

**Strength and Conditioning for Dancers  
(7DC001)**

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**A Six Week Strength Training Intervention with Recreational  
Ballet Dancers: Improving Jump Height**

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# **A Six Week Strength Training Intervention with Recreational Ballet Dancers: Improving Jump Height**

## **Introduction**

### Strength Deficit

Anecdotal observation shows that a greater number of professional, ex-professional and recreational dancers, who (still) train regularly, are convinced that ballet training produces high athletic performance in strength, power, endurance and skill. While this is the case with skill, (Krasnow & Chatfield, 1996) and (Wyon, Redding, Abt, Head, & Sharp, 2004) the same cannot be said for other factors. Research from Wyon, et al. (2002, p. 44) stated that although a dance class has been classified as high intensity intermittent exercise, (Dahlstrom M, 1996) and (Rimmer & Plowman, 1994) this only really applies to the centre work phase. Furthermore, research has shown that dancers are often not as muscularly strong as they need to be in order to perform optimally and to avoid injuries when fatigued (Allen & Wyon, 2008) and (Kumar, 2001). Considering that athletes' skills are detrimentally affected by fatigue (Guidetti, Baldari, Capranica, & Persichini, 2000) it is logical to assume that this is also the case with dancers (Twitchett, Angioi, Koutedakis, & Wyon, 2011, p. 35). Building strength, power and endurance will guard against fatigue during class, rehearsal and performance (Koutedakis & Jamurtas, 2004). However, not only does a ballet class not offer sufficient endurance and strength stimulation, dancers have also been traditionally conditioned to believe that any extra strength training builds ugly large muscles and spoil aesthetics. Research has shown that this is not the case and that performance is actually enhanced by supplemental strength and fitness training (Twitchett, Angioi, Koutedakis, & Wyon, 2011) and (Angioi, Twitchett, Metsios, & Koutedakis, 2012).

Research on strength, endurance and plyometric training for dancers has clearly shown that increase in performance quality and reduction of injuries can be attained through such

supplementary training. Most of this research has been conducted on professional adult dancers, or professional students in vocational training e.g. (Brown, Wells, Schade, Smith, & Fehling, 2007), (Twitchett, Angioi, Koutedakis, & Wyon, 2011) and (Koutedakis, et al., 2007). Although research from (Padfield, 1993) showed that recreational dancers also benefit from supplementary strength training. Research from Brown, Fehling, Wells, Schade, & Smith (2007) carried out with recreational dancers enrolled in a minimum of one ballet class per week, showed that a twice weekly supplementary strength training over a period of six weeks was sufficient to improve strength.

### Plyometric Training and Bone Health

Improving strength and power through plyometric training will enable the dancer to improve allegro quality possibly enabling an increase in amount undertaken of this type of exercise. Research shows that when landing from a jump muscles contract eccentrically generating forces much greater than bodyweight to absorb the impact; making jumping a resistance type exercise (McHugh, Tyler, Greenberg, & Gleim, 2002) which can produce increases in bone mineral density, (Conley & Rozenek, 2001). In later life, bone mass is determined by the peak bone mass reached in early adulthood and the rate at which this “bone bank” diminishes in adult life (Koutedakis & Sharp, 1999, p. 285). Therefore, awareness and improvement of bone mineral density at a young age is vital. According to research, women who were physically active in school maintained their higher activity level at age 25, plus, this recreational physical activity increased bone mineral density which was shown to be 1.8 - 5.5% higher at the hip, spine, and total body compared to inactive women who had a low combined score. (Callréus, McGuigan, Ringsberg, & K., 2012). From the perspective of annual bone loss in old age these percentage differences may correspond to a 2–5-year advantage (Callréus, McGuigan, Ringsberg, & K., 2012, p. 2523). Activities, such as dance, that incorporate sudden change of direction, high impact forces and jumping, appear to be

ideal for promoting bone health at an early age and delaying or even preventing osteoporosis later in life (Koutedakis & Sharp, 1999, p. 285).

