

# PRODUCTIVE IMPULSE DIFFERENCES IN ADVANCED VS. TRAINING LEVEL DRESSAGE HORSES

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## INTRODUCTION

Dressage is a riding discipline that seeks to improve the trainability and longevity of a riding horse. Horses are improved gymnastically by progressively developing 1) their ability to move with a supple and longitudinally flexed spine, and 2) their ability to shift weight from the forehand to the haunches. As training progresses, the horse develops an increased ability to lift vertically and lighten the forehand. The purpose of this investigation was to determine if there is any difference in the productive impulse (PI) produced on the horse's back in an advanced vs. training level dressage horse. Productive impulse is defined as the area under a force time curve minus the impulse created by the sum of the rider's weight plus the saddle ( $m$ ), see fig. 1. Our hypothesis is that productive impulse on the horse's back, at a specific gait, increases as the horse becomes more advanced in its training.

## METHODS

The test subjects were a Hanoverian mare trained to the Grand Prix level and a Holsteiner gelding schooling at training level. Both riders were of advanced ability, and both horses were fitted with high quality modern dressage saddles. The saddle fit was assessed as excellent for both horses.

Pressure and force measurements were taken with the Pliance® saddle test system. Static measurements were taken with each rider mounted and their horses standing at the halt. This yielded the force produced from the combined weight of the rider and saddle. The force time integral ( $\mathbf{fti}$ ) was then computed using the Pliance® software, with  $\Delta t=5$  sec. This yielded the value of  $mg\Delta t$ . Previous studies show there is a good correlation between the total force measure by the Pliance® saddle test system and the actual weight of the rider and the saddle. Next, measurements were taken of both horses at the walk, trot, and canter. The  $\mathbf{fti}$  was computed at each gait. The productive impulse at each gait was calculated by subtracting  $mg\Delta t$  from the  $\mathbf{fti}$ .

## RESULTS

The Grand Prix horse showed significantly higher productive impulse at all the paces. This is

likely due to the increase in both lift and pushing power that occurs in an advanced level dressage horse.

## FIGURES

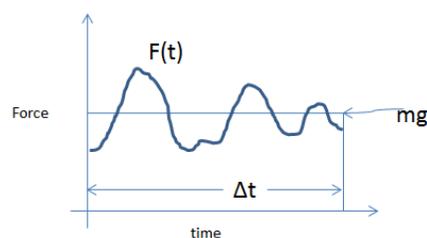


Figure 1: Productive impulse =  $\int F(t)dt - mg\Delta t$

Table 1: Productive impulse at each gait

Gait	Productive Impulse	Productive Impulse	Percent Difference
	$F_{ti} - mg\Delta t$ (Grand prix horse) (N*s)	$F_{ti} - mg\Delta t$ (Training Level Horse) (N*s)	Grand prix horse compared to training level horse.
walk	274.6	218.2	+ 20.5 %
trot	913	388.2	+ 57.5 %
canter	1273	761.4	+ 40.2 %

## REFERENCES

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