Undesirable substances



# Investigation of the rumen digesta washing mechanism in live cattle



#### S. Valerio, J. Hummel, D. Codron, J.-M. Hatt, M. Clauss

Clinic for Zoo Animals, Exotic Pets and Wildlife / AgroVet Strickhof, Vetsuisse Faculty, University of Zurich, Switzerland University of the Freestate Bloemfontein, South Africa Ruminant Nutrition, Dept. of Animal Science, University of Göttingen, Germany

GfE 2023





GEORG-AUGUST-UNIVERSITÄT Göttingen





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Undesirable substances



#### Brommer & van Oldruitenborgh-Oosterbaan (2001) **Iron deficiency in stabled Dutch warmblood foals.** Journal of Veterinary Internal Medicine 15: 482-485



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Gutte et al. (1967) **Der Einfluss von Auslauf und Erde auf Wachstum und Hämoglobingehalt des Blutes von Saugferkeln.** Zeitschrift für Tierphysiologie, Tierernährung und Futtermittelkunde 22: 160-173



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#### ESTIMATES OF SOIL INGESTION BY WILDLIFE

W. NELSON BEYER, U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, 12011 Beech Forest Road, Laurel, MD 20708-4041

ERIN E. CONNOR, U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, MD 20708 SARAH GEROULD, U.S. Geological Survey, Mail Stop 412, 12201 Sunrise Valley Drive, Reston, VA 22092

J. WILDL. MANAGE. 58(2):375-382

1994

















#### Innere Medizin und Chirurgie des Rindes

Gerrit Dirksen Hans-Dieter Gründer Matthaeus Stöber (Hrsg.) Als "Krankheiten des Rindes" begründet von Gustav Rosenberge S. Auflage, unveränderter Nachdruck der 4. Auflage

Cattle may not show adverse signs when consuming, with their feed, 10 kg of sand per day for more than 30 days.





#### Particles separate







#### Particles separate in fluid: Sorting





#### Ruminants are not super-hypsodont





# The rumen washes off abrasives before heavy-duty chewing in ruminants Mammalian Biology 97 (2019) 104–111

Jean-Michel Hatt<sup>a</sup>, Daryl Codron<sup>b</sup>, Dennis W.H. Müller<sup>a</sup>, Nicole L. Ackermans<sup>a</sup>, Louise F. Martin<sup>a</sup>, Patrick R. Kircher<sup>c</sup>, Jürgen Hummel<sup>d</sup>, Marcus Clauss<sup>a,\*</sup>





- Four rumen-cannulated (10 cm diameter) cows of the Original Swiss Brown cattle breed (705  $\pm$  64 kg, 5 years)
  - 2 lactating cows received grass silage (app. 5 cm)
  - 2 cows in the galting phase received mixed diet: onethird of chopped straw (app. 5 cm) and two-thirds of grass silage (app. 5 cm)







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  - sand at ~2% as fed / 6% dry matter (~ 1 kg/day)









































































- Day 18
- 0 / 10 / 20 / 40 / 60 / 120 / 360 min after feeding







- Day 18
- 0 / 10 / 20 / 40 / 60 / 120 / 360 min after feeding
- dorsal rumen middle part







- Day 18
- 0 / 10 / 20 / 40 / 60 / 120 / 360 min after feeding
- dorsal rumen middle part, dorsal rumen blindsac







- Day 18
- 0 / 10 / 20 / 40 / 60 / 120 / 360 min after feeding
- dorsal rumen middle part, dorsal rumen blindsac, dorsal rumen atrium ruminis







- Day 18
- 0 / 10 / 20 / 40 / 60 / 120 / 360 min after feeding
- dorsal rumen middle part, dorsal rumen blindsac, dorsal rumen atrium ruminis, middle part of the rumen







- Day 18
- 0 / 10 / 20 / 40 / 60 / 120 / 360 min after feeding
- dorsal rumen middle part, dorsal rumen blindsac, dorsal rumen atrium ruminis, middle part of the rumen, ventral rumen







#### Sand in the rumen



















- no effect on dry matter or water intake





# Additional findings









#### Additional findings



# no clinical problems



#### Additional findings



# no clinical problems





#### Conclusion





#### Conclusion

# **PNAS**



#### The Ruminant sorting mechanism protects teeth from abrasives

Sarah O. Valerio<sup>a</sup>, Jürgen Hummel<sup>b</sup>, Daryl Codron<sup>c</sup>, Jean-Michel Hatt<sup>a</sup>, and Marcus Clauss<sup>a,d,1</sup>

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#### Tooth Evolution











































# thank you for your attention