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Effect of normal and high NaCl intake on portal-drained visceral urea-N flux and renal urea-N kinetics in lactating Holstein cows

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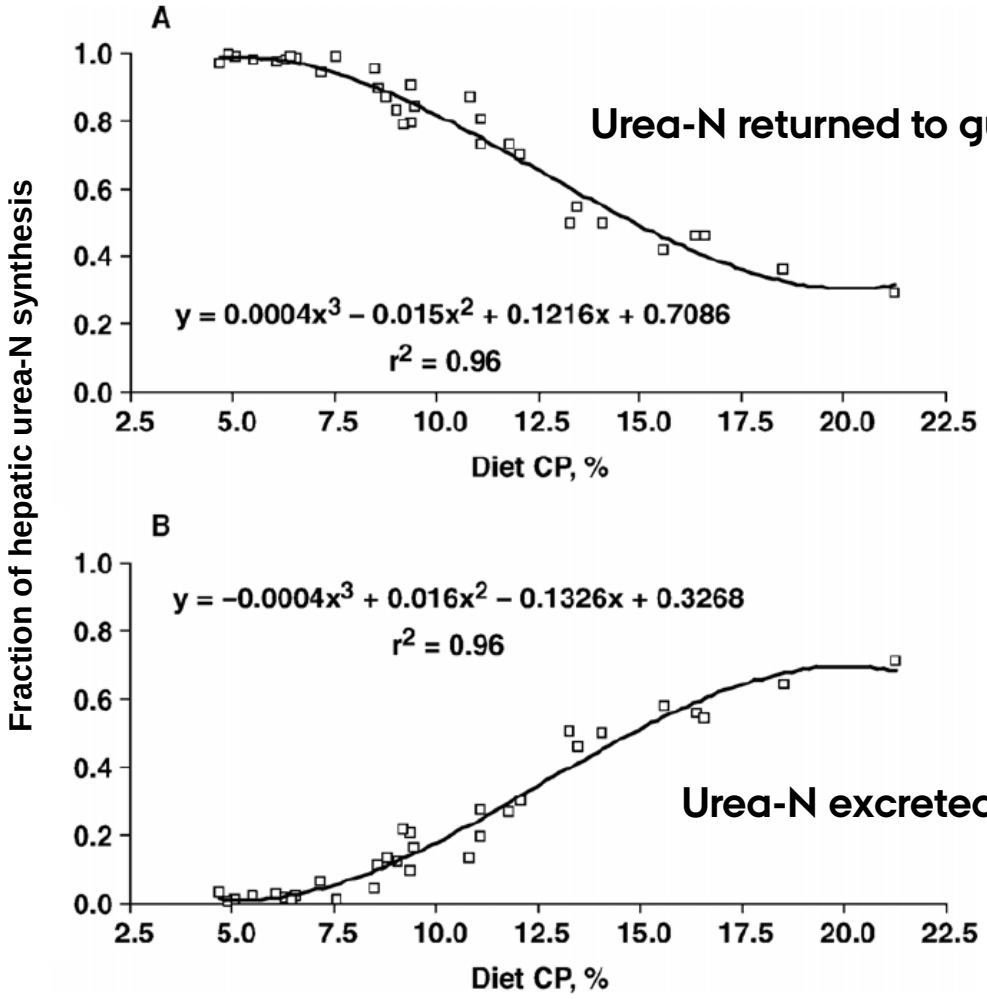
Urea-N recycling seems promising from a fractional view



Urea-N returned to gut via blood and saliva

Urea-N excreted in urine and milk

Absolute amount of urea-N recycled not increased, but relatively constant when going from high to low N intake

Reynolds and Kristensen (2008)

