

GROUND REACTION FORCES IN PIGS DURING GAIT ON DRY AND GREASY FLOOR

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INTRODUCTION

Leg weakness, meaning clinical leg and claw disorders, joint diseases and locomotion disturbances, form a large welfare concern in modern pig production. Inappropriate flooring is a major contributor to these leg problems [1].

The dual purpose was to study the normal walk of slaughter pigs on solid (non-slatted) dry floor and to examine the effect of greasy floor condition on the gait.

METHODS

Kinetic data were collected from 12 healthy Danish crossbred slaughter pigs, with 6 pigs walking on dry and 6 on greasy concrete floor, respectively. Rape oil was used to make the floor greasy. Ground reaction forces were recorded at 1KHz from a force plate in the floor. Three to four trials were obtained for both right limbs. Vertical forces (Fz) were normalized to percentage body weight. For the stance phase vertical peak force (PeakFz), vertical mean force (MeanFz), horizontal craniocaudal peak (PeakFy) and minimum (MinFy) forces and stance phase duration were examined. Video recordings (50 Hz) were used to calculate walking speed.

Average vertical force curves were aligned according to a registering method [2]. Representatives of front and hind limb were chosen as templates. Then average of forces for each point of time was taken.

Results are reported as average (SD). Ratios are front/hind limb. Paired t-tests were used to compare limbs and unpaired t-tests to compare conditions. Level of significance was 5%.

RESULTS AND DISCUSSION

Average weight of the pigs was 75 (6) kg. Average walking speed was 0.86 (0.12) m/s on dry and 0.75 (0.11) m/s on greasy floor, with pigs tending to move faster ($P<0.07$) on dry floor. Figure 1 shows the vertical force exerted by front and hind limbs on dry floor. Kinetic parameters are reported in Table 1. Front limb MeanFz was significantly higher than hind MeanFz for both conditions, with a mean ratio of 1.2, that is the front limb carried more weight. Correspondingly, front limb PeakFz was significantly higher for both floor conditions meaning that the front received higher vertical peak forces

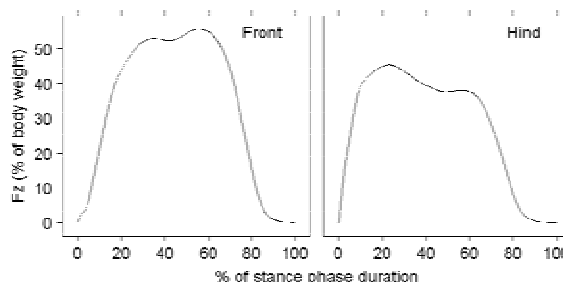


Figure 1: Average vertical ground reaction force of walking pigs during stance phase on dry floor (n=6). Left: front limb (24 trials), right: hind limb (23 trials).

than the hind (mean ratio 1.3). Front PeakFy in dry condition tended ($P<0.06$) to be higher than for the hind limb (ratio 1.1), whereas for greasy condition it tended ($P<0.07$) to be lower than the hind PeakFy (ratio 0.9). Front limb MinFy tended ($P<0.09$) to be lower than hind for dry condition (ratio 0.8). Comparing conditions, front limb PeakFy was significantly higher for dry than greasy condition, whereas hind limb PeakFy for greasy condition tended ($P<0.06$) to be higher than for dry. MinFy for the front limb tended ($P<0.1$) to be larger for greasy condition. Regarding stance phase duration, front limb stance phase lasted significantly longer than hind for both conditions. Stance phase duration of the hind limb was significantly longer than the front for greasy condition.

CONCLUSIONS

Pigs carry more weight on the front limb, and the front limb absorbs higher vertical peak force than the hind limb. Front limb peak horizontal force is higher on dry than on greasy floor. On dry floor horizontal peak force tends to be largest on the front limb and horizontal minimum force tends to be largest on the hind limb, however, on greasy floor the situation is reversed. Front limb stance phase lasts longer than hind for both dry and greasy floor. On greasy floor pigs have longer hind limb stance phases and tend to walk slower.

REFERENCES

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Table 1: Average (SD) stance phase parameters from pigs on dry and greasy floor. Percentages are force normalized to body weight. Significant differences ($P<0.05$) between a) front and hind limbs, b) floor conditions.

Condition	MeanFz (%)		PeakFz (%)		PeakFy (N)		MinFy (N)		Stance phase duration (ms)	
	Front	Hind	Front	Hind	Front	Hind	Front	Hind	Front	Hind
Dry	37.0 (2.7) ^a	31.7 (1.4)	57.2 (3.2) ^a	45.1 (2.7)	58 (8) ^b	51 (6)	-51 (14)	-63 (15)	665 (118) ^a	556 (41) ^b
Greasy	38.2 (1.5) ^a	32.3 (1.6)	57.7 (2.1) ^a	45.2 (2.7)	48 (9)	57 (5)	-59 (5)	-56 (12)	711 (79) ^a	635 (68)