systematic and sequential training that would produce measurable results in the form of changes in muscle strength. In addition to the many specific movements that the various dance classes provide, kettlebell exercises using the simplest possible basic human movements were used. The aim was to keep the exercises simple and to reduce the impact of the complex movements on the nervous system in order to allow the students to concentrate on strength development and flawless technical execution. In line with the methodological principles of the *StrongFirst* approach, an explosive quick lift, a kettlebell swing, and a slow strength exercise were selected for the training (Tsatsouline, 2013). These were performed alongside a few warm-up lifts that promoted safe performance. A correctly executed two-handed kettlebell swing can actually be considered a plyometric exercise: "plyometric exercises train neuromuscular (nerve-muscle) connections and muscle flexibility, thereby developing strength and speed. The goal of plyometric training is to train muscles to contract faster and more forcefully from an active pre-tensioned position" (Turcziné Soós, 2013). The kettlebell swing, which poses no risk to the joints used in jumping, has this property, and this, with considerable transfer effects, has an impact on other exercises such as jumping or sprinting. The importance of maintaining spinal stability during the two-handed kettlebell swing and maintaining increased muscle control throughout the exercise is of significant importance for the development of trunk strength (Jones, 2019).

Standing up with or without weight is an appropriate exercise to help the participant become familiar with unobstructed movement during high muscle tension (Tsatsouline, 2013). In terms of developing core strength, standing up is a performance-enhancing exercise in which the spine is kept in full control throughout the movement, while the weight held over the head is used to control movement. This greatly improves shoulder stability and resistance, and also helps to develop proprioception (muscle joint and balance perception) as well as other reflexes that have a significant impact on balance and coordination (Jones, 2019).

After technical instruction regarding the exercises, each student in the study was assessed in regard to their optimal starting weight. Safety was a major focus here; thus, the weight of the students and their technical knowledge of kettlebell exercises had to be taken into account. Where a lack of technical familiarity or strength was evident, a lower weight was chosen as a starting weight. During the program, the increase or decrease of weights varied according to each student's performance: if the weight began to feel light, resistance was increased (i.e., a switch to a kettlebell of a larger size was made). Conversely, when fatigue or exhaustion were experienced by the student, it was permissible to work with a lower weight in order to ensure that the continuity of adaptation was not interrupted. The weight of the students also played a role in the selection of the appropriate kettlebell. The average weight of the participants was between 50 and 70 kilograms, with those closer to 50 given a smaller weight and those closer to 70 given a heavier one.

## 4. RESULTS

The 10 boys who formed the sample were students of classical ballet at the Dance Training Institute of the Hungarian Dance University. The average age of the participants was 17.3 years. The average weight of the participants was 61.72 kg, and the average height was 178 cm. Despite the fact that, in general, they all received similar specific physical workloads in their professional training and had similar daily schedules, they had very different body builds and muscle masses. Due to age differences and the extra workload that some of the students received during the training program, we obtained baseline values that differed in some cases (see *Table 1*).

| Code | Age (year) | Height (cm) | Weight (kg) | Input strain force level (N) | Output strain force level (N) | Rate of change (N) |
|---|---|---|---|---|---|---|
| **A1** | 16 | 176 | 58.4 | 109.08 | 155.4 | +46.32 |
| **A2** | 15 | 175 | 55 | 104.6 | 129.84 | +25.24 |
| **A3** | 16 | 173 | 53 | 109.44 | 119.3 | +9.86 |
| **A4** | 17 | 183 | 77.8 | 108.9 | 105.22 | -3.68 |
| **A5** | 19 | 179 | 65 | 84.8 | 89.48 | +4.68 |
| **A6** | 18 | 180 | 63 | 118.84 | 80.56 | -38.28 |
| **A7** | 19 | 173 | 55 | 95.06 | 104.58 | +9.52 |
| **A8** | 19 | 171 | 59 | 60.62 | 93.46 | +32,84 |
| **A9** | 16 | 184 | 63 | 79.08 | 80.1 | +1.02 |
| **A10** | 18 | 186 | 68 | 88.26 | 102.24 | +13.98 |

