

# Frequency of forelimb weight shifting in normal horses.



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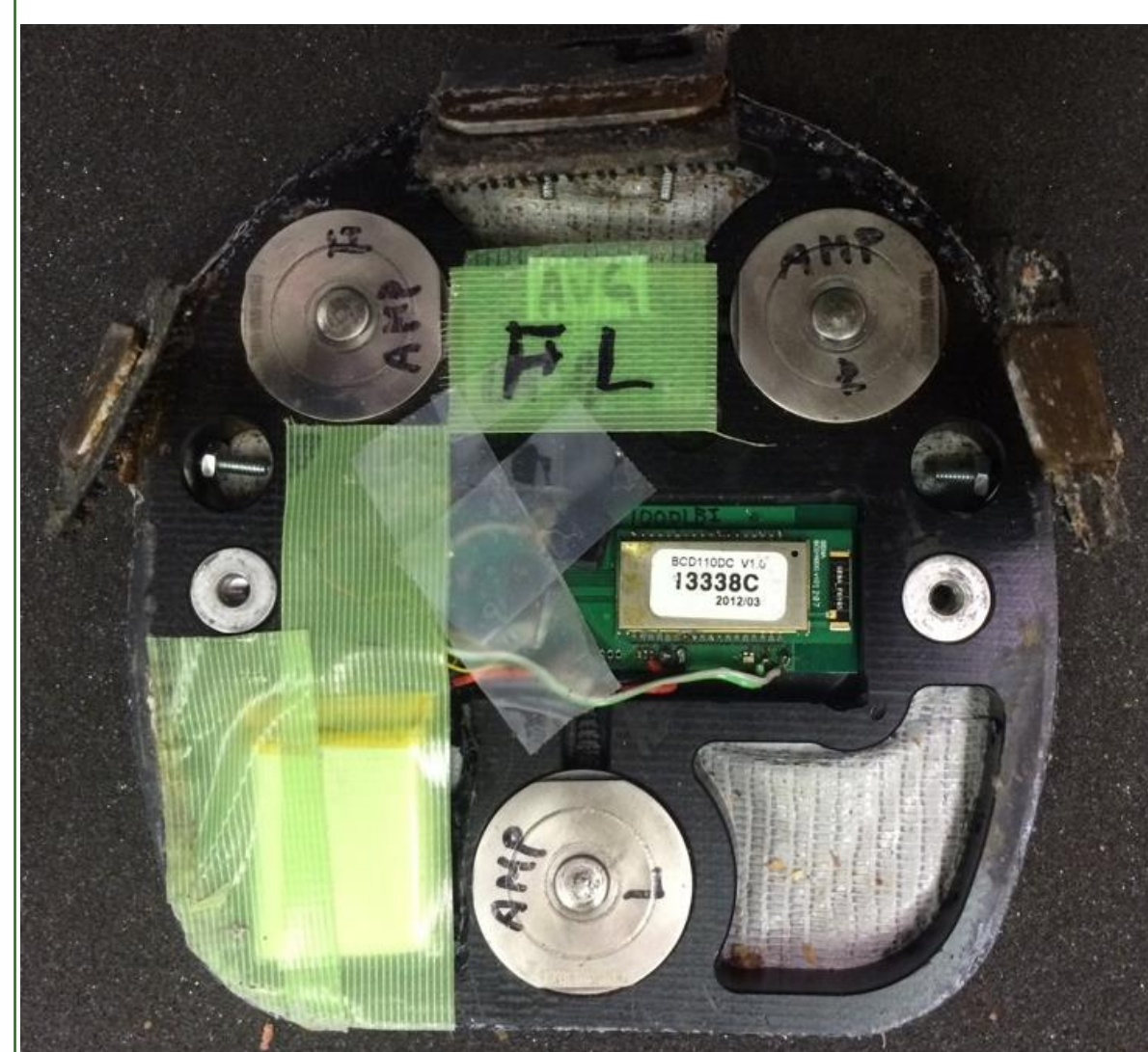
## BACKGROUND & HYPOTHESIS

