

Physiological effects of concentrate feeding

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The where and how of the concentrate effects



- General body
- The rumen
- The body fat
- The skeleton
- The kidney
- The reproductive system



Some general effects of growth rate on lambs at the same weight



Faster growth results in:

- Fatter carcasses and more intramuscular fat (marbling)
- Smaller muscles
- Lower ossification scores
- Lower muscle compression and more tender connective tissue

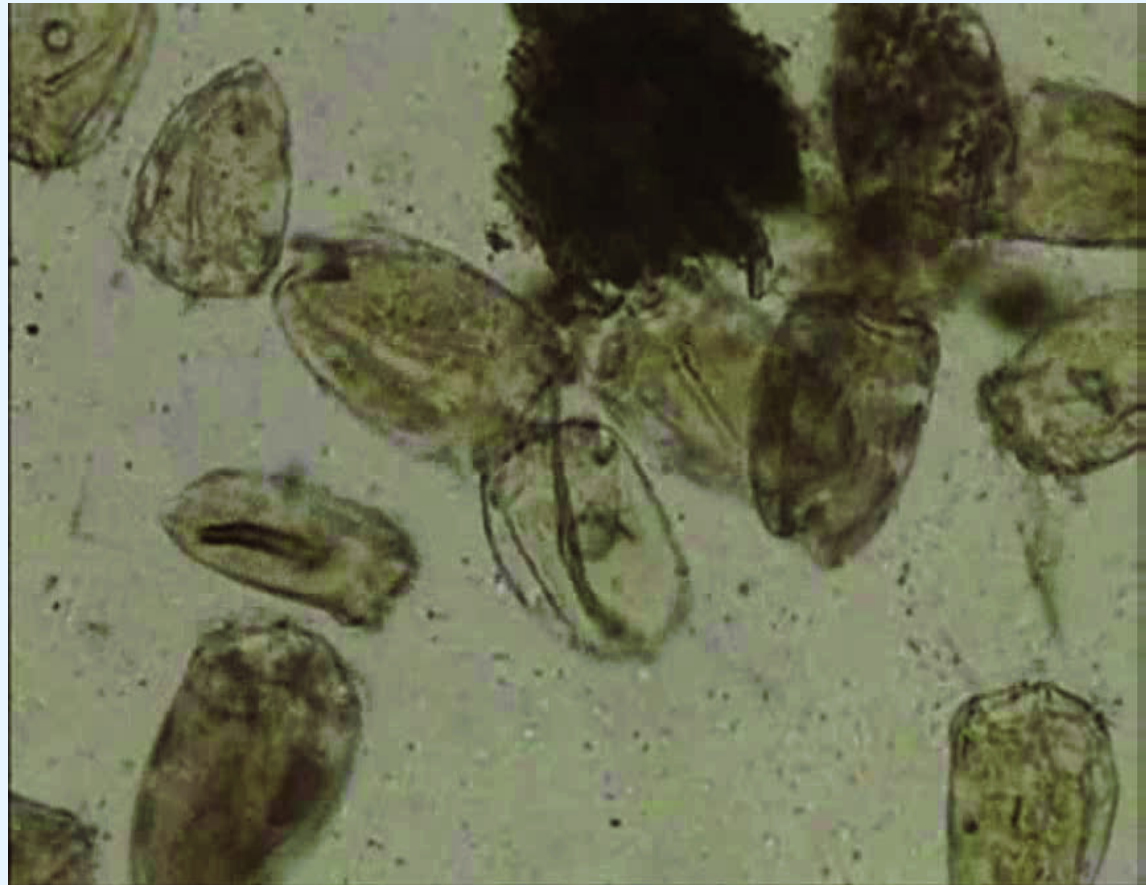
Oddy and Sainz (2002)

The rumen microbes at work



Influenced by the nature of the diet

Good nutrition and feeding practice involves optimising the environment for the rumen micro-organisms