Before growth is completed care must be taken with the epiphyses when undertaking physical training. The epiphyses (growth plates) are a site of potential weakness and can be damaged when too great an amount of mechanical stress through intensive exercise, is applied to the body (Koutedakis & Sharp, 1999, p. 259). However, research on Plyometric training for teenagers showed that carefully planned resistance training programs which included plyometric exercises enhanced movement biomechanics, improved functional abilities, and decreased the number of sports-related injuries (Faigenbaum A. , et al., 2009).

### Plyometric Training Recommendations

Plyometric exercise programs for children are necessary in order to develop neuromuscular and anaerobic skills which they can utilise at a higher level later on. Therefore it is important to progress gradually from simple to more complex training plans (National Strength and Conditioning Association, 2008, p. 422). Moreover, it is essential for any age group to begin plyometric training programme at a low intensity. Plyometric exercises should be part of a comprehensive plan including strength, speed, flexibility and aerobic training, plus correct nutrition (National Strength and Conditioning Association, 2008, p. 426). Faigenbaum, et.al recommended that training should take place 2 or 3 times per week on non-consecutive days (48–72 hours between sessions) in order to allow for adequate recovery between sessions and effective enhancement of strength and power in children and adolescents (2009) and in adults (National Strength and Conditioning Association, 2008, p. 420). Information and studies concerning the frequency and intensity of plyometric training for young people varies. A review from Johnson, et al., (2011) of studies on plyometric training for children showed highly varied information; 1, 2, or 3 weekly training sessions were undertaken lasting from 8 to 20 weeks. Jump count per training was also highly varied,

however this review could conclude that current evidence suggests beginning with 50-60 ground contacts (jumps) per session and ending the training cycle at 92 -190 contacts. Faigenbaum et al. recommended that inexperienced adults begin with 80-100 ground contacts and considerably experienced adults begin with 120-140 contacts (2009). Progression of intensity varied amongst studies. Kotzamanidis increased intensity by 12 jumps per session (2006), Malatesta and Meylan, 18 jumps per session (2009). Both studies recorded large effects due to these increases. Faigenbaum et al. decreased repetitions as intensity increased and found that muscular fitness and cardiovascular endurance in elementary school children was enhanced (2009).

<b>Appropriate Plyometric Volumes</b>	
<b>Plyometric experience</b>	<b>Beginning volume*</b>
Beginner (no experience)	80 to 100
Intermediate (some experience)	100 to 120
Advanced (considerable experience)	120 to 140

\*Volume is given in contacts per session.

**Figure 1:** Plyometric training volumes for adults; foot-ground contacts per session (National Strength and Conditioning Association, 2008, p. 421)

Research highlighted the importance of creating an enjoyable exercise experience for all participants because enjoyment has been shown to mediate the effects of youth physical activity programs (Dishman, et al., 2005). Literature from M. Csíkszentmihályi, (2008) and E. L. Deci, (1996) point out that above all in order to succeed, enjoyment of an activity is paramount.

## Contraindications

Compressive force on the joints is increased by greater body weight. Individuals over 100 kg should avoid high volume, high intensity plyometric training. Previous injuries or abnormalities of the spine or limbs may increase risk of injury and people with recurrent muscle strains, joint laxity and spinal dysfunction must be cautious when starting a plyometric program (National Strength and Conditioning Association, 2008, p. 425)

## Study Aims

Taking literature and research into account, plus the age, experience, fitness and activity levels of the participants, this study aims to observe the possible benefits of a lower body plyometric jump and strength training plan on jump height (JH) in a mixed age group of highly diverse young females attending ballet classes once or twice a week on a recreational basis.