- Laminitis is a significant cause of lameness in horses. Early detection and treatment dramatically improve prognosis, but it is often diagnosed after irreversible hoof damage has occurred.
- Weight shifting between forelimbs and from forelimbs to hind limbs are commonly associated with the developmental phase of laminitis. However, the frequency of shifting between forelimbs and the distribution of force in percent body weight between forelimb and hind limbs in laminitic and non-laminitic horses are unknown.
- The objective of this study is to establish the frequency in forelimb weight shifting and the distribution of weight between forelimbs and hind limbs in non-laminitic horses over long periods of time resting in a stall.

**We hypothesize that normal horses will shift weight between forelimbs less than ten times per minute and that forelimbs will consistently carry greater than 60% of total body weight.**

## MATERIALS & METHODS

- 4 adult horses (two mares and two geldings) of various breeds were used.
- They wore devices with 3 force-measuring sensors (two front, one back, battery, radio, associated electronics) on all four feet.
- The devices were secured to the hooves and laced within commercial hoof boots (Easy Boots).
- The horses were stalled with the force shoes for an average of 18.25 hours (range was 14-22 hours).
- Force data were collected from each sensor (10 Hz sampling rate), but averaged and reported per minute. Data from 3 sensors in each hoof device were averaged to give an overall average force per minute on each limb.
- Data analysis for each horse included the average number of weight shifts between the forelimbs and the distribution of weight between front and hind feet.