Effects of concentrate feeding on the rumen



- Fall in rumen pH
- Inhibition of the rumen micro-organisms that breakdown plant fibre
- Increase in propionic acid and decrease in acetic
- Overload of the liver with propionate
- Accumulation of methylmalonic acid leading to the formation of branched-chain fatty acids and soft oily carcass fat

Effect of diet type on rumen fermentation

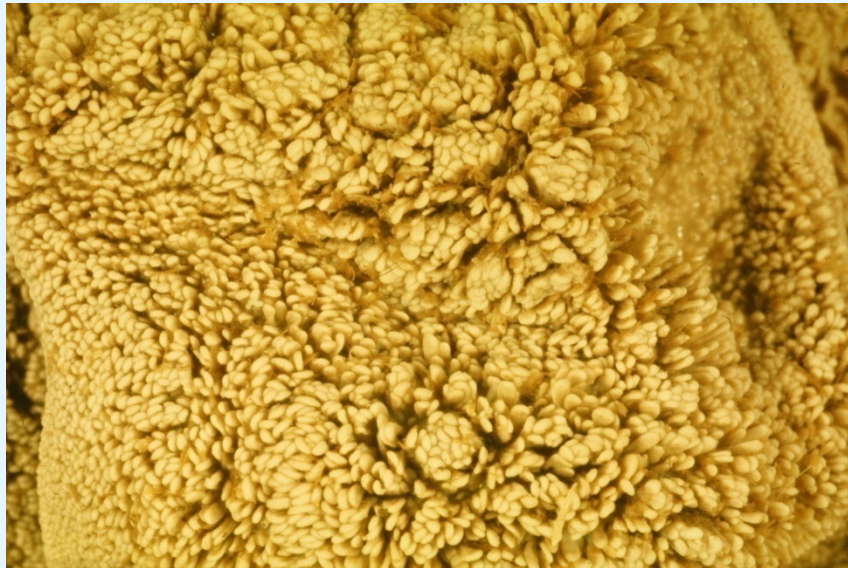


	Molar proportions	
	Acetic	Propionic
Young ryegrass	0.60	0.24
Milled barley concentrate	0.45	0.45
Whole barley concentrate	0.53	0.30
80:20, hay:concentrate mix	0.61	0.25
20:80, hay:concentrate mix	0.40	0.40

Rumen parakeratosis



Inside of rumen wall



- Clumping together of the rumen papillae
- Bacteria enter blood stream
- Liver abscesses
- Sudden death

Effect of growth rate on mineral content of body and development of skeleton



Growth rate (g/day)	230	160	120
Calcium (g/kg EBG)	4.92	5.78	6.28
Phosphorus (g/kg EBG)	3.08	3.83	4.35

Wan Zahari *et.al.*, (1990)

Effect of diet (grass v concentrates) on mineral content of body

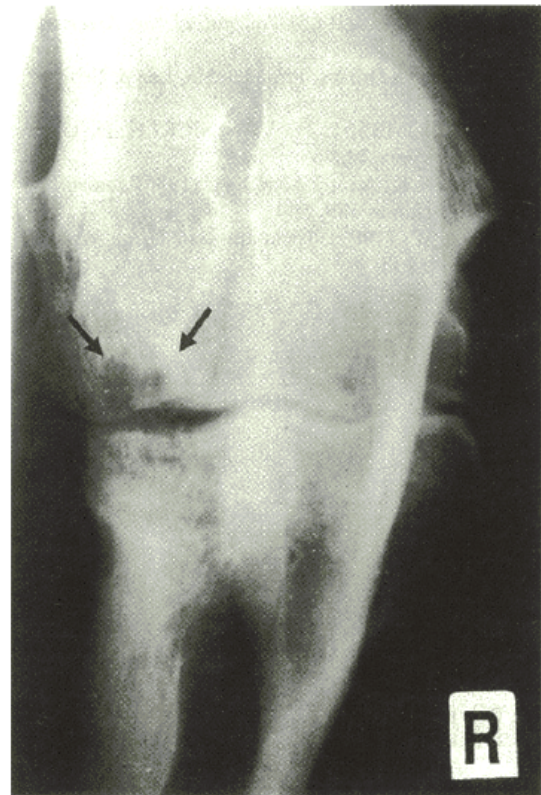


Composition of Empty-body Weight Gain (g/kg)