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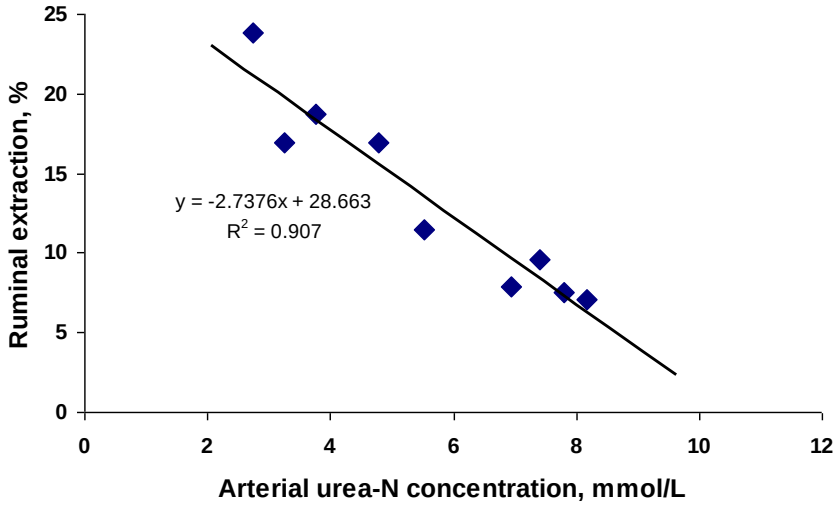
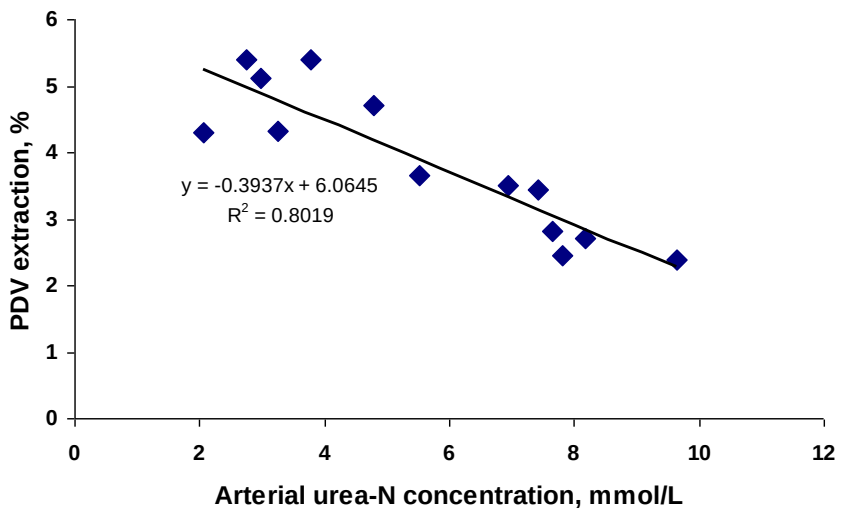
Kinetics of urea-N transport are complex

- **Long-term adaptation to N status affects urea-N permeability of gut epithelia**





Extraction = (arterial conc. – venous conc. / arterial conc.)

Røjen et al. (2008), Kristensen et al. (2010), Røjen et al. (2011a), Røjen and Kristensen. (2012), Røjen et al. (in press), actual study

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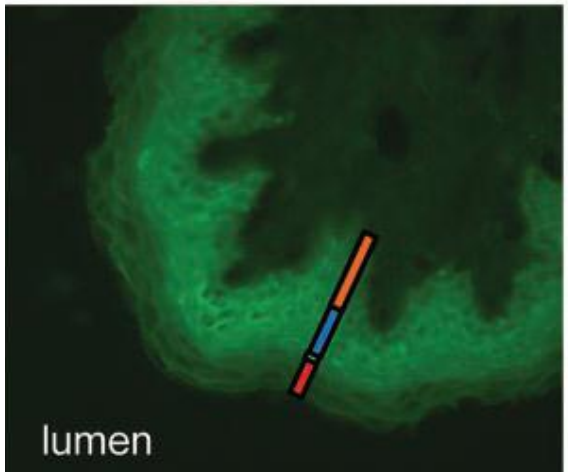
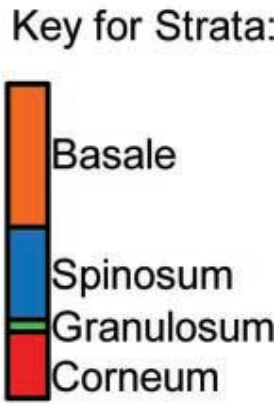
Kinetics of urea-N transport are complex

- Not possible to correlate UT-B mRNA expression and protein abundance in ruminal papillae with changes in N supply

Røjen et al. (2011b)



Simmons et al. (2009)



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Different short-term regulation of urea-N transport when urea supplied from ruminal side or by intravenous infusion:

- Short-term intravenous urea infusion showed urea-N transport to be directly proportional to arterial urea-N concentrations → no change in arterial urea-N extractions across rumen and PDV

Kristensen et al. (2010)

- Increased ruminal N supply from ruminal urea infusion induced postprandial decrease in ruminal extraction of urea-N → reflecting short-term regulatory mechanism affecting ruminal urea-N transport

Røjen et al. (2011a)

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Objective: To investigate if high NaCl intake would increase water diuresis and urea-N excretion, and decrease arterial blood urea-N concentration compared with normal NaCl intake.