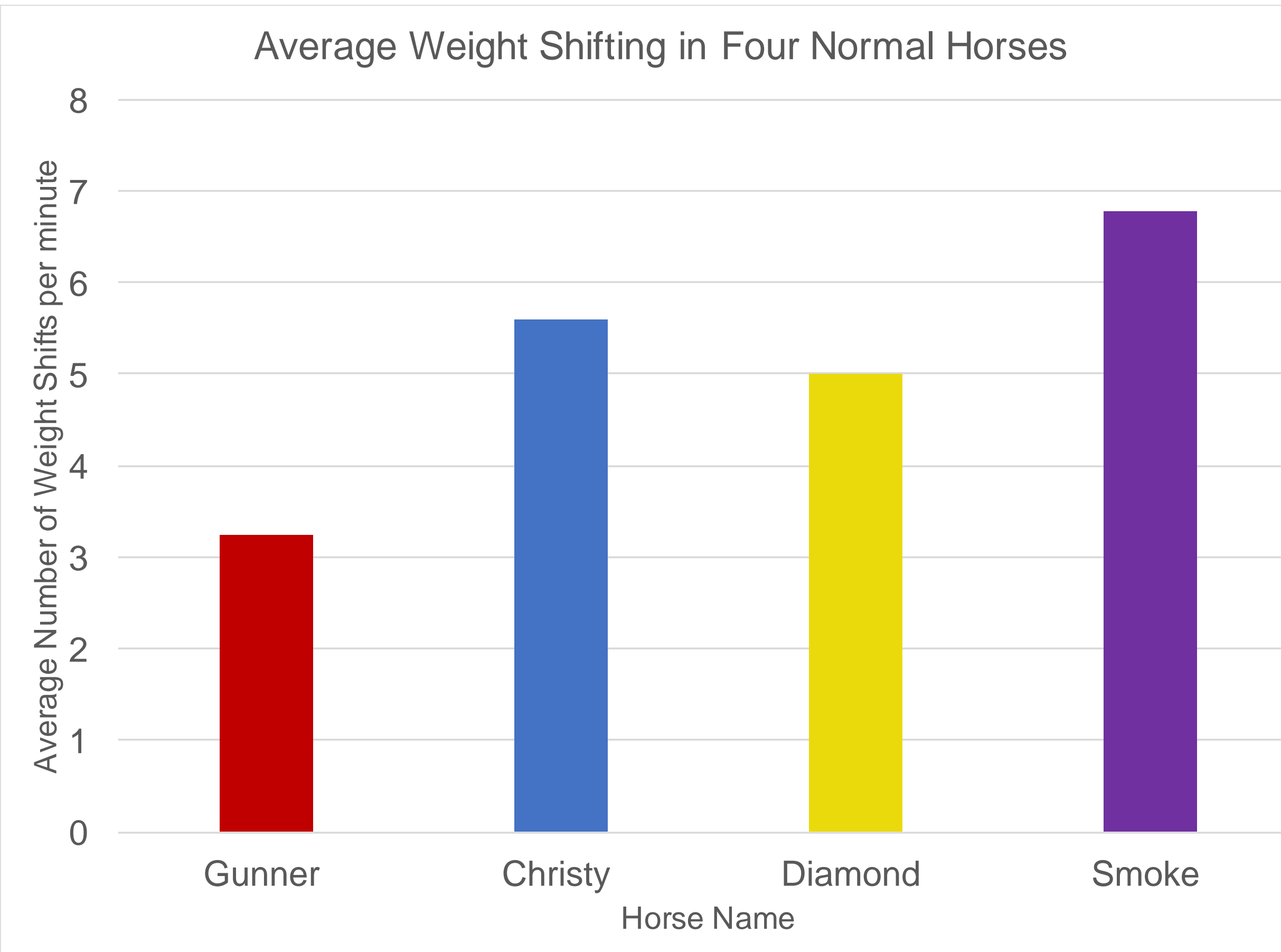
Open force shoe with sensors



Easy Boot

Top of force shoe  
(contacts sole of the hoof)

