Comparison of Joint Angles for Feet and Leg Conformation Traits between Gilts at Selection and at their Second Gestation and Sows Parity 5 and Above

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Summary and Implications

This study is a portion from the validation process of an objective methodology to measure feet and leg joint angles and to evaluate their relationship with sow longevity.

Joint angle measurements from five feet and leg conformation traits (knee, hock, front and rear pasterns and rear stance) that have been previously described in the literature as being related with sow longevity were obtained from maternal gilts at selection and during their second gestation and compared with those obtained from 45 crossbred sows parity 5 and above. Significant differences ($P < 0.05$) between parities were identified in the knee, both pasterns, hock and rear stance joint angle measurements. These results suggest that as pigs age, structural changes occur. The range of which these changes occur could carry implications for the use of objective feet and leg angles towards future selection programs and protocols.

Introduction

Several individual conformation traits, such as pasterns, knees and hock position, are associated with longevity and survivability in sows. In a previous study, joint angles for feet and leg conformation traits were measured in multiparous sows using digital imaging technology. Results indicated that objective feet and leg conformation trait measurements could be successfully implemented as alternatives to subjective methods for selection of replacement gilts as it is repeatable and provides an accurate representation of the joint. However, the joint angles from that study were measured in older parity sows (i.e. sows parity 5 and above). It has been suggested that sows that remain in the herd at older parities, may have undergone a selection process for good feet and leg conformation. Thus, joint angle measurements at time of selection are required to compare with measurements from higher parity sows as there is limited information in the scientific literature regarding possible changes on feet and leg conformation across parities. Understanding these changes will help further the validation process of the objective method for evaluation of feet and leg conformation traits and their relationship with increased longevity. The objective of this study was to compare feet and leg angle ranges of gilts at selection and second gestation to sows parity 5 and above. These results will be collectively used to validate the previous work done in the sow population.

Materials and Methods

Profile and rear stance digital images were obtained from maternal gilts at selection (n = 319 gilts; average age 21.6 ± 1.8 weeks; range 19 to 25 weeks) and during their second gestation (n = 277; average gestation 26.7 ± 17.2 days; range 0 to 87 days; hereafter referred to as sows). Additionally, images from 45 crossbred multiparous sows (6.7 ± 2.5 average parity; range 5 to 14; hereafter referred as sows parity 5^{+}) were also obtained. Joint angles for the knee, front and rear pastern, hock, and rear stance were measured using the angle feature in image analysis software ImageJ (ImageJ, National Institute of Health, Bethesda, MD). Data was analyzed using mixed model equation methods in SAS PROC MIXED (SAS Inst. Inc., Cary, NC). Side where images were taken (left or right legs) and parity were included in the model as fixed effects.

Results and Discussion

Joint angle measurements did not differ between sides where images were taken ($P > 0.05$) suggesting that joint angles were symmetric. Differences ($P < 0.05$) between parity were observed in all angle measurements (Table 1). Sows parity 5^{+} had smaller angles for the knee, front and rear pastern joints and the rear stance and a greater angle for the hock compared with sows at selection and during their second gestation ($P < 0.05$)

Results from this study suggest that joint angles change as parity progresses. Further investigation is still required to determine total biological implications as the changes identified are within the error range identified from our previous study. Similarly investigation for the angle changes within the same individual to the end of their growth cycle also needs to be conducted.

Table 1. *Differences in feet and leg conformation trait joint angles (LSMeans ± SE) between 319 gilts[1] and 45 multiparous crossbred sows*

	Knee		Front Pastern		Rear Pastern		Hock		Rear Stance	
Variable	LS Means	SE	LS Means	SE	LS Means	SE	LS Means	SE	LS Means	SE
Parity										
0	159.9[a]	0.2	56.5[a,b]	0.3	58.3[a]	0.3	140.0[a]	0.3	91.9[a]	0.4
1	159.0[b]	0.2	57.3[a]	0.3	54.1[b]	0.4	147.2[b]	0.3	86.6[b]	0.4
5+	156.1[c]	0.5	55.0[b]	0.9	52.3[b]	1.0	146.2[b]	0.8	88.6[c]	1.0

[1] *Joint angles* measured at time of selection and during their second gestation
[a,b,c] Within columns, significant differences between predictor variables; $P < 0.05$