



Central New England Region Digest

January 2018



Happy 2018!

Instead of a club/center spotlight this month we wanted to share a research project by a member of Wentworth Pony Club: Chelsea Hoyt, who is heading to Kentucky next week to showcase her equine research at the USPC Annual Meeting. A summary of her project is below as many of you may find it a very interesting read! Congratulations Chelsea and best of luck in Kentucky!

Biomechanics of Jumping in Equines

How jump height affects potential energy stored in the suspension apparatus

By Chelsea Hoyt

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ABSTRACT:

In all horse sports the suspension apparatus is an extremely important structure, needed for absorbing concussion and creating elastic potential energy. In rigorous sports like show jumping, racing or eventing, the suspension apparatus is often maximally stretched or even over stretched. This can result in a life or career ending injury. How does the suspension apparatus really aid the horse in jumping?

Ten horses were used to show the relationship between potential energy stored in suspension apparatus and jump height. Each horse was free jumped over a jump that progressively increased in height by intervals of 7.6cm from a starting height of 0.76m to an ending height of 1.114m. A camera videotaped foot falls and screenshots were taken at the loading phase of the trailing foreleg during the final stride. The measurements were taken using the application Geometer's Sketchpad and used to calculate elastic potential energy. Graphs of the data were generated with trend lines. The trend lines showed that as the jump height increased, the amount of potential energy also increased in a quadratic manner, with 90% of all horses increasing with a positive quadratic term.

The information from this study can give riders insight on how important healthy tendons are, what stresses them, and the importance of proper rehabilitation and conditioning thus improving the athleticism of horses. If a tendon is impaired, the horse may not be able to store or utilize the energy efficiently putting more stress on other structures.

BACKGROUND:

In all horse sports the suspension apparatus is an extremely important structure, needed for absorbing concussion and creating elastic potential energy. In rigorous sports like show jumping, racing or eventing, the suspension apparatus is often maximally stretched or even over stretched. This can result in a life or career ending injury. But how does the suspension apparatus really aid the horse in jumping? This research will provide insight on how the horse works and the effect of jumping on horses tendons and ligaments. The tendon and ligaments of the lower leg of the horse are very important to the horses'

movement and athletic ability and so if we can begin to see how jumping influences those structures we can better understand how to rehab horses who have been injured, prevent injury and even start to look at ways to protect tendons and limit the strain on those structures.

QUESTION:

Does the design of the jump change the potential energy stored in suspension apparatus of equines?

HYPOTHESIS:

As the jump height increases, the amount of potential energy stored in the equine suspension apparatus will increase in a quadratic function, where the quadratic term is a positive real number.

Goals: To find how the suspension apparatus contributes to the horses jump, and how it changes as the jump gets taller.

Expected Outcomes: It was expected that the data would show the amount of potential energy stored in the suspension apparatus and also be able to see how it changes as the height of the

jump increases. The hope is that this research will provide insight on the importance of the suspension apparatus.

MATERIALS/METHODS:

1. 5-10 horses
2. 2 tripods
3. 2 cameras
4. 10 jump standards (about 4feet tall)
5. 10 jump poles (12ft long)
6. Scale (upper weight limit of 400lbs or 181.4 kg)
7. Tape measure
8. Lunging equipment (lunge line, lunge whip, helmet, gloves, boots)
9. 4 foam interlocking mats
10. Halters and lead ropes for horses
11. Silver Alushield ©

Preparation of horses and jump course

Ten horses were selected to test. The horses were marked with visible markers using Alushield, a non-toxic wound protectant at the following anatomical locations: hoof, the metacarpophalangeal joint (MCPJ), and carpal joint (forelimb) and the hoof, metatarsophalangeal joint (MTPJ) and tarsal joint (hindlimb). This was done so that during analysis, distances could more easily be determined and measured.

Jump runs were established with a line of two jumps, 3 strides apart, the first to set the correct distance to the test jump and the second, the test jump to test the hypothesis. The first jump was set as a 2' vertical, the second was set initially at 2'6" but adjusted during the testing.

JUMPING AND ANALYSIS:

The horses were sent over a line of two jumps, 3 strides apart, one to make sure they get the correct distance to the next one and the second to test the hypothesis. The first jump was a 2' vertical, the second was be adjusted to the test heights. The first couple of runs through the line were to test the striding. After proper striding was confirmed, the testing runs began. The horses were jumped at different jump heights that progressed upward: 2'6", 2'9" 3', 3'3" 3'6". Multiple cameras were used to video record the progression through the jumps. Using still frames from videos, the distance from the carpal joint to the bottom of the hoof (front legs) was determined and recorded and from the tarsal joint to the bottom hoof, at most compressed stage of the leg at take off. *Any long spots, chips or other poorjumps were disregarded. From the videos, snapshots were taken of the horse at the most compressed stage of the hind and forelimbs. Using the markings placed on the anatomical positions described above the distances were measured using a scale factor by measuring the horses' cannon bones before jumping and converting the picture measurements into accurate measurements. Measurements were also taken of the legs while standing, weight bearing and finding relaxed length of leg. To find length of relaxed leg the horse's leg was held at the cannon bone and allowed to relax and then measured from the carpal/tarsal joint to hoof. Weight was approximated using the equation: $(\text{LengthHeartgirth} \times \text{length heartgirth} \times \text{body length}) / 330 = \text{Weight}$, or use a scale to mass one of the horses legs.

