



Deformation of forelimbs in growing milk sheep



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Signalment

- 2 Sheep, Ear Tag Nr. 1807 8556 and 1794 1350
- Breed: Lacaune (used for milk production)
- Age: 6 months and 6 days old at presentation (*12.08.15)
- Sex: Females





Medical history / Background

- Same pen as lactating sheep
- Same total mixed ratio (TMR) as lactating sheep
- Grew very well and very fast, very active lambs
- Several lambs presented with valgus formation in forelimbs, roughly 3 months after birth → deterioration over time
- Previous year: Same ramb and ewes used, lambs were fed the same ratio as dried off, non-pregnant sheep and grew much slower → No problems





Clinical examination

- Bright, alert, responsive (BAR)
- BCS: good (4/5)
- Both front limbs valgus formation
- Carpal joints seem to be the most affected
- Claws also deformed
- No swelling or pain detectable
- Rest of clinical exam within normal range



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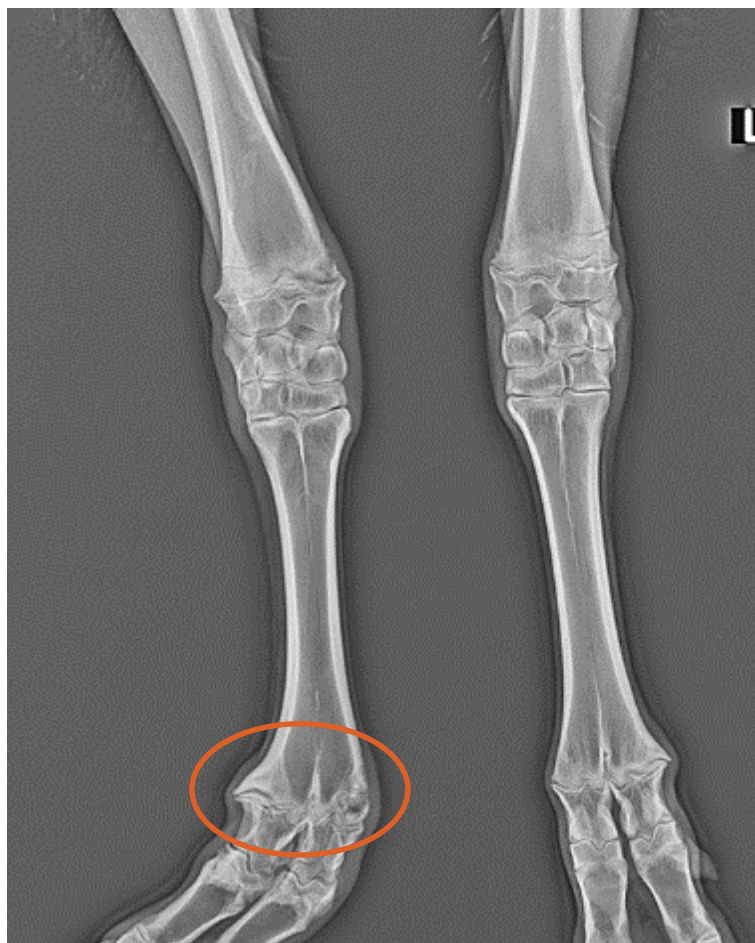
Radiograph



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Radiograph



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Differentials - DAMN-IT

D	Degenerative	Unlikely, sheep very young
A	Anomalous Hereditary	Unlikely, as a lot of sheep are affected Possible, but same ram and ewe used the last time and no problems were recorded
M	Metabolic	Unlikely, as a lot of sheep are affected and clinical examination was normal
N	Neoplastic (Paraneoplastic)	Unlikely, sheep very young
	Nutritional	Energy Minerals: Calcium / Phosphorus Vitamin D
I	Inflammatory	Unlikely, as a lot of sheep are affected
	Infectious	No clinical signs for primary infectious cause and lactating sheep in the same pen not affected
T	Traumatic	Possible, but a lot of sheep affected and no trauma recorded in the history
	Toxic	Unlikely, since lactating animals in the same pen were not affected and clinical examination was normal
V	Vascular	Unlikely, as a lot of sheep are affected





Ration – Estimation of feed intake

	Ration/day/group [kg]	Estimated intake/lamb [g]
Water	150	625.0
Hay ¹	60	250.0
2. cut hay ¹	120	500.0
Gras pellets ²	50	208.3
Concentrates ³	20	83.3
Mineral Supplement ⁴	0.825	3.4
Salt ²	0.275	1.1

¹ Hay and 2nd cut hay analysis from 2015 or 2014

² Agroscope, 2015. Feeding recommendations for ruminants (green book) [Fütterungsempfehlungen für Wiederkäuer (Grünes Buch)]