Hypothesis: A decreased blood urea-N concentration induced from high NaCl intake will induce a lower increase in ruminal and portal-drained visceral (PDV) extraction of urea-N comparable with an equal hypouremia from decreased dietary N intake

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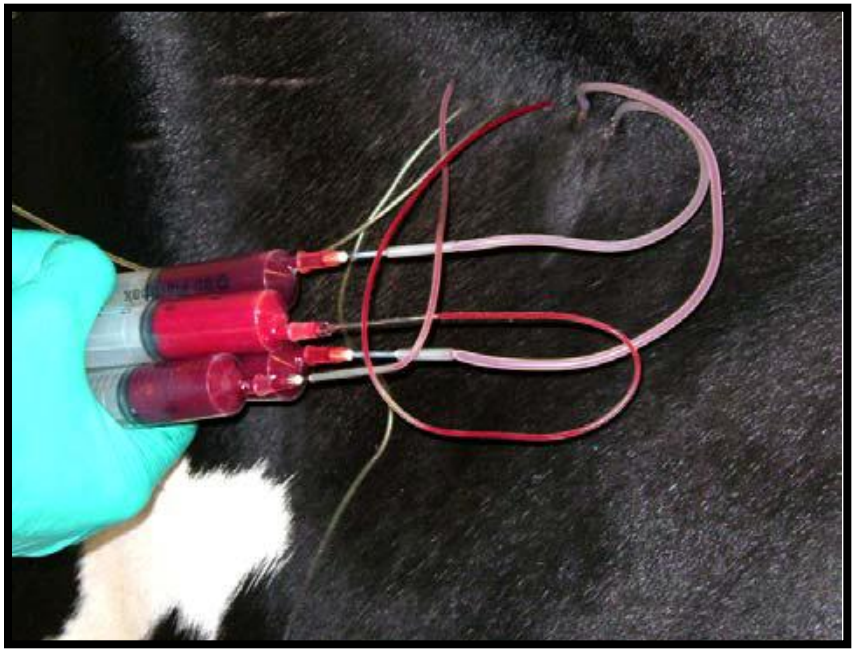
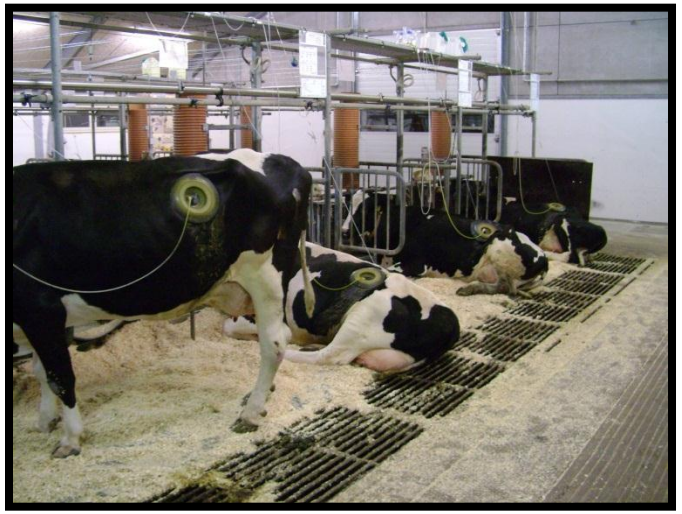
Multicatheterized animal model



Ruminal cannula and permanent indwelling catheters in major splanchnic blood vessels



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Experimental design

Treatments:
TMR with **normal NaCl** content (0% of DM)
TMR with **high NaCl** content (2.5% of DM)

Feed: Corn and clover silage based feed ration in three equal sized portions daily (0800; 1600; 2400 h). Restricted feeding to 95% voluntary intake

Design: Cross-over, 21d periods, n = 9

Sampling (8 hourly sets starting 30 min before morning feeding at 0730 h):
Arterial, portal, hepatic, and ruminal vein blood
Rumen fluid
Urine

