Nutritional problems in beef meat production A comparison of Europe and South America

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Production

Beef and Veal Production - Selected Countries Summary
1,000 Metric Tons (Carcass Weight Equivalent)

	2014	2015	2016	2017	2018 Oct	2018 Apr
Production						
Brazil	9,723	9,425	9,284	9,550	9,700	9,900
European Union	7,443	7,684	7,880	7,900	7,900	7,855
China	6,890	6,700	7,000	7,260	7,110	7,325
India	4,100	4,100	4,200	4,250	4,300	4,300
Argentina	2,700	2,720	2,650	2,830	2,900	2,915
Australia	2,595	2,547	2,125	2,149	2,250	2,280

Cattle Stocks - Selected Countries Summary
(in 1,000 head)

	2014	2015	2016	2017	2018 Oct	2018 Apr
Total Cattle Beg. Stks						
India	300,600	301,100	302,600	303,600	305,000	305,000
[redacted]						
China	103,000	100,450	100,275	99,173	98,100	96,850
European Union	87,619	88,406	89,152	89,152	89,030	88,445
Argentina	51,545	51,545	52,565	53,515	54,215	53,765
Australia	29,291	29,102	27,413	24,971	25,500	25,500
Russia	19,564	19,152	18,879	18,638	18,380	18,380
Mexico	17,760	17,120	16,615	16,490	16,585	16,584
Turkey	14,533	14,345	14,128	14,222	14,550	14,500
Uruguay	11,903	12,053	12,016	11,864	11,804	11,754
Others	76,103	44,185	43,746	43,967	44,153	44,314
Total Foreign	919,877	890,493	896,569	901,637	909,667	907,442
United States	88,526	89,143	91,918	93,705	94,400	94,399
Total	1,008,403	979,636	988,487	995,342	1,004,067	1,001,841

(USDA, 2018)

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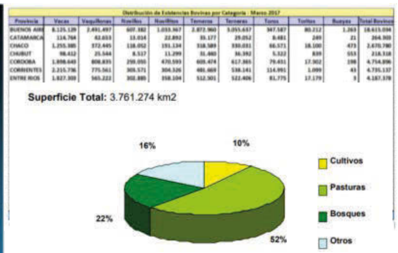
Argentinian cattle existences



(INTA, 2007; SENASA, 2017)

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Breeds

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Feed intake

Physiological factors: Sex
Body fat (21.3 to 31.5%)
Age
State

Enviromental factors: Temperature and adaptation
Wind, precipitation, mud
Seasonal

Management and dietary factors: Quantity forage
Growth promoting implants
Ionophores (monensin, lasalocid)
Nutrient deficiency (protein)
Grinding grain (small particle size)

NRC, 1998

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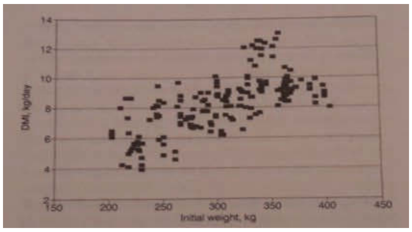
Relationship between initial BW and DMI for growing and finishing cattle



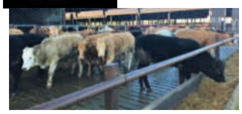
NRC, 1998

Production systems

Different systems of beef production

- Intensive (Argentina aprox 20%)
- Semi-intensive
- Extensive (pastures)

} Cost/opportunity



(Costa CEDIVE unpublished)

	Traditional extensive	Semi-intensive	Semi-intensive early weaning	Intensive
Weaning	6 months 150-180kg	6 months 150-180kg	4 months 120-140kg	Weaning at birth
Growing	Pasture	Pasture approx. 8 months	Pasture-feedlot	Milk + Starter Concentrate
BW enter Finishing	150 kg Pasture	250 kg feedlot	250 kg feedlot	Feedlot
Final BW	300- >450kg Pasture	300->450 kg feedlot (5-7 months)	300->450 kg feedlot (5-7 months)	300->450 kg Feedlot
Total time approx.	4-5 years	2 years 300kg	2 years 300kg	1.5-2 years 300 – 450kg

(Kismetal)

Creep feeding

Production systems

- **Ruminant industry** ⇒ feed costs can contribute up to 70% of total production costs

⇒ Prevention of diseases and improvements in longevity linked to animal welfare

⇒ Study oxidant/antioxidant balance pathways to development of metabolic disorders and impacts on immune function

(Bach, 2012; Loor et al., 2013; Celi and Gabai, 2015; McGrath et al., 2018).