## **Method**

### Participants:

Eleven recreational dancers, ( $15.03 \pm 7.71$  years) taking part in a ballet class of 75 minutes, one or twice a week participated in the study over a 6 week period. The group was highly varied in age, physique, aptitude and experience. All participants were healthy at the onset of the study and all were free of orthopaedic limitations. Using literature as a guideline, in this study, the term child refers to persons up to the age of 11 years, and the term adolescent refers to persons aged 12–18 years (Faigenbaum A. , et al., 2009). The group consisted of one child, four adolescents and six adults, one of which was overweight. Two participants took part in regular ice-skating training at competition level for 9-10 hours a week, another undertook one hour of horse-riding on a weekly basis, while a further participant absolved 1.5 hours of endurance cycling. Five participants were attending school and took part in 2-3 hours of regular sports lessons. Two participants absolved a 1.25 minute Modern Dance Class and

another 4 hours of Jazz and Modern Dance. Four were, apart from the weekly ballet classes, sedentary.

**Table 1: Descriptive Characteristics (Appendix A)**

Participants	Age (years)	Category	Ballet per week (Hours)	Other dance per week (Hours)	Sport in school (Hours)	Sport in leisure time (Hours)
1.	14,50	Adolescent	2,50	–	2	–
2.	14,50	Adolescent	2,50	–	2	–
3.	12,9	Adolescent	1,25	Modern 1,25	2,5	Ice Skating 9
4.	10,97	Child	1,25	–	3,3	–
5.	19,8	Adult	1,25	Modern & Jazz 4	–	Endurance Cycling 1,5
6.	23,76	Adult	1,25	Modern 1,25	–	Ice Skating 10
7.	24,08	Adult	1,25	–	–	–
8.	26	Adult	1,25	–	–	–
9.	12,45	Adolescent	1,25	–	2,5	Horse Riding 1
10.	22,65	Adult	2,50	–	–	–
11.	19,55	Adult	2,50	–	–	–

### Intervention

With consent from participants and parents<sup>1</sup> the intervention project was integrated into the ballet class which took place on Monday and Wednesday from 16:10 until 17:25. Seven participants took part in the class once a week and the remaining four undertook the class twice a week. The second and third training unit was to be independently absolved if not undertaken within the frame of the ballet class. After warming up, the intervention was undertaken; beginning with squats, following with calf raises, pogo jumps and butt kick jumps. The aerobic element, rope skipping, was completed after the plyometric exercises because this could otherwise have a negative effect on power production (National Strength and Conditioning Association, 2008, p. 423). Because anecdotal observation showed the dancers to possess more strength in the lower leg than the in the thigh, the progression over the weeks in the calf raises and the pogo jumps (placing emphasis on the lower leg) took place slightly sooner. Since this intervention was integrated within a ballet class where

<sup>1</sup> The intervention was carried out in a state-run music school where self-motivated practice outside of the school and participation in projects as part of tuition is a compulsory condition of contract. Therefore it was deemed unnecessary by the director of the school to apply for parental consent in order for the researcher to carry-out the intervention (Appendix B)

exercises stressing calf and thigh muscles, such as allegro were carried out, it was important to plan the intervention so that fatigue was not induced. Furthermore a compromise for all age-groups, fitness levels and body types needed to be reached.

Exercises	week 1	week 2	week 3	week 4	week 5	week 6
<b>1. Squats:</b> Put feet shoulder-width apart or slightly wider. Arms straight out in front of you. Sit back and go down like sitting on a chair. Back straight and leaning forwards. Go down so thighs are as parallel to the floor. Knees over your ankles. Weight back on heels. Come up.	X5	X5	X5	X5 X5	X8 X8	X12 X12
	REST 2-3 mins					
<b>2. Calf raises:</b> Stand with the balls of your feet on a step. Hold onto a wall for balance. Slowly lower your heels until you feel a stretch in the calves. Slowly go up into relevé. Hold for 2 seconds, then repeat.	X5	X5	X5	X8 X8	X12	X20
	REST 2-3 mins					
<b>3. Pogo jumps:</b> Stand parallel. Feet close together-not touching. Jump as high as you can using the lower leg as much as possible. Flex the feet and keep weight forward on the balls of the feet	X5 X5 X5	X5 X5 X5	X5 X5 X5	X8 X8	X12	X18
	REST 2-3 mins					
<b>4. Butt kick jumps:</b> Stand parallel feet as wide as hips. Bend and jump as high as you can. As soon as the legs are straight bring the heels to the sitting bones. Knees are in front of the body.	X5	X5	X5	X5 X5	X8 X8	X12 X12
	REST 2-3 mins					
<b>5. Rope skipping</b>	0,5 minute	1,0 minutes	1,5 minutes	2,0 minutes	2,5 minutes	3,0 minutes