Feed, feces and milk

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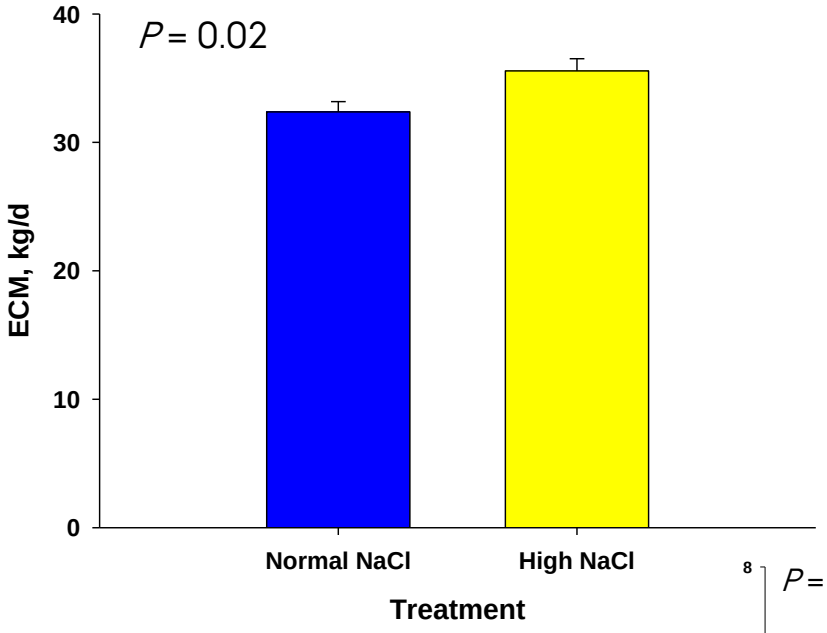
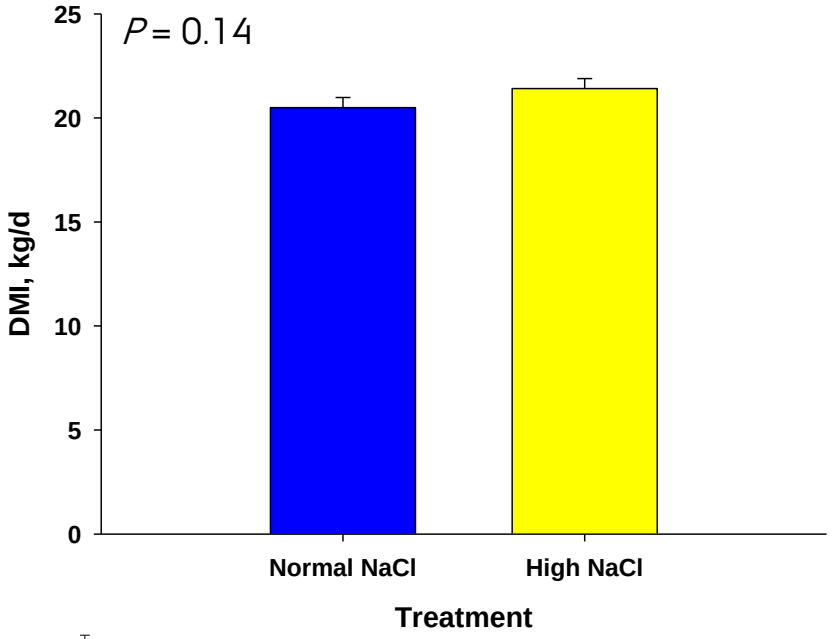
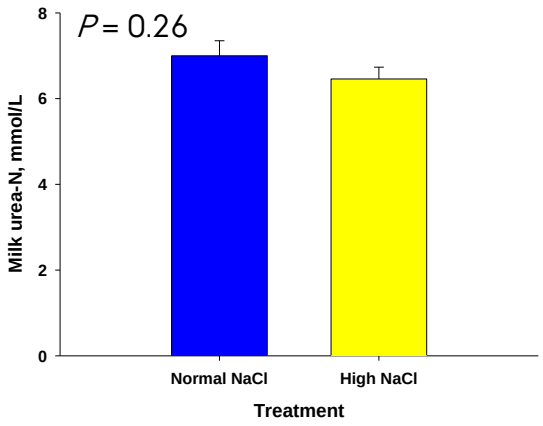
ECM increased with High NaCl
No change in DMI, urea-N concentration in milk