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Improperly fed

- Symptoms
  - Changes in body weight
    - Low
    - Thin appearance
  - Hair coat
    - Dull and rough
  - Activity
    - Weak and depressed

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Patologies

Produced or influenced by nutritional factors as well as management or production systems.

Gastrointestinal problems

Metabolic diseasses

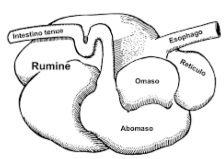

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Table 2: Deaths occurred in Adaptive and fattening periods grouped according to causative origin in a feedlot from La Plata (Argentine) during 1999.

Origen causal	Adaptación[1]		Terminación[2]		Población Total	
	N°	%	N°	%	N°	%
Tóxicas[a]	36	37,11	-	0,00	36	27,91
Digestivas[b]	13	13,40	22	68,75	35	27,13
Respiratorias[c]	29	29,90	-	0,00	29	22,48
Accidentales[d]	17	17,53	1	3,13	18	13,95
Sin diagnóstico[e]	1	1,03	5	15,63	6	4,65
Otras[f]	1	1,03	4	12,50	5	3,88
Total	*97*	*100,00*	*32*	*100,00*	*129*	*100,00*

(Costa et al;, 2003)

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Acidosis

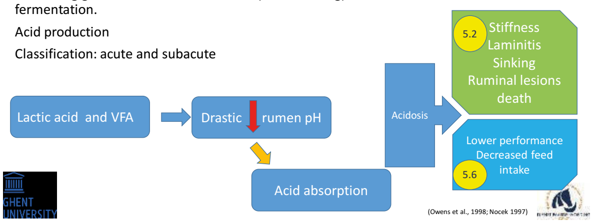
> 40% grain of dietary content

Highly processed grain and low level of roughage

Processing grain with heat and moisture (steam flaking) increases rate and of starch fermentation.

Acid production

Classification: acute and subacute



(Owens et al., 1998; Nocek 1997)

Acidosis

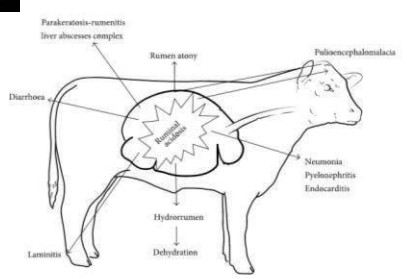
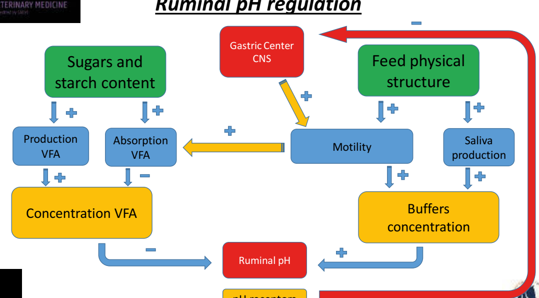


Figure 3: Clinical picture of the disease.

(Hernández et al. 2014)

Ruminal pH regulation



Ruminal acidosis

Acute acidosis

Haemorragic areas

Grain in the rumen

Ruminal acidosis

Subacute acidosis

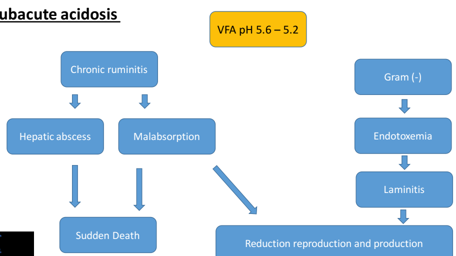


Table 1: Main differences between the two different clinical forms of ruminal acidosis [5].