	<u>Grass (Outdoors)</u>	<u>Grass (Indoors)</u>	<u>Concentrate (Indoors)</u>
Calcium	9.6	9.4	5.6
Phosphorus	5.2	4.5	3.8

Wan Zahari *et.al.*, (1989)

Dyschondroplasia / osteochondrosis



(R) Caudocranial study of the right elbow showing a radiolucent defect (arrowed) within the subchondral bone on the distomedial aspect of the medical humeral condyle.

(L) Caudocranial study of the normal left elbow

Doherty et al. (1996)

Effect of diet-induced shifts in blood acid- base status on mineral deposition in growing lambs



	1% NH ₄ Cl	2%NaHCO ₃
Urine pH	6.02	8.29
Calcium Retained (g/day)	1.45	2.34
Phosphorus retained (g/day)	1.14	1.63

Abu Damir *et.al.*,(1991)

High magnesium in concentrate diets – a pre-disposing factor in urinary calculi



Magnesium (% in DM) of some feed ingredients:

Barley, wheat, maize, dried citrus pulp 0.10-0.13

Fish meal 0.20

Soya bean meal 0.31

Rapeseed meal 0.56

Dried molassed beet pulp 0.30

Molasses 0.47

Middlings 0.39

Rice bran 0.73

Maize gluten 0.38

