



Bone of contention

At **TEAGASC**, researchers examined the effects of housing and diet on cartilage condition and bone mineral density in replacement gilts.

Lameness is a major cause of poor longevity and welfare in replacement gilts. The problem is exacerbated by inappropriate housing and diet during the rearing period, and thus in recent years, there has been growing interest in improving rearing practices (e.g., Quinn, *et al.*, 2015). Unlike other countries, in Ireland replacement gilts are often reared with finisher pigs, which are destined for slaughter. As male pigs are not castrated in Ireland, replacement gilts are exposed to high levels of potentially injurious sexual and aggressive behaviour that male pigs perform as they mature. This increases the risk of injuries to the limbs and cartilage damage. Furthermore, finisher pig diets are not designed to meet the needs of developing gilts, and may not supply the necessary minerals to support good limb health, especially cartilage and bone formation and integrity. The objective of this experiment was to evaluate the effect of supplementing a finisher diet with copper (Cu), zinc (Zn) and manganese (Mn), and of rearing in female-only groups, on the locomotory ability, bone mineral density and cartilage lesion scores of gilts up to breeding age.

Experimental set-up

At weaning, maternal line gilts were assigned to either female-only pens (FEM; n = 16 pens) or mixed-sex pens (MIX; n = 16 pens), with 12 animals per pen. All gilts had the same diet, appropriate to their age, until 117.5 ± 0.6 days of age. At this point, half of each treatment remained on a standard finisher diet (CONTROL) and the other half (SUPP) received supplementary minerals (Cu, Zn and Mn). Pigs were locomotion scored (0 = perfect, to 5 = unable to move) every two weeks from 81.3 days until 165.8 days (breeding age). A sub-sample (n = 102; ≈ 25 /treatment combination) were culled at breeding age and the front right limb was removed for analysis. Areal bone mineral density (aBMD) of the humerus, radius/ulna, and metatarsal bones was measured using

dual energy x-ray absorptiometry. The elbow joint was then dissected to examine and score the condition of the cartilage. The humeral condyle (HC) (**Figure 1**) and the trochlear notch (TN) surface were exposed, cartilage lesions were categorised by type (**Figure 2a**) and then counted. In addition, the incidence of separation of the cartilage from the underlying bone (i.e., osteochondrosis dissecans (OCD; **Figure 2b**) was also counted (**Table 1**).

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Results

There was no effect of either treatment on locomotory ability. In general locomotion, scores were extremely good, with only 18 pigs scoring two or more.

Bone mineral density

SUPP gilts had greater aBMD in the humerus than CONTROL gilts, and tended to have a greater aBMD in the radius/ulna. There was also an interaction between group composition and diet for the humerus. Within the SUPP treatment, FEM gilts had greater aBMD than those in the MIX groups (**Figure 2a**). The FEM-SUPP gilts also had greater aBMD than

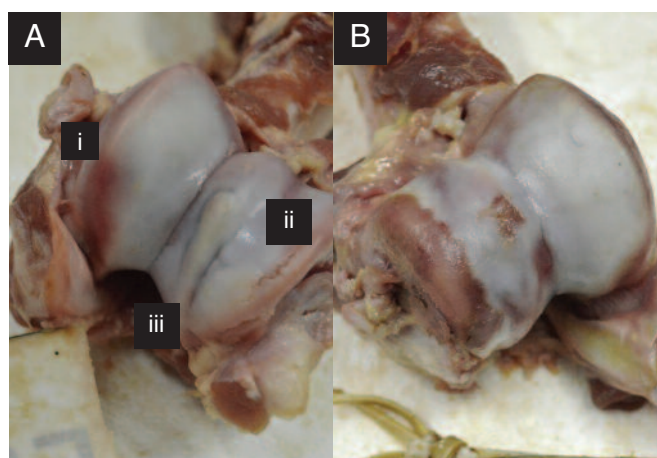


FIGURE 1: Exposed surface of the humeral condyle. Lesions that were scored included: (A) (i) thinning of cartilage, as evidenced by red bruise-like area; (ii) invagination of the cartilage; and, (iii) overgrowth; and (B) osteochondrosis lesions (separation of cartilage from the underlying bone).

FEM-CONTROL gilts. There was no effect of either diet or group composition on aBMD of the metacarpal.

Cartilage lesion scores

Gilts reared in MIX groups had more cartilage lesions (sum of thinnings, invaginations and overgrowths) than those in FEM groups (7.49 ± 0.3 vs 6.38 ± 0.32 , respectively). When considering only the humeral condyle, where most lesions occurred, MIX gilts also had higher total scores (MIX 6.35 ± 0.31 vs 5.29 ± 0.28 , respectively), and these gilts tended to have more areas of thinned cartilage. With regard to mineral supplementation, SUPP gilts tended to have fewer lesions than those in the CONTROL groups (6.49 ± 0.34 vs 7.38 ± 0.34 , respectively). Fractures of the humeral condyle occurred in five gilts (4.9 % of all examined gilts), of which four were gilts reared in MIX groups. There was no effect of group composition on the number of OCD lesions. Gilts on the SUPP diet, however, tended to have a lower number of OCD lesions than those on the CONTROL diet. All gilts with more than one OCD lesion were on the CONTROL diet.

Table 1: The number of gilts reared on a standard finisher diet (CONTROL) or on a standard finisher diet supplemented with minerals (SUPP), and penned in either mixed-sex (MIX) or female-only (FEM) groups, affected by one, two or three osteochondrosis dissecans lesions in the elbow joint.

No lesions present	Diet		Group composition	
	CONTROL	SUPP	MIX ¹	FEM
1	10	11	10	11
2	3	0	1	2
3	3	0	3	0
Total no. gilts with OCD	16	11	14	13

¹ Six males and six females per group.

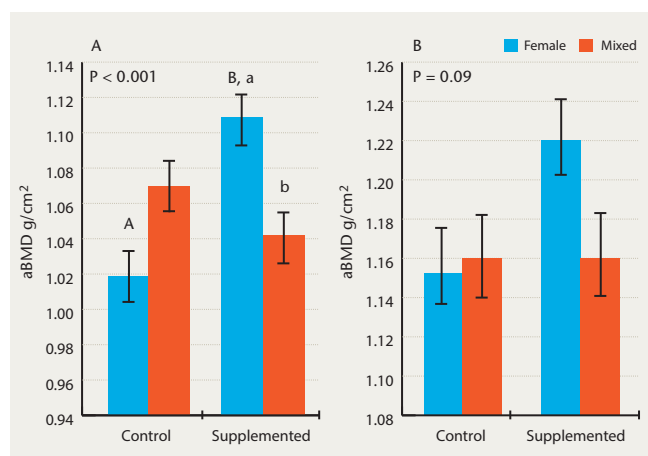


FIGURE 2: aBMD values for: (A) humerus; and, (B) radius/ulna. P-values represent the interaction effect between group composition and diet. Lower-case letters (a, b) indicate a difference of $P < 0.01$ between group composition within dietary treatment, whereas upper-case superscripts indicate a difference of $P < 0.001$ between dietary treatment within group composition.

Conclusions:

- the addition of trace minerals to the diet resulted in increased bone mineral density when compared to a standard finisher diet;
- rearing gilts in female-only groups reduced the number of cartilage lesions; and,
- differences in levels of cartilage damage did not translate to differences in locomotion score; thus, alternatives to locomotion scoring to aid identification of gilts at risk of lameness are needed.

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