**Figure 2:** Six week plyometric strength plan (Appendix C)

Research from by Dishman, et al. (2005), found enjoyment to be a key element in training effectiveness- therefore, in order to support enjoyment, parts of the intervention were accompanied by music. To encourage self-motivated participation each dancer was given a training booklet (Appendix C) with interesting and inspiring facts on health and fitness and a skipping rope so that they could absolve the 2<sup>nd</sup> and/or 3<sup>rd</sup> training unit alone. The booklet clearly depicted the training plan and included a progress chart where the participants could record their improvement. In order to encourage self-improvement instead of competition

with peers, weekly vertical JH data were only revealed to each individual separately and this was then recorded by the participant in their personal progress chart.

### Measuring Vertical Jump

After the warm-up on the first day of the intervention the vertical JH of each participant was recorded. A Sony HDR-CX130 camera, placed 1.5 meters away from the jump line and 4cm above floor level, was used for this purpose. The jump was taken from a parallel position, with the feet placed at hip width. A counter movement (knee bend) was used for the jump and each participant was instructed to push the floor away fast, to jump as high as they could and to stretch the feet. A natural swing of the arms to below shoulder height was allowed. JH was recorded once a week and was calculated using the movement capture programme *Kinovea*. It was decided to calculate JH using the distance of the feet from the ground. Using a jump and reach method (National Strength and Conditioning Association, 2008, p. 256) showed too many variances in body posture between participants, and between each jump performance. Furthermore, a commercial Vertec Device as suggested by the *National Strength and Conditioning Association* (2008, p. 257) was not available.

### Data Analysis

Using Excel, the individual scores at onset of the intervention were recorded for each dancer and from this data the starting group mean JH was calculated. The group mean increase in JH and individual mean increase in JH at completion of the intervention was calculated as was the standard deviation from these two means. Finally, the recorded start scores and end scores, after 6 weeks, for those still participating were compared using a t-test.

## Results

The standard deviation from the mean of the JH scores was calculated at 4,16512 at onset and 2,8641562 on completion of the intervention. Individual final scores for JH increase after completion of the intervention were varied and ranged from -2,47cm to 7,17cm. Results showed a mean increase in the final JH of the group of 3,755 cm and the paired t-test showed with 0,068674635 no significance in the group JH increase.

**Table 2:** *JH group mean value at onset, group mean value at completion, group mean value of JH increase (Appendix D)*

Participants (remaining)	JH Start	JH Week 6	Increase JH	Group Mean JH Onset	Group Mean JH Completion	Group Mean JH Increase
1.	34,55	36,25	1,70	28,48142857	31,61714286	3,135714286
2.	30,45	31,4	0,95			
3.	29,13	34,67	5,54			
4.	23,18	30,35	7,17			
5.	30,42	27,95	-2,47			
6.	28,73	30,1	1,37			
7.	22,91	30,6	7,69			