## Forelimb Weight Shifting

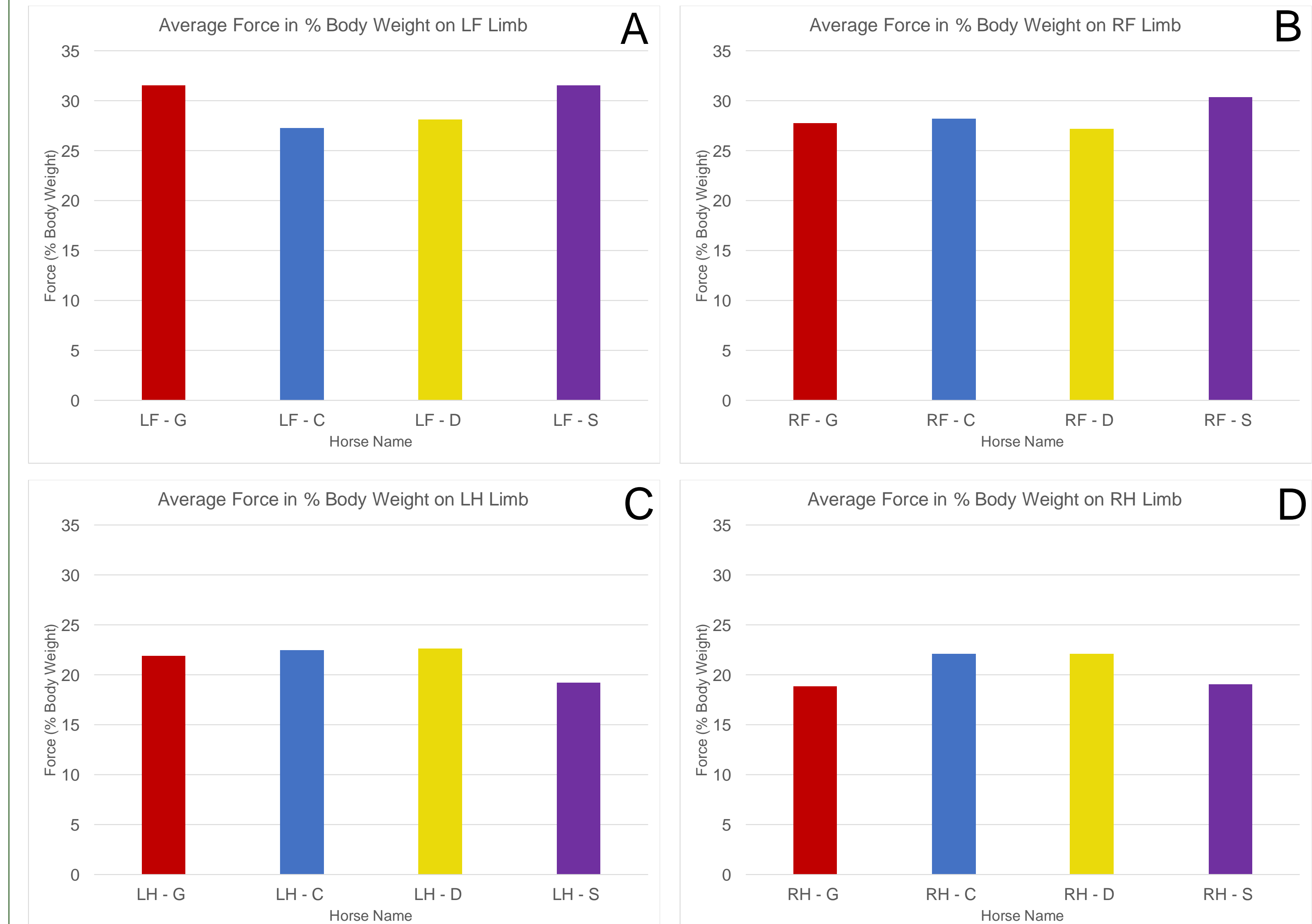


**Figure 1: Forelimb Weight Shifting.** Number of forelimb weight shifts per minute in 4 non-laminitic horses resting in a stall. The average number of weight shifts between forelimbs ranged from 3.2 to 6.7 times per minute, which is 187 to 400 times per hour. A study that analyzed horses standing on force plates while in stocks for one hour reported 125 +/- 55 weight shifts per hour.