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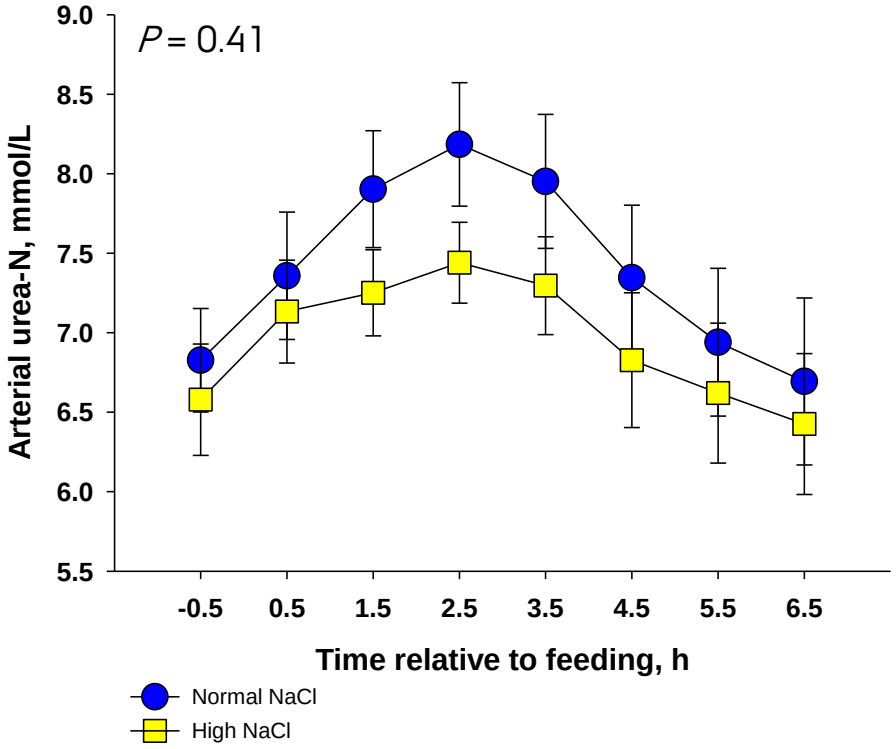
Arterial urea-N concentrations not affected by High NaCl



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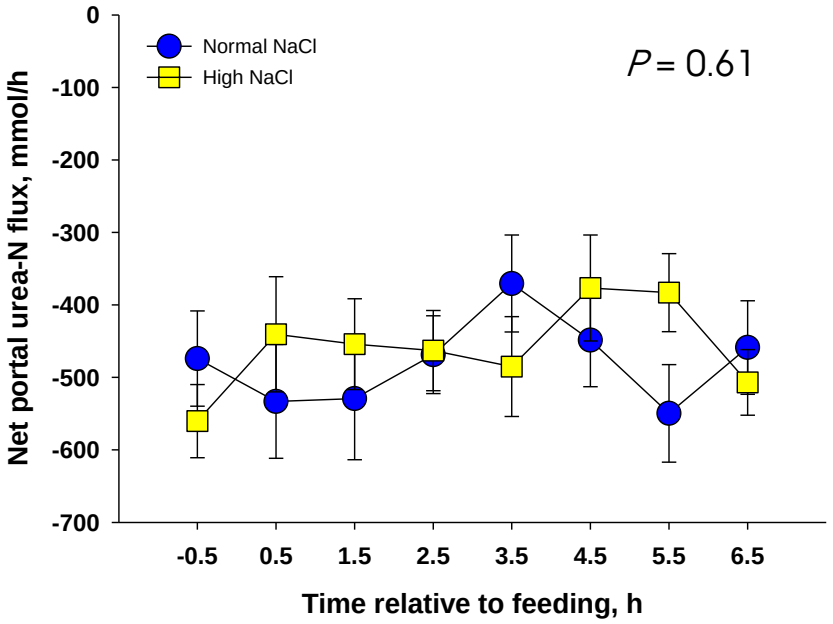
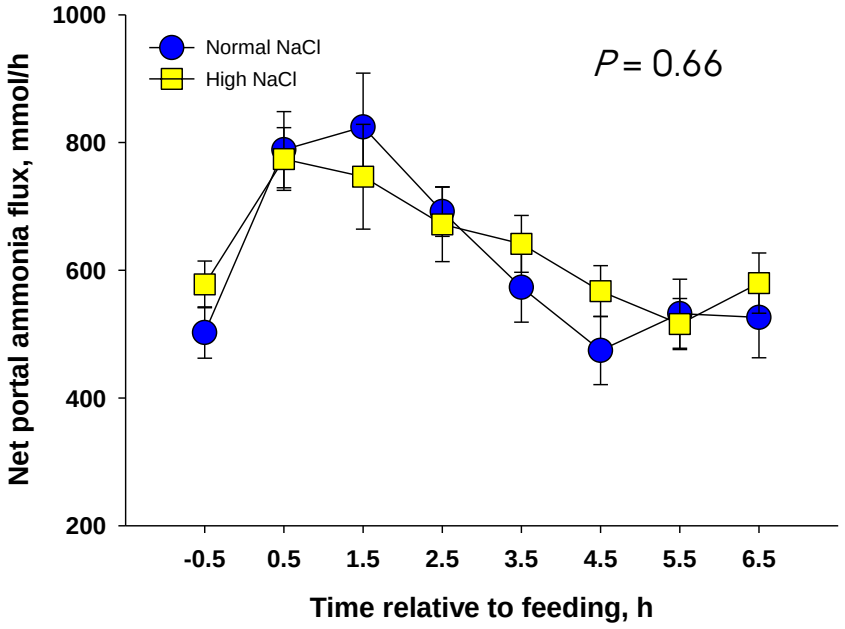
Net portal urea-N and ammonia flux similar between treatments