The equation, $PE=1/2kx^2$ was used to find the potential energy the leg stores (where k =spring constant, x =spring displacement). X was found by measuring the smallest distance between the two measuring points when the horse had both feet on the ground and subtracting from equilibrium. k can be solved for by using the equation; $k= F/(x-x_1)$. x being the displaced length, x_1 being leg at equilibrium and F equaling force. The values used for that equation were x equaling leg being stood on, x_1 relaxed leg, F being force on standing leg. To find force $(\text{Length heartgirth} \times \text{length heartgirth} \times \text{body length}) / 330 = \text{Weight of horse}$, to find force on one leg, multiply by .55 (for forelimbs) or .45 (hindlimbs) then divide by two or a scale to calculate the mass of the horse.

CONCLUSION: The data collected from this study partially supported the hypothesis. The data showed that there is a direct correlation between the amount of elastic potential energy (PE) stored in the suspension apparatus and the height of jump. In addition, the relationship between the 2 variables increased quadratically. In the first few jumps (those of lower height), the horse would not rely on the suspension apparatus in the fore as much as power from the hind end, however, as the jump height increased the horse had to add energy which was done by tapping into the potential energy of the suspension apparatus of the forehand. This explains why the relationship is quadratic and not linear. 90% of the horses' studied showed that potential energy (PE) increased in this manner, and only one of the horses (horse #3) had a negative quadratic term which could be attributed to his unique jumping style relating to his confirmation. Even within the 90% that exhibited a positive quadratic term, there were slight variations in their curves / quadratic formulas. Such small variations could be likely be attributed to such things as arthritis and jumping style. Knowing that the contribution increases in this way, shows that for those competing at higher levels, even small increases in jump height translates into significantly more input from the forehand. This shows how much conformation and jumping style is important. For horses with poor conformation or medical issues such as navicular, knowing this can be vital for maintaining a healthy horse. Small incremental changes in jump height might be preferred to minimize injury.

**Below are upcoming events in CNE to mark on your calendar:*

- January 20th @ 12:30** Regional Unmounted Meeting: Poisonous Plants/Bandaging
- January 24th-28th** USPC Annual Meeting Louisville, KY
- February 2nd @ 6:00** HB/UL Prep @ 72 Main St, Westford, MA
- February 3rd @ 2:30** Regional Council Meeting @ Wendy Johnson Residence
- March 2nd@ 6:00** HB/UL Prep @ 72 Main St, Westford MA
- March 3rd @1:00** Confirmation Clinic @ Scarlet Hill Farm
- DATE TBD** Dentistry Clinic @ Dover Saddlery
- April 7-8** Leadership Seminar for DC's/CA's/Jt. DC's & Regional Officers

January Regional Unmounted Meeting: Poisonous Plants/Bandaging

- January 20th from 12:30-2:30pm
- Held at the Prescott School 145 Main Street, Groton MA
- Clinicians Wendy Johnson & Betsey Reeves

HB Prep

- February 2 @ 6 pm
- March 2 @ 6 pm
- Held at Nelson Residence 72 Main St, Westford, MA

Regional Council Meeting

- February 3rd @ 2:30 PM
- Held at Wendy Johnsons 44 Browning Ave, Nashua, NH
- Planning for Spring Rallies, Leadership Seminar, etc

Confirmation Clinic

- March 3rd
- Held at Scarlet Hill Farm 245 Lowell Road, Groton, MA
- Clinician Meredith Scarlet

Dentistry Clinic

- To be held at Dover Saddlery
- Originally scheduled for February 24th but clinician had to change date
- New date will be communicated asap

Leadership Seminar

- April 7-8
- Littleton, MA
- A Representative from the National office is going to be coming to mentor our DC's and Officers on leadership training! The region is expecting and will fund each club/center to send 1 representative (preferably their DC) but more are encouraged. Details will be discussed at the upcoming regional meeting but for now, DC's and officers please set aside the weekend of April 7-8th.

Please send any club news or upcoming events to Andrea (atnelson6@comcast.net) by the end of each month to be included in the next month's newsletter.

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