Key:		
Gunner	Red	G
Christy	Blue	C
Diamond	Yellow	D
Smoke	Purple	S

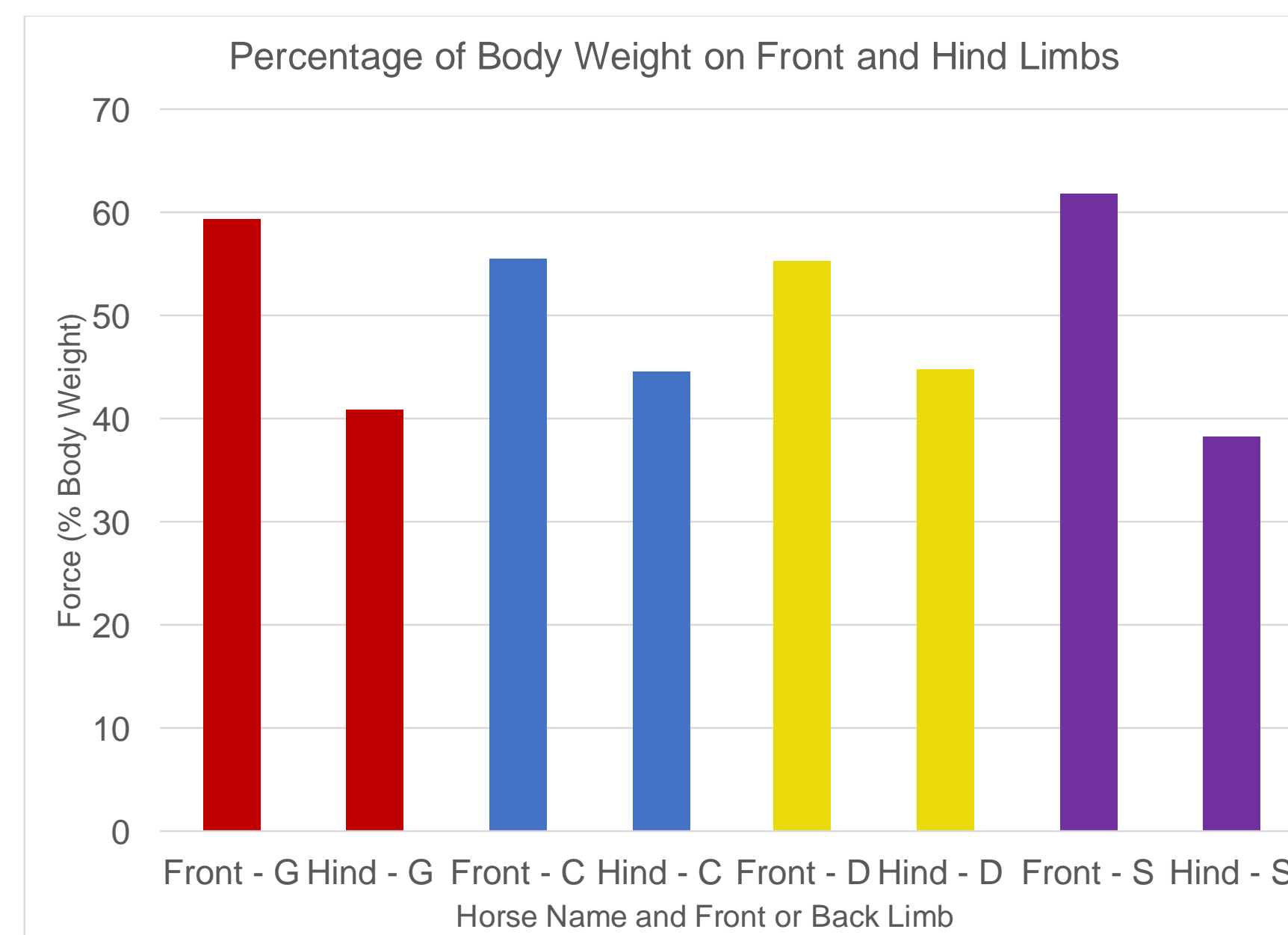
## RESULTS

### Average Force on each Limb



**Figure 4: Average Force on each Limb.** The force in percent body weight on each limb was calculated by taking the sum of the force from all three sensors in one device and dividing the sum from all sensors in all four devices x 100. The averages were then calculated based on the total length of collection time for each horse. The average percentage on the left front (A) was 29.6%, the right front average was 28.3% (B), the left hind average was 21.6% (C), and the right hind average was 20.5% (D). These values are similar to another study that used force plates rather than force shoes. They reported 28% weight on each front hoof and 22% on each back hoof. Non-laminitic lameness did not have a clinically significant impact on the percentage of weight borne on the affected limb.

## Front-Hind Limb Weight Distribution



**Figure 2: Front-Hind Limb Weight Distribution.** The 55-60/45-40 front to hind weight distribution we observed with the use of force shoes is similar to weight distribution seen by other means of measurement.

## CONCLUSION & FUTURE RESEARCH

- The number forelimb weight shifts per minute fell within a range that averaged less than ten times per minute.
- Various types of non-laminitic lameness do not appear to significantly affect weight shifting or the amount of weight borne on a limb.
- Additional non-laminitic horses will be tested for the current study.
- A follow-up study will be performed with laminitic horses and will be compared to the current study.
- The goal is to use these force shoes as a diagnostic tool to detect laminitis during the developmental phase to begin treatment earlier and improve prognosis.

## ACKNOWLEDGEMENTS

Research Supported by: The E. Paige Laurie Endowed Program in Equine Lameness and an Endowment established by IDEXX-BioResearch.