**Table 3:** *Individual JH Increase, individual mean JH increase, t-test giving p-value (Appendix E)*

Participants (remaining)	JH Start	St. Dev Start	week 1	week 2	week 3	week4	week 5	week 6	St. Dev week 6	Increase JH	Mean JH	t-test p-value
1.	34,55	4,16512	33,93	39,25	36,71	42,62	38,31	36,25	2,8641562	1,7	37,97	0,06867463 *
2.	30,45		32,12	28,84	32,36	34,38	31,83	31,4		0,95	31,63	
3.	29,13		33,32	34,3	35,02	x	36,09	34,67		5,54	33,76	
4.	23,18		x	24,86	25,42	25,25	26,93	30,35		7,17	26,00	
5.	30,42		22,36	28,98	x	27,57	27,57	27,95		-2,47	27,48	
6.	28,73		29,56	32,79	30,67	30,58	31,37	30,1		1,37	26,17	
7.	22,91		29,81	x	32,98	31,98	31,74	30,6		7,69	26,19	

\*p-value is greater than 0.05- therefore the increase in JH is not significant

## Discussion

The diversity in the compilation of the participant group was reflected in the results. The two highest JH increase scores were achieved by the youngest (10.97 years) and oldest (26 years) participants, numbers 4 and 7. Both were not otherwise particularly active; 4 taking part only in school sport and 7 being sedentary. Both participants achieved, on average an increase of more than 1cm per week. Perhaps the intervention overloaded these two participants sufficiently enough to cause a training effect, “Without the stimulus of overload, even an otherwise well-designed program greatly limits an athlete’s ability to make improvements” (National Strength and Conditioning Association, 2008, p. 380). This would also explain why participant 6, who took part in also modern dance for 1.25 hours and ice-skating for 10 hours a week made no progress in JH. The intervention was possibly not of a greater intensity (overload) than that of which the participant was used to and therefore not enough stimuli to cause a training effect. Participant 5 who took part in additional dance and sport regressed in JH. Between the 2<sup>nd</sup> and 5<sup>th</sup> week of the intervention this participant reported fatigue due to taking part in modern dance competitions for the duration of each weekend, with additional rehearsals. Fatigue is detrimental to performance (Koutedakis & Sharp, 1999) & (Koutedakis & Jamurtas, 2004) and may have been the reason for the negative end result in reported JH for participant 5. Participant 3 achieved a JH increase of 5.54 cm, despite absolving up to 10.25 hours of physical activity in addition to the 2.5 hours of ballet. In comparison to participant 6, the training plan seemed to be sufficient enough stimuli to cause a training effect in participant 3. Many factors could be the reason for this outcome; age, talent, proportions, quality of training, psychological state etc. Physically participants 3 and 6 contrasted greatly and an age difference of 10.86 years existed between them.

Research presents varying information concerning amount and time-span for strength training; Brown et.al (2007) showed that a twice weekly supplementary strength training over

a period of six weeks was sufficient to improve strength, Johnson et.al (2011) found that 1-3 training units per week over a minimum of 8 weeks were sufficient, while Rubley et.al (2009) found that with one unit per a training effect was not perceived until 14 weeks of the intervention. In this present study, overall, no significant training effect through absolving 3 units a week was seen within the six week period. In order for this particular group to progress in JH, individual training plans need to be implemented. For participants 4 and 7 developing on the existing plan could be sufficient. However, highly active participants, as in the case of participant 6 would need a far more intensive programme. In the case of participant 5 obtaining an overview of forthcoming events and competitions would be advisable in order to construct a plan that could aid development while avoiding fatigue.

Post intervention, the participants were eager to persist with the strength training exercises and the majority expressed interest and awareness for the effect on bone health that jumping has been shown to have (McHugh, Tyler, Greenberg, & Gleim, 2002). All participants reported that after the 6 weeks the exercises were easier to perform and that jumping seemed easier.

#### Disadvantages of the study

The group of had 3 drop-outs, diminishing from 11 to 7 participants. Due to the size and diversity of the group, results gained were only representative of the sample and not representative of the population.

This study did not have a control group or follow an existing JH measurement procedure nor use a commercial measuring device for vertical jump height as recommended by Baechele & Earl (2008, pp. 256-257). However, the intermittent tests showed no unexplainable radical changes or inconsistency which indicated that the testing method, although not from a previous model, was in all probability, reliable.