	Ruminal acidosis	
	Acute	Subacute
Presence of clinical signs	Yes	Maybe
Mortality	Yes	No
Ruminal changes		
(1) Rumen pH	Below 5	5.0–5.4
(2) Lactic acid	Increase (50–120 mM)	Normal (0–5 Mm)
(3) Volatile fatty acids (VFA)	Decrease (<100 mM)	Increase (150–225 mM)
(4) Gram negative bacteria	Decrease	Normal
(5) Gram positive bacteria	Increase	Normal
(6) *Streptococcus bovis*	Increase	Normal
(7) *Lactobacillus* spp.	Increase	Normal
(8) Lactic acid producers	Increase	Increase
(9) Lactic acid consumers	Decrease	Increase
Blood parameters		
(1) Blood pH	Low	Borderline
(2) Bicarbonate	Low	Borderline
(3) Lactate	Increase	Normal

(Hernández et al. 2014)

Evaluation risk of acidosis

50% of cattle ruminating

Faeces evaluation

Degree 1
Liquid,
grain

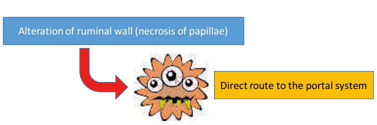
Degree 2
Liquid soft
consistency
low fiber

Degree 3
Good
consistency
well
digested
fiber

Degree 4
Fiber
excess
piles

Liver abscesses

Common disorder in feedlot
Average incidence of 12 to 32 per cent
Fed high-concentrate finishing rations with lower inclusion of roughage
Fusobacterium necrophorum is the most common cause



(Nagaraja and others 1996, Radostits 2000, Plaizier and others 2008, Hernández and others 2014, Calkins and Dewey 1968, Narayanan and others 1997)

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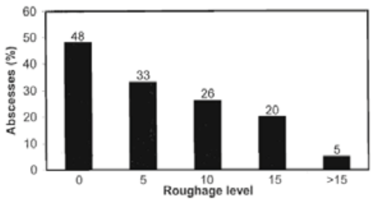
Effect of liver abscesses



Effect of dietary roughage level on the incidence of liver abscesses in grain-fed cattle

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(Nagaraja et al., 1996)

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Effect of liver abscesses

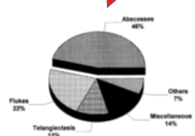
Most common in the United States of America, Canada, Europe, Japan, and South Africa

Economic lost

Animal performance: no effect
depression in daily gain of as much as 11%
decrease in feed efficiency of up to 9.7%
Condemnation due to liver abscess

Table 1.1 Relationship between severity of liver abscesses and performance and carcass yields in feedlot cattle (from Nagaraja & Chengappa, 1998).

Item	Liver abscesses score[1] O (%)	A- (%)	A (%)	A+(%)
Brink *et al.*, 1990				
No. of steers (% of steers)	405(71.5)	52(9.2)	37(6.5)	72(12.7)
Daily feed intake, kg DM	8.39^{c}	8.27^{c}	8.42^{c}	7.96^{d}
Daily gain, kg	1.27^{c}	1.23^{c}	1.24^{c}	1.15^{d}
Gain/DMI	0.151^{c}	0.149^{c}	0.145^{c}	0.130^{d}



Leading causes of liver condemnation in slaughtered beef cattle

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(Smith, 1944; Wieser et al., 1966; Harman et al., 1989, Brink et al., 1990, Nagaraja et al., 1996, Montgomery, 1992)

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Control of liver abscesses

Vaccination against F. necrophorum has shown little benefit in field application

Increasing dietary roughage level
↑ NDF to stimulate the chewing activity, and increasing particle size and length

↑ salivation production and ruminal pH

Antibiotics (i.e., bacitracin methylene disalicylate, chlortetracycline, oxytetracycline, tylosin, and virginiamycin).

1 January 2006 the European Union banned the non-medicinal use of antibiotics in livestock production. In 2011, the EU voted to ban the prophylactic use of antibiotics

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(European comimission, 2013; Reinhardt and Hubbert, 2015)

Control of liver abscesses

Buffers (sodium and potassium bicarbonate), or alkalinizing agents (sodium and potassium carbonate, magnesium oxide) → limitated effects

Organic acids → malic acid, fumaric acid, and aspartic acid → (1) lactate utilization; (2) increase in ruminal pH; (3) increased digestibility of dry matter (DM) and organic matter (OM); neutral detergent fiber (NDF) and hemicellulose; (4) decreased methane production; (5) decrease in ruminal lactate concentration

Probiotics

(Reinhardt and Hubbert, 2015)

