



Impact Forces of Jump Landings Between Beginner and Elite Dancers

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Abstract

Introduction: Unlike most athletic activities, dancers complete the vast majority of their training by concentrating solely on dance technique, with very little to no other forms of exercise. This limitation obviously increases probability of excelling in dance, however it can pose some obstacles in regards to the overall health and sustainability of the dancer, in particular to the joints.³ Jumping is an integral part of dance technique and as they advance in training, dancers are taught many forms of jumps, but may not be aware of the amount of force absorbed by the joints upon landing.

Purpose: The purpose of this study was to compare the impact force upon landing between beginner and elite trained dancers.

Methods: 11 beginner (6 female, 5 male; age 17 ± 1.91 yr; weight 69.745 ± 13.587 kg; height 1.7178 ± 0.091 m) and 12 elite (10 female, 2 male; age 24 ± 4.609 yr; weight 57.778 ± 0.091 kg; height 1.618 ± 0.211 m) dancers participated in this study. The knee angle of each subject's maximum *plie* was measured along with their maximum jump height. Each subject performed three trials of 2 different jumps (*ballonne* and *soubresaut*) on a force plate at their maximum height where their impact force during landing was recorded and analyzed.

Results: There was a significant difference in impact force between the beginner and elite dancers while executing both jumps (*soubresaut* beginner 3.288 ± 0.3685 (BW) elite 3.7059 ± 0.4971 (BW); *ballonne* beginner 2.3672 ± 0.4249 elite 2.2992 ± 0.7116 (BW)) when controlling for the angle of *plie* depth. There was no significant difference in impact force for *soubresaut*, however there was significant difference in impact force between the two groups for *ballonne*, when controlling for jump height. The elite group had a significantly higher jump height (0.350 ± 0.0766 m) than the beginner group (0.296 ± 0.0758 m). Beginner dancers had a maximum depth of *plie* $136 \pm 14.6553^\circ$ and elite dancers had a maximum depth of $122.0833 \pm 10.128^\circ$.

Conclusion: The elite dancers exerted more force than the beginner dancers when performing both jumps when confounding variables were taken out of the analysis. This could be due to the fact that the elite dancers weighed more and jumped higher than the beginner dancers. The elite dancers also had a more acute angle of *plie* depth than the beginners, thus allowing for more elastic energy to be stored in the Achilles tendon, which possibly increases the height of the jump.

Purpose

The purpose of this study was to compare the impact force upon landing from a jump between beginner and elite trained dancers.

Methods

The subjects reported to the biomechanics lab where they familiarized themselves with the force plate and warmed up with their normal routine. The subjects first performed a *demi-plie* and a goniometer was used to measure the maximum angle of each subject's right knee joint. The subject performed 2 basic dance movements which were assigned a random order. The movements were *ballonne* and *soubresaut*. The *ballonne* and *soubresaut* were chosen because they are jumps that are taught to dancers early in their training and are jumps that are used in several genres of dance. A *ballonne* is a jump during which the dancer begins in 5th position performs a *demi-plie* and springs into the air, extending one knee either in front, back or to the side and landing on the foot that was held straight. A *soubresaut* is a jump where the dancer begins in 5th position with legs and feet together. He then performs a *demi-plie* and jumps vertically into the air, keeping the legs and feet together while extending the ankle and lands on both feet back in 5th position. A good trial consisted of a take-off from the maximum *demi-plie* angle and landing completely on the force plate without movement of the legs after landing. In addition, there had to be a minimum of 200 ms of landing data collected by the force plate. Each subject performed both jumps with 3 trials being recorded landing on the force plate. All acceptable trials were used for statistical analysis.

To assess jump height, a tape measure was mounted to the floor next to the force plate and the tape end attached to waist to the subject. Height of jump was determined to be the difference between the measure of tape before and after the jump.

Group	Height	Weight	Jump Height	Knee Angle of Max Plie	Impact Force Soubresaut	Impact Force Ballonne
Beginner	1.7178 ± 0.091 m	69.745 ± 13.587 kg	0.296 ± 0.0758 m	$136 \pm 14.6553^\circ$	3.288 ± 0.3685 (BW)	2.3672 ± 0.4249 (BW)
Advanced	1.618 ± 0.211 m	57.778 ± 0.091 kg	0.350 ± 0.0766 m	$122.0833 \pm 10.128^\circ$	3.7059 ± 0.4971 (BW)	2.2992 ± 0.7116 (BW)

Results

There was a significant difference in impact force between the beginner and elite dancers while executing both jumps (*soubresaut* beginner 3.288 ± 0.3685 (BW) elite 3.7059 ± 0.4971 (BW); *ballonne* beginner 2.3672 ± 0.4249 elite 2.2992 ± 0.7116 (BW)) when controlling for the angle of *plie* depth. There was no significant difference in impact force for *soubresaut*, however there was significant difference in impact force between the two groups for *ballonne*, when controlling for jump height. The elite group had a significantly higher jump height (0.350 ± 0.0766 m) than the beginner group (0.296 ± 0.0758 m). Beginner dancers had a maximum depth of *plie* $136 \pm 14.6553^\circ$ and elite dancers had a maximum depth of $122.0833 \pm 10.128^\circ$.

Conclusions

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