The JH was filmed from the front making incorrect data identifiable when participants

failed to stretch the feet. However, additionally filming from the side would have helped eliminate further incorrect data. For example, if, during the jump, the dancer brought her legs behind the sagittal line, this would alter the apparent JH as filmed from the front.

Furthermore, it was not possible to control if the 3rd and in some cases also the 2<sup>nd</sup> training unit, was absolved independently. Therefore, the actual amount of training units undertaken per participant is unclear, although each participant did complete at least one unit per week.

## **Conclusion**

Acknowledgment and respect of individuality should always be taken into account in any training plan. In a group as diverse as the one in this study, individual training plans are needed and differentiation is paramount if the group is to make progress and injuries are to be avoided. Sufficient stimulus, e.g. amount of training and load, timing of sessions and construction of exercises plus specific rest periods between exercises and adequate recovery between training units is required in order to achieve training effects. Furthermore, each individual will require a different stimulus, “A single formula for successful training to satisfy the needs of all individuals of varying age, gender and fitness levels does not exist” (Koutedakis & Sharp, 1999, p. 159).

An unforeseen positive effect of the intervention was that awareness and interest in bone health was awakened.

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## Appendices

Appendix A, Table 1

Participants	Age (years)	Category	Ballet per week (Hours)	Other dance per week (Hours)	Sport in school (Hours)	Sport in leisure time (Hours)
1.	14,50	Adolescent	2,50	--	2	--
2.	14,50	Adolescent	2,50	--	2	--
3.	12,9	Adolescent	1,25	Modern 1,25	2,5	Ice Skating 9
4.	10,97	Child	1,25	--	3,3	--
5.	19,8	Adult	1,25	Modern & Jazz 4	--	Endurance Cycling 1,5
6.	23,76	Adult	1,25	Modern 1,25	--	Ice Skating 10
7.	24,08	Adult	1,25	--	--	--
8.	26	Adult	1,25	--	--	--
9.	12,45	Adolescent	1,25	--	2,5	Horse Riding 1
10.	22,65	Adult	2,50	--	--	--
11.	19,55	Adult	2,50	--	--	--

### **General teaching conditions of the Vienna Music School: Clauses V & VI**

#### V. Unterricht

Der Unterricht an der Musikschule Wien erfolgt auf Basis der „Lehrpläne der Musikschule Wien“ in der aktuellen Fassung und findet an Musikschulstandorten sowie in Schulen und anderen geeigneten Räumen statt.

Veranstaltungen, Exkursionen, öffentliche Auftritte und die Durchführung von Projekten (inklusive Proben) bilden einen unverzichtbaren Bestandteil des Unterrichts an der Musikschule Wien. Wenn die Durchführung von Projekten oder Proben für Auftritte/Veranstaltungen dies erfordert, können sich die grundsätzlichen Unterrichtseinheiten verändern, geblockt werden oder punktuell ohne Ersatz entfallen. Die entfallenen Unterrichtseinheiten gelten in diesem Fall als erbracht.

Der Unterricht findet in einem schuljahresbezogenen Zyklus statt und unterteilt sich in zwei Semester (Winter- und Sommersemester). Die Ferien an den Wiener Schulen sowie die gesetzlichen Feiertage sind unterrichtsfreie Zeit. Es gelten die diesbezüglichen allgemeinen gesetzlichen Regelungen sowie jene für das Land Wien.

#### V. Classes

**The classes at the Music School Vienna are based on the "Curricula of the Vienna Music School" in the current version and take place at music school locations as well as in schools and other suitable rooms.**

**Events, excursions, public appearances and the realization of projects (including rehearsals) form an indispensable part of teaching at the Vienna Music School. If the implementation of projects or rehearsals for performances / events requires this, the basic lesson units may change, be blocked or be discontinued without replacement. The canceled lessons are deemed to have been provided in this case.**

**The lessons take place in a school-year cycle and are divided into two semesters (winter and summer semester). Holidays at the Viennese schools as well as public holidays are free of lessons. The relevant general legal regulations as well as those for the Province of Vienna apply.**

#### VI. Pflichten der SchülerInnen

Die SchülerInnen sind zum regelmäßigen und pünktlichen Besuch des Unterrichts verpflichtet. Dazu gehört auch die unentgeltliche Mitwirkung an Veranstaltungen, Exkursionen, öffentlichen Auftritten und Projekten (inklusive Proben) der Musikschule Wien.