Feedlot bloat

Animal prevented from expelling ruminal gas → pressure on diaphragm and lungs

Charaterized as Frothy → (stable foam)
Eructation is inhibited when cardias is covered with foam
Higly fermentable grain-based diet
Microbial factors, mucopolysaccharide slime (S. bovis)

Free-gas bloat
- Physical obstruction
- damage to the cardias or esophagus
- Reduction ruminal motility

(Cheng et al, 1998; Nagaraja et al; 1998)

Factors

Wheat most bloat-provocative grain in feedlot diets
Processing: fine particle size promote frothiness, acelerates production of bacterial slime
Generally cattle in transition, starter diets to high grain
Enviromental factors affecting feeding intake
Stress

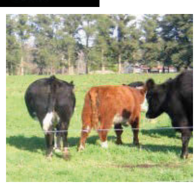
Bloat

Frothy pasture bloat: high soluble protein concentration (legumes)
Rapid fermentation
Animal factors ???

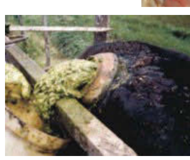


(Cheng et al, 1998; Nagaraja et al; 1998)

Diagnosis



Treatment →



(Giuliodori, 2018)

Treatment


Prevention and Treatment

Add carminatives

Ionophores to reduce the feed intake

Monensine inhibit bacterias producing lactate and mucopolysaccharide slim

Restriction of feeding intake

Poloxalene antifoaming agent decrease the incidence

Pasture test animals

Pre-dry increasing DM content

(Galyean and Rivera, 2018; Gimenez 2007)

Poliencephalomalacia (PEM)

Neurologic disorder

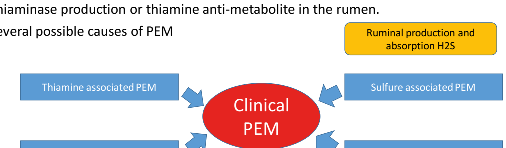
Blidness, incoordination, muscular tremors and recumbency with seizures.

Described as thiamine deficienty

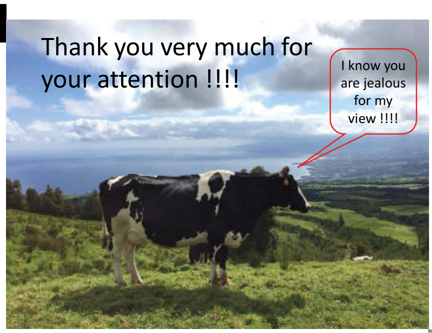
Specific brain lesion (post-mortem examination)

Thiaminase production or thiamine anti-metabolite in the rumen.

Several possible causes of PEM



(Blood and Radostits, 1989; Gould 1998,)



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Hipocuprosis

Enzimatic co-factor (ceruloplasmina, SOD, tirosinase, etc)
Functions: Mieline, queratine, haemoglobin and melanine.
Celular respiration, metabolism free radicals
Clinical signs: Depigmentation
Resistance to infection
Reproductive problems
Growth retardation
Diarrhoeas
Anemia

Forage: < Cu (8ppm)
> Mo (3ppm), >S (0.3%), > Fe (1000 ppm)
Water: SO_4 > 1g/L

Cu sources
Gramineas: 3-8 ppm MS
Cereal grain: 4-8 ppm MS
Legumes: 14-24 ppm MS

(NRC 1996, Giuliodori unpublished data, McDowell, 1992)

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Treatment
Pasture fertilization
Feed supplementation
Water supplementation
Intra-ruminal dispositive
Injectable

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Grass tetany

Animals grazing without supplementation
Magnesium functions: membrane equilibrium, nervous conduction, muscular contraction.
Enzymatic co-factor ATPase, adenilciclase
Presentation: Subclinic <1.8mg/dl, Clinic <1 mg/dl
Clinical sign: nervous system, ataxia, decubitus, seizures, etc
Death as storm or dropping
Magnesium metab. non hormonal control
Non readily available Mg reserve
Salivary secretion
Intracellular capitation (fat tissue)

Mg sources
Gramineas: 0.03-0.18 %MS
Cereal grain: 0.13-0.22 %MS
Legumes: 0.16-0.20 %MS

Hipomagnesemia.mpg

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