Dried brewers grains 0.18

Dark distillers grains 0.30

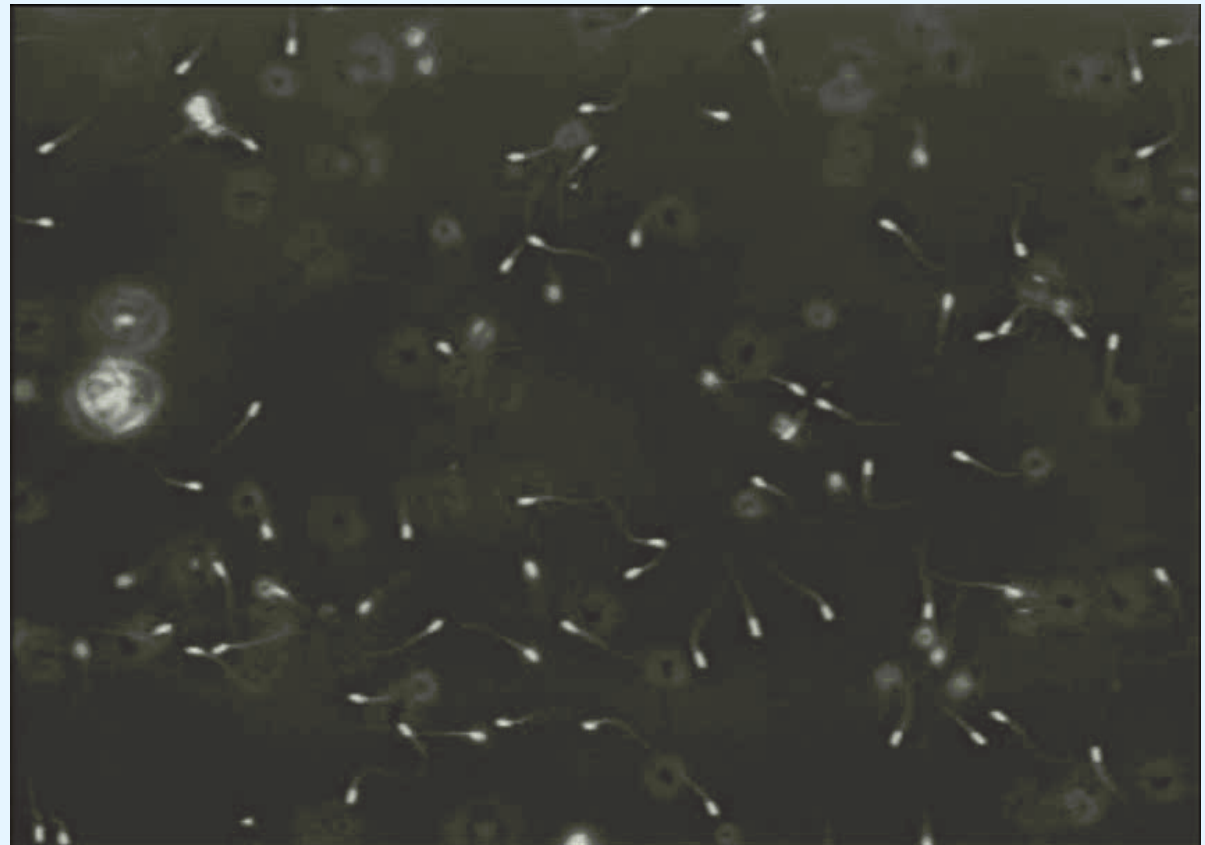
Sperm quantity and quality



Concentration
and motility

% alive and
normal

Forward
movement



Effects of feeding regimen on scrotal and semen characteristics



	<u>Extensive</u>	<u>Intensive</u>	
Scrotal fat (g)	45	109	**
Semen volume (ml)	1.1	1.1	
Motility index	3.3	2.3	**
Linear progression	2.6	1.6	*
Semen concentration (x 10 ⁶ / ml)	1170	732	**
% normal sperm	88	83	**

Fourie et.al.(2004)

How high concentrate feeding reduces sperm quality



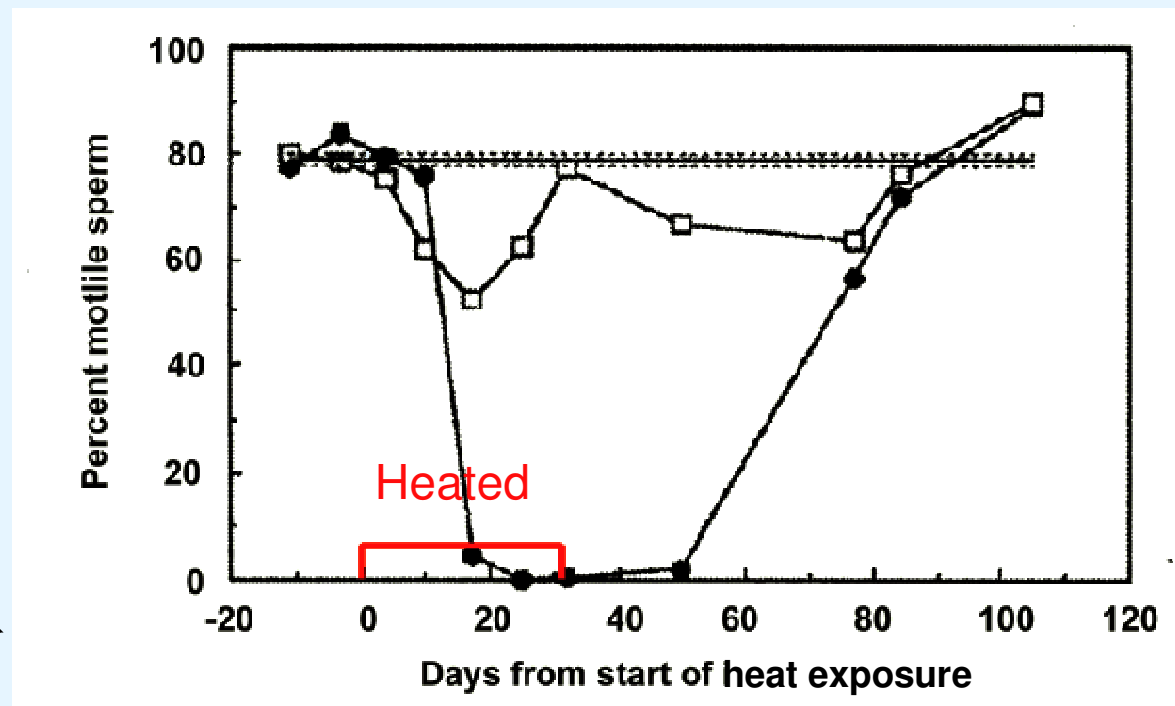
- Increases body heat production
- Increases the lying time of the ram and therefore the duration of time that the testicles are trapped in an overly- hot micro-environment
- If brought indoors, for concentrate feeding and for shade, bedding can become contaminated with spilled feed which, in turn, provides a rich source of fuel for increasing the temperature of the bedding around the trough area where rams tend to lie