Regelmäßiges häusliches Üben der Schülerin / des Schülers am Instrument ist Voraussetzung und maßgebend für den Unterrichtserfolg! Für die Beschaffung von Lehrmitteln (Instrumente, Noten, Notenständer) hat die / der SchülerIn Sorge zu tragen. Nähere Informationen über die Möglichkeit von Mietinstrumenten finden sich auf der Internetseite der Musikschule Wien [www.musikschule.wien.at](http://www.musikschule.wien.at)

#### VI. Duties of the pupils

**Pupils are required to attend classes regularly and on time. This includes the free participation in events, excursions, public appearances and projects (including rehearsals) of the Vienna Music School**

**Regular home practice of the student on the instrument is a prerequisite and decisive for the success of the lesson! The pupil has to take care of the procurement of teaching aids (instruments, grades, music stands). Further information about the possibility of renting instruments can be found on the website of the Music School Wien [www.musikschule.wien.at](http://www.musikschule.wien.at).**

English translation of clauses in bold face.



# Let's Jump Higher!

(Training program for a better jump)

Name \_\_\_\_\_ Age \_\_\_\_\_ Group \_\_\_\_\_ Number \_\_\_\_\_

## Let's jump higher!

This program has been designed especially for your ballet group and aims to help you jump higher.

Over a period of 6 weeks we will undertake this program as part of our weekly training.

You will also independently undertake the program so that you complete it three times each week.

This program has been thought out with the help of scientific research and writings. It has been designed so that we start off very gently and slowly build up. The exercises for your calves and the Pogo Jumps will target your lower legs, while the Squats and the Butt-Kick-Jumps target your upper legs. Skipping is included to train our endurance and increase our oxygen intake.

We aim to get really strong for our performance in the Summer. A big stage needs big movements and BIG jumps!

### **IMPORTANT POINTS**

1. Warm-up
2. Do not do the exercises when you are tired or hungry
3. Take a 2-3 minute before starting the next exercise.
4. Quality (maximum effort); Do the exercises as well as you can

The Program takes around 15-20 minutes and should be carried out three times a week on Monday, Wednesday, Friday or Saturday.

X5 means do 5 times.

## Interesting stuff about our bodies

Did you know that .... ?

That ballet dancers need to be strong- REALLY STRONG.

We have over 650 muscles in our body.

If we train our muscles we strengthen our immune system.

Our muscles normally account for only 50 -60% of our body weight.

Being flexible is genetic and muscles only influence our flexibility by about 10%. The other 90% is affected by our tendons, bones, and temperature inside and outside of the body and sometimes just how we feel.

Being able to move the head and the shoulders independently is something that only humans can do. This is to maintain our balance while running.

We have two types of muscle fibre (what the muscle is made-up of) red fibres and white fibres. People with more white muscle fibres can be faster than those with more red fibres. People with more red fibres can keep active for longer than those with more white fibres.

If we want to jump fast,

we have to train our white muscle fibres.

If we want to be able to dance the whole day we need to train our red muscle fibres.

To become stronger we have to train at 70% or more of our maximum. For example, your maximum in lifting a weight would be the amount of kilos that you can lift with all the energy and strength you have just ONCE. So to get stronger we really have to work hard.

Trained people can burn up more fat because they have good muscles and muscle burns fat.

To be "trained" means to have a regular program that you follow.

Jumping helps your bones get stronger and jumping when you are young will help keep your bones strong even when you are old.

Warming-up helps guard against injury and help you get the most out of your training. When you warm-up your muscles to you affect how enzymes react in the body, this makes your body will produce more energy.

