



EFFECT OF MATERNAL RESTRICTED DIET DURING LATE GESTATION ON MUSCLE AND BONE DEVELOPMENT IN SHEEP OFFSPRING

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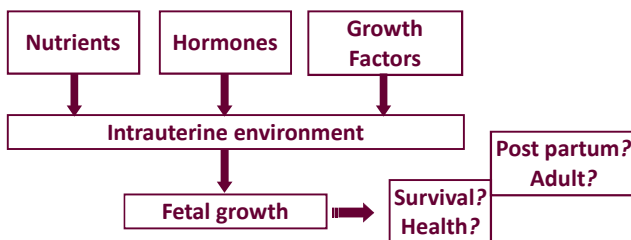
OBJECTIVE

Evaluate the effect of maternal under-nutrition during gestation on fetal hind-limb muscle and bone development in sheep.

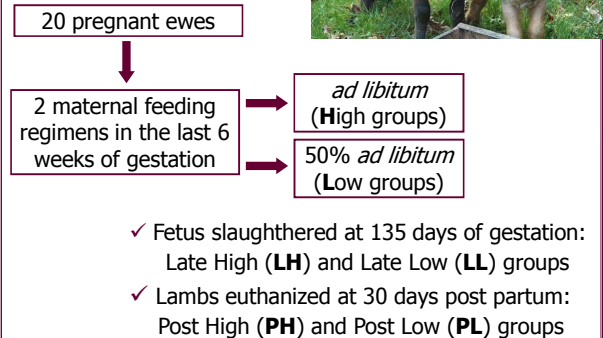


INTRODUCTION

The intrauterine environment has been associated with fetal programming, which contributes to different phenotypes which may determine health and susceptibility to disease throughout life. These changes seem to be mediated through alterations in both anabolic and catabolic hormone levels. The present study determines the impact of under-nutrition on musculoskeletal growth to give insight into the endocrine axis most likely causing the effect.



EXPERIMENTAL DESIGN



RESULTS

Taking in consideration the close physical and functional association of muscle and bone and the influence of maternal nutrition on the musculoskeletal system was assessed by Spearman analysis.

	MuW	DMu	BoW	DBo	MuDM	BoDM	TL	TBMD	TAC	FL	FBMD
BW	LL r = 0.943 P = 0.005	*	LL r = 0.943 P = 0.005	LL r = 0.829 P = 0.042	*	*	PH r = 0.900 P = 0.037	LL r = 0.829 P = 0.042	PH r = 0.900 P = 0.037	LL r = 0.941 P = 0.005	*
CR	*	*	*	*	*	LL r = 0.975 P = 0.005	*	*	LL r = 0.975 P = 0.005	*	*
MuW	LL r = 0.829 P = 0.042 PH r = 1.000 P = 0.000		LL r = 0.829 P = 0.042	*	*	LH r = -0.886 P = 0.019	*	LL r = 0.943 P = 0.005	*	LL r = 0.941 P = 0.005	*
DMu			LL and LH r = 0.829 P = 0.042	LL r = 0.943 P = 0.005	*	*	*	LL r = 0.943 P = 0.005	*	LL r = 0.941 P = 0.005 LH r = 0.820 P = 0.046 PH r = 1.000 P = 0.000	LL r = 0.829 P = 0.042 LH r = -0.886 P = 0.019
BoW				LL and LH r = 0.943 P = 0.005	*	PL r = -0.900 P = 0.037	PH r = 0.900 P = 0.037	PH r = 0.900 P = 0.037	*	LL and LH r = 0.941 P = 0.005 PH r = 0.900 P = 0.037	LH r = -0.886 P = 0.019 PL r = 0.900 P = 0.037 PH r = 0.900 P = 0.037

Variables: BW – Birth weight, Kg; CR – Crown rump, cm; MuW – Muscle weight, g; DMu – Dry muscle, g; BoW – Bone weight, g; DBo – Dry bone, g; MuDM – Muscle dry matter, %; BoDM – Bone dry matter, %; TL – Tibia length, mm; TBMD – Tibia bone mineral density, g/cm²; TAC – Tibia ash content, %; FL – Femur length, mm; FBMD – Femur bone mineral density, g/cm²; Asterisks mean that no correlation was found.

Experimental groups: LL – Late low; LH – Late high; PL – Post low; PH – Post high
Asterisks mean that no correlation was found

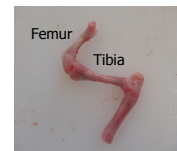
- ✓ Nutrient restriction during pregnancy did not significantly affect the axial growth of lambs
- ✓ Birth weight of fetuses of the LL group was the most affected, influenced equally by muscle and bone weight
- ✓ Crown rump measurement was positively correlated with bone dry matter and tibia ash content indicating that when nutrients are limiting, a trade-off occurs between satisfying bone biomechanical parameters and accumulating minerals and bone growth
- ✓ In the LH lambs there was a significant negative correlation between bone weight and femur mineral density that suggests *in utero* bones grow in length yet accumulate limited quantities of minerals
- ✓ Irrespective of maternal nutrient supply *in utero*, dry muscle is correlated to bone development. In contrast, *post partum* growth of muscle and skeleton are less tightly coupled and unaffected by the events *in utero* if an adequate post-partum diet is provided

RECORDED PARAMETERS

- ✓ Weight
- ✓ Crown rump length
- ✓ Bone and muscle weight



Hind-limb



Hind-limb bones analysed: femur and tibia

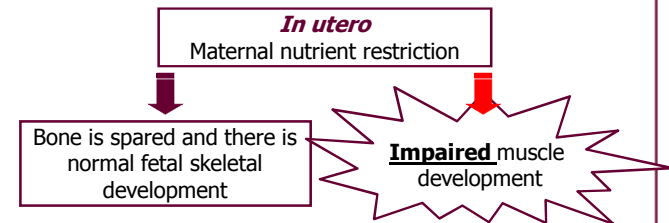
ANALYSIS

- ✓ Bone and muscle dry weight
- ✓ Bone ash content
- ✓ Bone Calcium and Phosphorus content
- ✓ Femur and tibia length
- ✓ Tibia thickness
- ✓ Bone densitometry: Bone mineral density (BMD)

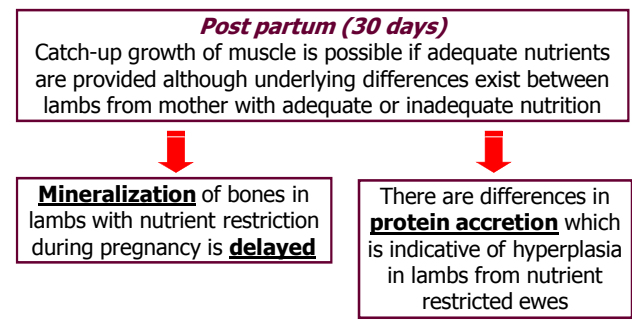
STATISTICAL ANALYSIS

- ✓ Spearman correlations were determined for all parameters studied

CONCLUSION



Hypothesis: The skeleton is essential to support lamb post birth. Modified endocrine system may be linked with skeletal development. Candidates – GH? IGF? PTHrP?



Acknowledgments

This work was funded by the Pluriannual funding to CCMAR from the Portuguese Science and Technology Foundation (FCT). The authors would like to thank A. Ribeiro for helping with the BMD determinations.