Net ammonia absorption greater than net uptake of urea-N – ammonia efficiently absorbed





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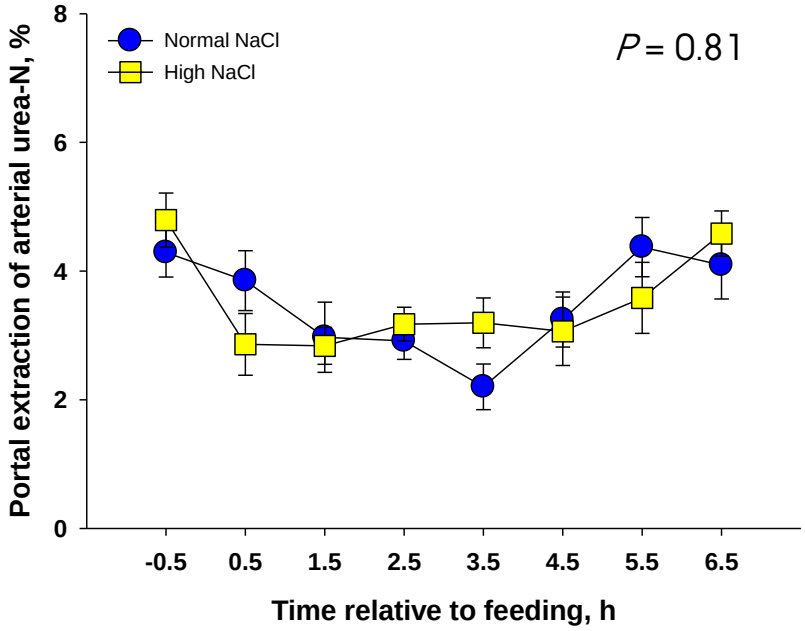
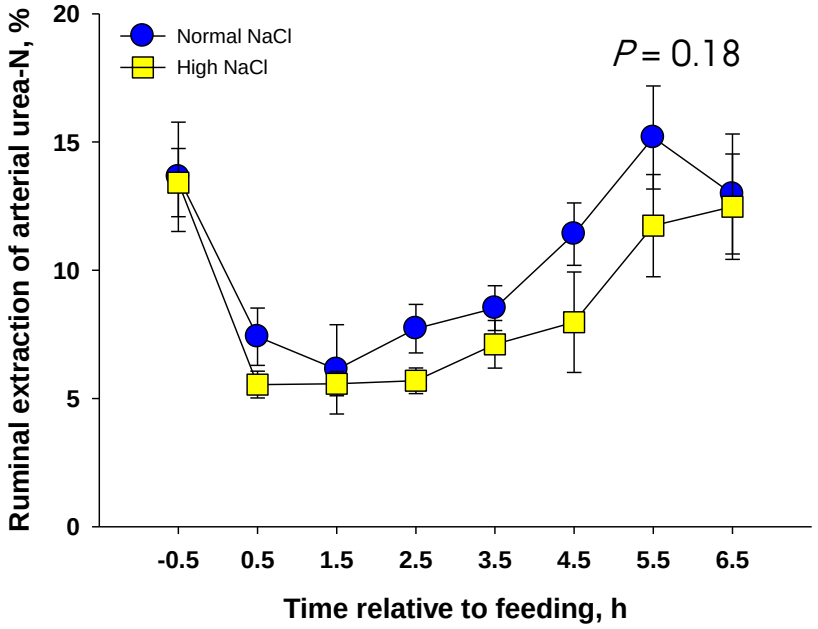
Portal and ruminal extractions of arterial urea-N not affected by High NaCl