*Table 1.* Participants' results

As part of the training program mentioned above, after the measurements were taken, the average core muscle strength of the group was obtained by adding the results from the two areas measured and averaging them. Compared to the initial strain of muscle force exertion, the group's muscle force exertion increased by 10.15 N (Newton) by the end of the program (see *Table 2*), one Newton being the force that accelerates a body weighing 1 kilogram to a speed of 1 meter per second in 1 second. The six-week kettlebell training program resulted in an increase of 10.58% from the baseline for the whole group. The performance of the measurements was easily learned by the students, ensuring accurate execution.

| Group average: | Age (Y) | Height (cm) | Weight (kg) | Input strain force level (N) | Output strain force level (N) | Rate of change (N) |
|---|---|---|---|---|---|---|
| | 17.3 | 178 | 61.72 | 95.868 | 106.018 | 10.15 |

*Table 2.* Group mean change in core strength

The answers to the satisfaction questionnaire completed by the participants at the end of the program also provided insightful feedback. When asked about their perceived physical improvement, the majority of the respondents reported that their jumps performed in their professional classes had become higher and more dynamic. In regard to their lifting classes, the participants reported that they could hold their partner above their head with ease, while in their ballet class they highlighted an improved sense of stability in their arms.

Participants found kettlebell strength training very useful and were satisfied with its results. When asked about what surprised them the in regard to the implemented skill-building approach, many indicated that their leg musculature had improved in terms of its robustness. They also found the swing exercise to be novel and interesting. Although at the beginning of the program they felt muscle soreness in muscle groups where they had not previously experienced or expected it, this sensation subsided after the first week. The participants reported that the muscle soreness did not impede their daily training routine.

The students also reported nervous fatigue, detailing days when the 8 kg kettlebell felt very heavy and other days when training with the 16 kg weight was not at all tiring. The responses indicated that they had never experienced such a positive impact on the body from such simple movements. Although many of the participants reported feeling stronger despite showing no significant muscle gain, they clearly indicated that after just one six-week exercise program, they had found it much easier to complete the lifting lessons, and that they had made significant positive changes in a short period of time.

When asked to mention something important that they learned from the kettlebell strength training, the students mentioned the importance of the correct technical execution of exercises, and that sometimes less is more. They also highlighted the importance of concentration in general, without which it is not possible to hold correct positions for long periods of time. The technical details of the movement, which were not seen as a major concern but nonetheless important, were also mentioned, namely that a set or the exercise itself only ends when the weight is safely on the ground; in other words, attention and control must be maintained throughout the training. The participants also reported learning that persistent work pays off, and that consistent and systematic work is more important than one-off intense work. Due to the significant force-enhancing effect of the special breathing technique used during kettlebell movements, the participants sometimes got the impression that they had the strength to do the work even when they felt otherwise prior to the training. The participants considered it necessary to include kettlebell training on a

permanent basis in the training routine of the Hungarian Dance University. Many of the students continued kettlebell strength training on their own after the end of the program.

## 5. SUMMARY

The body can be developed using a wide range of specific equipment. When starting a training program, all tools and all training programs will show success for a certain period of time. However, as a development educator, it is of paramount importance to find methods and tools that produce lasting and positive results in the long term and are adaptable to the needs and goals of the individual or group. With this experiment, we have proven that weight training is a fundamental conditioning method that has a place in dance training, and that hardstyle kettlebell training is a particularly effective direction in this regard. The form of the weight and its movement exercises allow a considerable amount of high-intensity work to be carried out in a short period of time, in a relatively small space, and under safe conditions. It is therefore not surprising that hard-style kettlebell training forms part of the training of many special forces units around the world (Jones, 2019). Our measurement results proved that by the end of the program, the muscle strength of the male ballet students had increased.

The specific physical demands placed on students at the Hungarian Dance University are extremely demanding. This methodological experiment also highlighted how kettlebell training using simple basic human movement patterns can shape students' bodies and mindsets and provide a stronger foundation for performing specific movements. Such an approach can lead to the development of a deeper sense of responsibility on the part of both teacher and students in order to ensure that strength development achieves its objective. Through this method, students can also improve and develop their discipline and concentration. By increasing muscular strength and improving neuromuscular coordination, the number of injuries that occur during daily training can be reduced. The compact duration of kettlebell strength training and the simplicity of its exercises make it easy to integrate into the daily routine at an institution with a complex and diverse training system. Once the students had mastered the movement techniques and the parameters of the training program, they were able to carry out the daily work independently, thus developing their autonomous and autonomous behavior. The positive feedback from both the students and the ballet masters who run the classes can also provide insights for further scientific research to be carried out in the future.

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