Access:

<http://www.agroscope.admin.ch/futtermitteldatenbank/04834/index.html?lang=de>. (Consultation Date 31.08.2016)

³ 88.922 Organic concentrate [Biogetreidewürfel], Mill Jakob Wicki

⁴ KM 4223, Organic compliant mineral feed [Biokonformes Mineralfutter]

Estimation of intake:

60 animals in group: 15 lambs ($\approx 15\text{kg}$) and 45 ewes ($\approx 75\text{ kg}$)

Calculated estimated intake per kg body weight

Example: $60000\text{ g hay per day} / 3600\text{ kg (total weight of group)} = 16.7\text{ g/kg sheep}$

Lamb $15\text{ kg} = 16.7 \times 15 = 250\text{ g hay per lamb per day}$





Ration calculation

	Intake [g]	Dry matter [g]	NEV [MJ]	APD [g]	Ca [g]	P [g]	Mg [g]	Na [g]	Vitamin D [I.E]
Hay ¹	250.0	218.0	1.2	17.9	1.2	0.6	0.5	0.1	
2. cut hay ¹	500.0	443.5	2.6	42.1	2.5	1.2	0.9	0.1	
Gras pellets ²	208.3	183.3	1.1	19.1	1.0	0.8	0.3	0.0	
Concentrates ³	83.3	73.3	0.6	7.9	0.0	0.0	0.0	0.0	
Mineral Supplement ⁴	3.4	3.4	0.0	0.0	0.5	0.3	0.2	0.1	45.8
Salt ²	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.4	
Total per day	1046.3	922.7	5.5	87.1	5.2	2.9	1.9	0.7	45.8
Requirements 1 (Agroscope) ² 15 kg (daily gain 200g)		600	4.8	75	5.5	2.5	0.5	0.5	90
Requirements 2 (NRC) ⁵ 20 kg (daily gain 200g)		820	3.8	86	3.4	2.7	0.8	0.5	none mentioned
Percentage TMR / Requirements 1 (Agroscope) ²		154	114	116	95	116	382	138	51
Percentage TMR / Requirements 2 (NRC) ⁵		113	144	101	153	107	239	138	

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² Agroscope, 2015. Feeding recommendations for ruminants (green book) [Fütterungsempfehlungen für Wiederkäuer (Grünes Buch)]
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⁵ National Research Council. Nutrient Requirements of Small Ruminants: Sheep, Goats, Cervids, and New World Camelids. Washington, DC: The National Academies Press, 2007.





Ration calculation– Conclusions and problems

Conclusions:

1. Energy intake too high → rapid growth
2. Calcium intake too low → bone strength ↓
3. Vitamin D intake too low → active calcium uptake ↓

Problems:

1. Feed intake based on estimations
2. Content of feedstuff from tables or old measured data





Influence of energy intake on bones

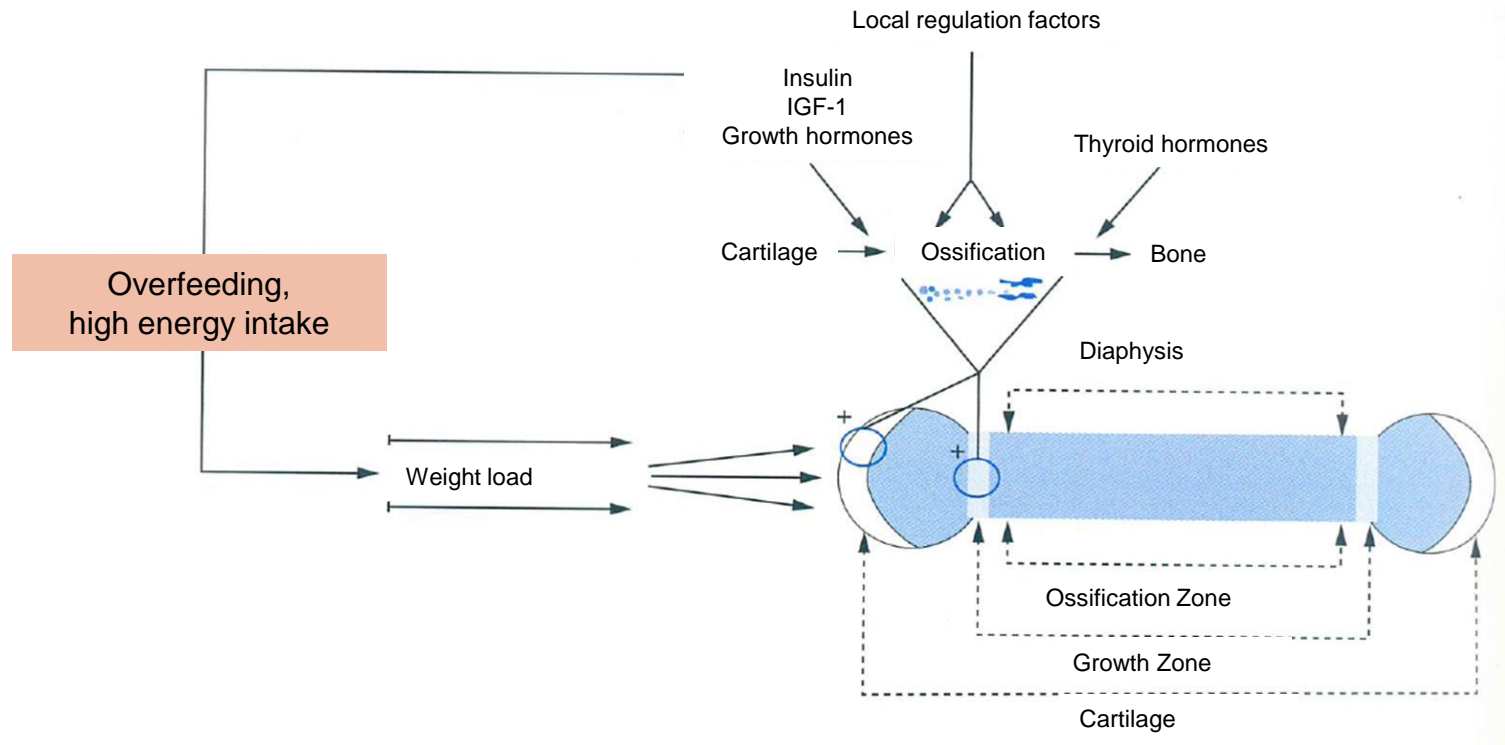


Figure from Zentek (2013)



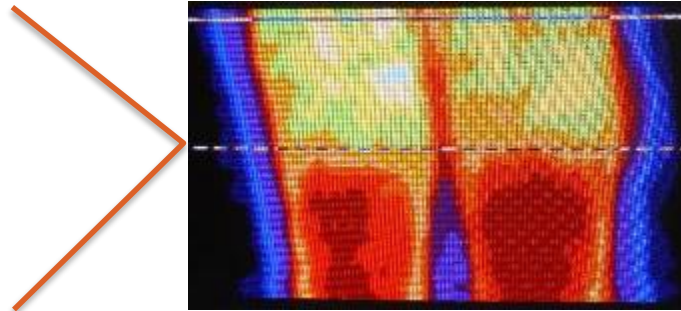
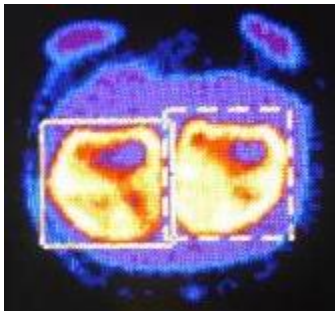
pQCT (peripheral Quantitative Computed Tomography)

Sheep 1807 8556

Right limb, distal metatarsus

Measurements were taken

1. middle of the diaphysis (50%)
2. epiphysis (90%)



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Results pQCT

			1807 8556	1794 1350	Reference Values ¹
Hind Left	Distal	Total bone mineral density (BMD)	461	444	566
		Trabecular density	286	348	516
	Middle	BMD	834	770	566
		Cortical density	1049	1025	966
Hind Right	Distal	BMD	403	370	566
		Trabecular density	310	152	516
	Middle	BMD	807	784	566
		Cortical density	1048	1008	966

Results:

Distal: BMD ↓ and trabecular density ↓

Middle: BMD ↑ and cortical density ≈

¹ Kovács, Sandra, M. R. Wilkens, and A. Liesegang. "Influence of UVB exposure on the vitamin D status and calcium homoeostasis of growing sheep and goats." *Journal of animal physiology and animal nutrition* 99.S1 (2015): 1-12.





Conclusion

Energy intake too high → rapid growth → compression on growth plate → distal BMD ↓ and trabecular density ↓ and normal to high BMD in diaphysis

Together with

- Calcium intake too low → bone strength ↓
- Vitamin D intake too low → active calcium uptake ↓





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Questions?



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References

Agroscope, 2015. Feeding recommendations for ruminants (green book) [Fütterungsempfehlungen für Wiederkäuer (Grünes Buch)]. Access: <http://www.agroscope.admin.ch/futtermitteldatenbank/04834/index.html?lang=de>. (Consultation Date 31.08.2016)

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