Rumen extraction of urea-N subject to short-term regulation





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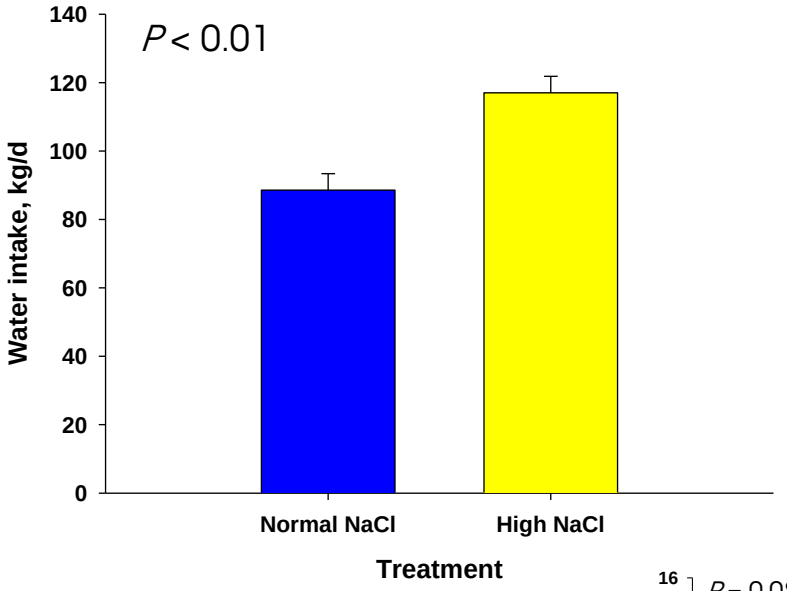
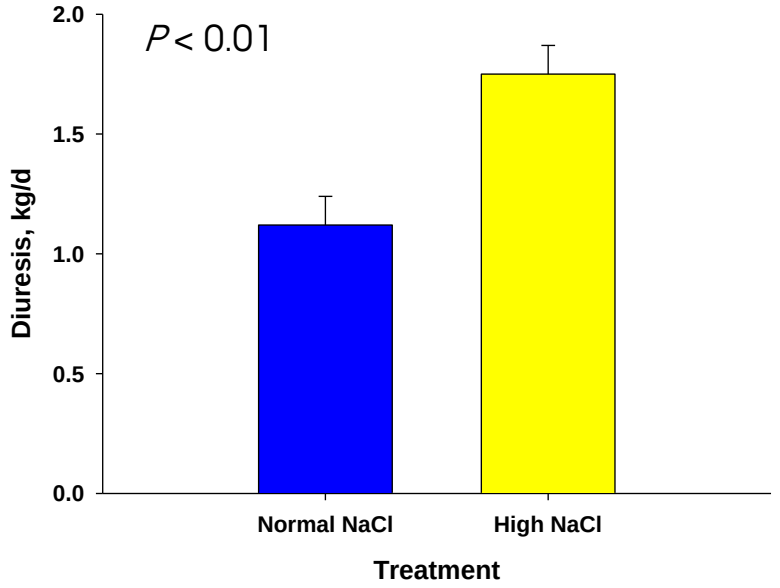
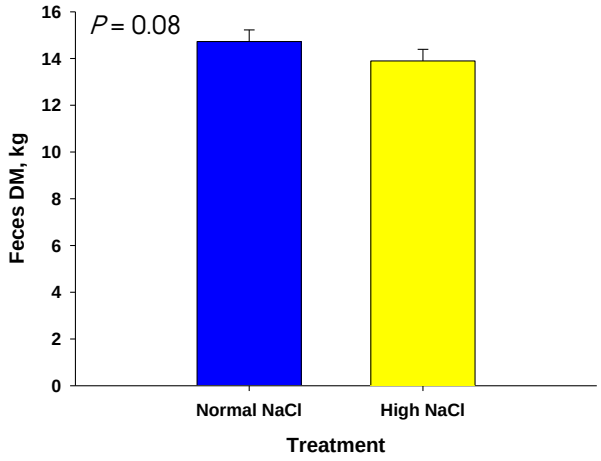
Water intake and diuresis increased with High NaCl