Effects of increase in scrotal temperature



- Testosterone ↓
- Abnormal sperm ↑
- Motility ↓
- Post-freezing survival ↓
- Embryo mortality ↑

Setchell (1998)



Arman et.al.,(2006)

Why concentrate feeding was deemed necessary



Falling growth rates with age due to:

- Seasonal decline in grass quality
- Seasonal decline in the efficiency of utilization for lamb growth of the metabolizable energy (ME) in grass

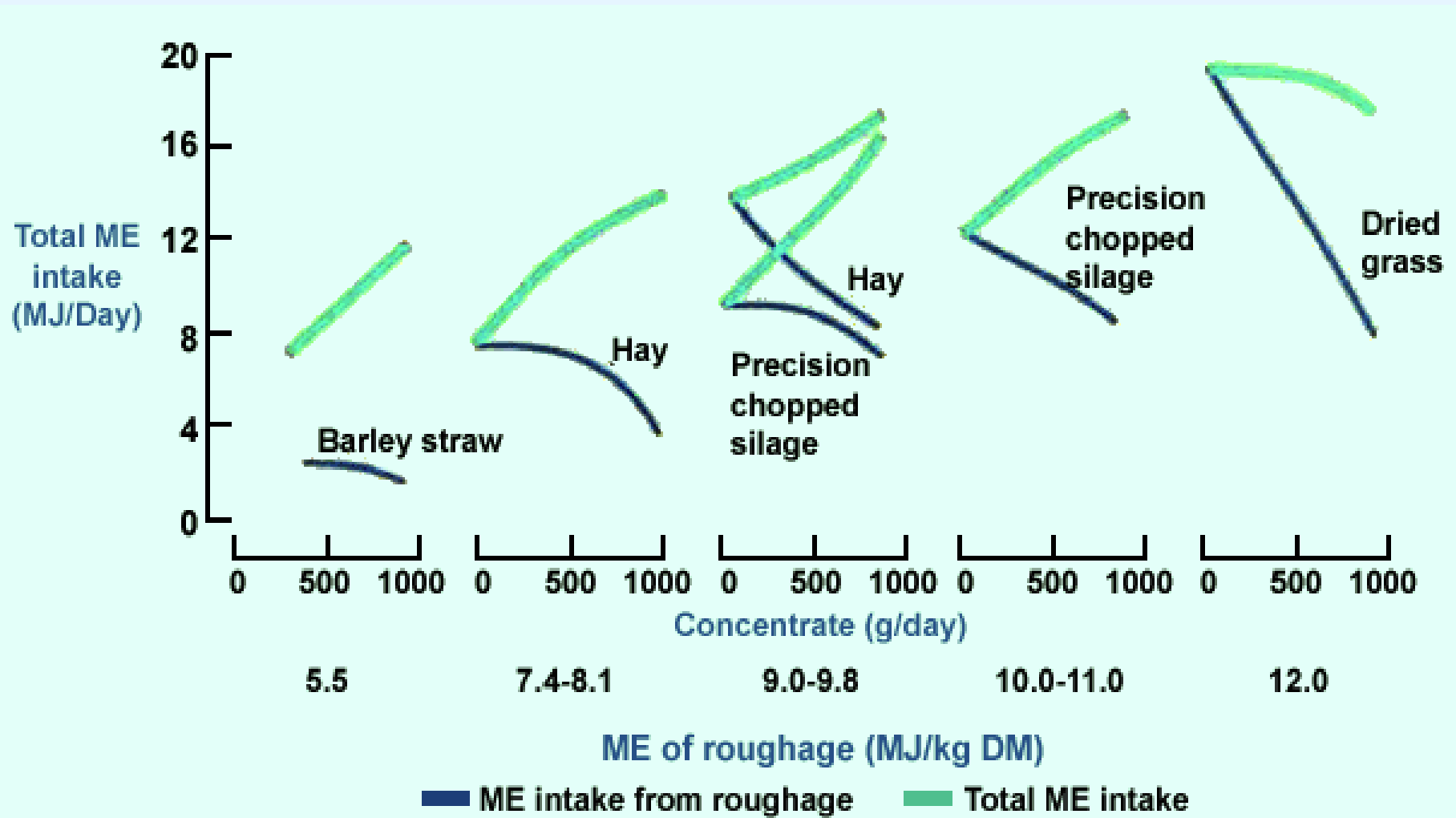
Efficiency of utilization of the ME in grass