Just 1° increase in muscle temperature causes a 13% increase in the metabolism of the muscle cells.

Cooling down after training guards against injury and speeds up recovery!

Exercises	week 1	week 2	week 3	week 4	week 5	week 6
<p><b>1. Squats:</b> Put feet shoulder-width apart or slightly wider. Arms straight out in front of you. Sit back and go down like sitting on a chair. Back straight and leaning forwards. Go down so thighs are as parallel to the floor. Knees over your ankles. Weight back on heels. Come up.</p> <p>REST 2-3 mins</p>	X5	X5 X5	X5 X5 X5	X5 X5 X5 X5	X8 X8 X8 X8	X12 X12
<p><b>2. Calf raises:</b> Stand with the balls of your feet on a step. Hold onto a wall for balance. Slowly lower your heels until you feel a stretch in the calves. Slowly go up into relevé. Hold for 2 seconds, then repeat.</p> <p>REST 2-3 mins</p>	X5 X5	X5 X5 X5	X5 X5 X5	X8 X8 X8	X12 X12	X20
<p><b>3. Pogo jumps:</b> Stand parallel. Feet close together-not touching. Jump as high as you can using the lower leg as much as possible. Flex the feet and keep weight forward on the balls of the feet</p> <p>REST 2-3 mins</p>	X5 X5 X5	X5 X5 X5 X5	X5 X5 X5 X5	X8 X8 X8	X12 X12	X18
<p><b>4. Butt kick jumps:</b> Stand parallel feet as wide as hips. Bend and jump as high as you can. As soon as the legs are straight bring the heels to the sitting bones. Knees are in front of the body.</p> <p>REST 2-3 mins</p>	X5	X5 X5	X5 X5 X5	X5 X5 X5	X8 X8 X8	X12 X12 X12
<p><b>5. Rope skipping</b></p> <p>REST 2-3 mins</p>	0,5 minute	1,0 minutes	1,5 minutes	2,0 minutes	2,5 minutes	3,0 minutes

Mission completed! Here you can tick off your completed training sessions and record your progress in jump height 😊

Monday	Jump Height start	Week 1		Jump Height Week 1	Week 2		Jump Height Week 2	Week 3		Jump Height Week 3	Week 4		Jump Height Week 4	Week 5		Jump Height Week 5	Week 6		Jump Height Week 6
Wednesday																			
Friday/Saturday																			

Appendix D, Table 2

Participants (remaining)	JH Start	JH Week 6	Increase JH	Group Mean JH Onset	Group Mean JH Completion	Group Mean JH Increase
1.	34,55	36,25	1,70	28,48142857	31,61714286	3,135714286
2.	30,45	31,4	0,95			
3.	29,13	34,67	5,54			
4.	23,18	30,35	7,17			
5.	30,42	27,95	-2,47			
6.	28,73	30,1	1,37			
7.	22,91	30,6	7,69			

Appendix E, Table 3

Participants (remaining)	JH Start	St. Dev Start	week 1	week 2	week 3	week 4	week 5	week 6	St. Dev week 6	Increase JH	Mean JH	t-test p-value
1.	34,55	4,16512	33,93	39,25	36,71	42,62	38,31	36,25	2,8641562	1,7	37,97	0,068867463 *
2.	30,45		32,12	28,84	32,36	34,38	31,83	31,4		0,95	31,63	
3.	29,13		33,32	34,3	35,02	x	36,09	34,67		5,54	33,76	
4.	23,18		x	24,86	25,42	25,25	26,93	30,35		7,17	26,00	
5.	30,42		22,36	28,98	x	27,57	27,57	27,95		-2,47	27,48	
6.	28,73		29,56	32,79	30,67	30,58	31,37	30,1		1,37	26,17	
7.	22,91		29,81	x	32,98	31,98	31,74	30,6		7,69	26,19	

\*p-value is greater than 0.05- therefore the increase in JH is not significant