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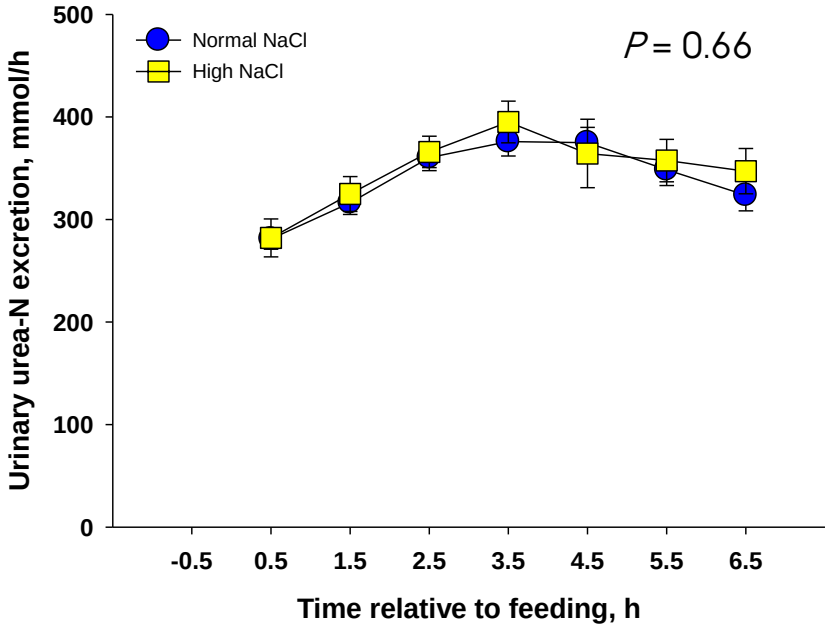
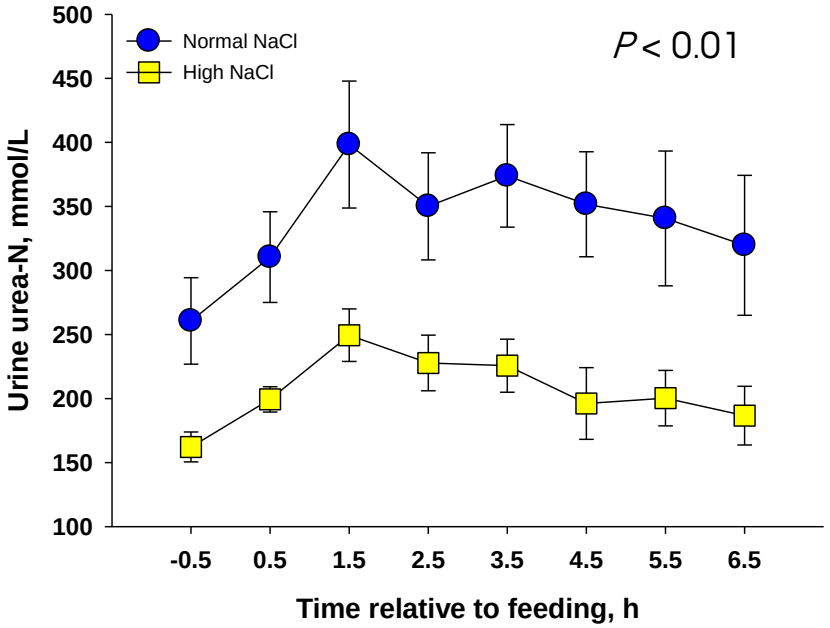
Urinary urea-N excretion similar between treatments





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Conclusions

- High NaCl increased ECM yield
- Arterial urea-N concentration did not decrease with High NaCl – Level not high enough?
- Diuresis increased with High NaCl
- Urea-N excretion was similar between treatments – more related to arterial plasma urea-N concentration than to urine flow rates
- Net flux of urea-N across PDV not affected by High NaCl
- Ruminal and portal extractions of arterial urea-N similar between treatments
- In the present experiment NaCl not able to change urea-N transport by moving urea-N to urine

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