Metabolizability of gross energy

	0.4	0.5	0.6	0.7
1 st Growth	0.21	0.34	0.47	0.61
Aftermath	0.16	0.27	0.38	-

Effect on total energy intake of supplementing forage with concentrates



Specific dietary nutrients in concentrates that can improve sperm quality



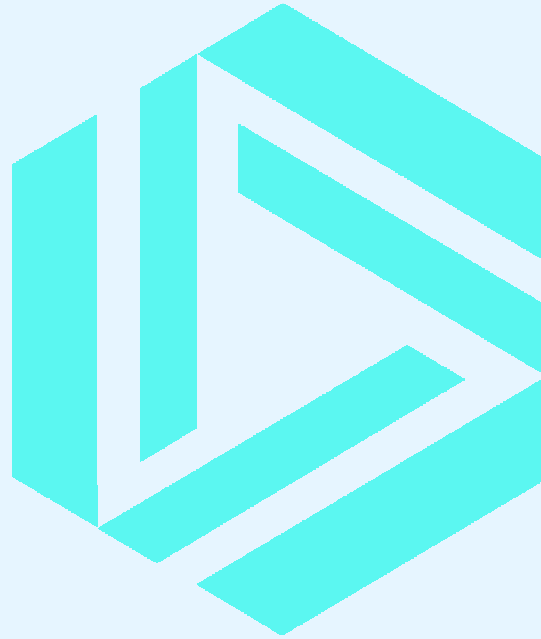
- Supra-nutritional supplementary trace minerals (Zn, Co, and Se) improved sperm motility, % live sperm and sperm membrane integrity in ram lambs (Kendall *et.al.*,2000)
- Beneficial effect of Se (50mg as barium selenate by s.c. injection) on sperm motility and viability; beneficial effect more pronounced following freezing and thawing (Anderson *et.al.*,1996)

Polyunsaturated fatty acids



- Important in sperm membrane integrity, sperm viability and motility
- Have been shown to have a beneficial effect on sperm production and survival following freezing and thawing in roosters, boars and stallions and, if protected from bio-hydrogenation in the rumen, in rams.
- Their beneficial effect is dependent on increasing the inclusion rates of antioxidants, in particular Vitamin E, in the diet.

Spring grass is a rich source of polyunsaturated fatty acids



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