Responses of Boer goats to saline drinking water

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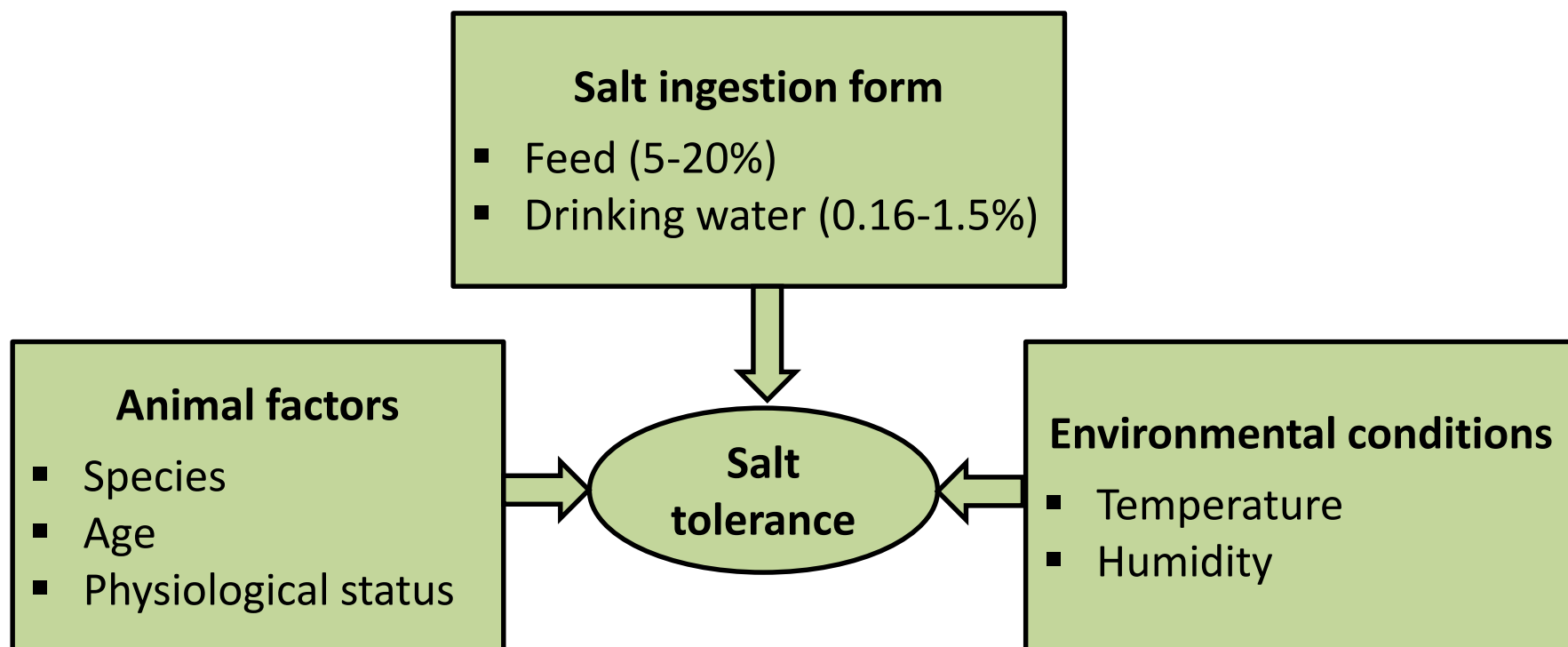
Introduction

- Salinization of ground water and soil is a global phenomenon (IPCC, 2014)

- Threats for animal health and production

Source: Daily Camera, 2013

Introduction

- Salt (NaCl) regulates body fluid homeostasis, nerve functions and nutrient absorption (Suttle, 2010)

Salt ingestion form
- Feed (5-20%)
- Drinking water (0.16-1.5%)

Animal factors
- Species
- Age
- Physiological status

Salt tolerance

Environmental conditions
- Temperature
- Humidity

Source: Peirce, 1957; Weeth and Haverland, 1961; Wilson and Dudzinski, 1973; Masters *et al*., 2005; Digby *et al*., 2011

Introduction

- Choice experiment on feeds in sheep and goats (Kyriazakis and Oldham, 1993; Fedele *et al.*, 2002) → select a balanced diet

- Two choice test used to determine taste responses and thresholds to saline water (Bell, 1959; Goatcher and Church, 1970a)

- Free choice system is closer to natural conditions

Objective

- Investigate the capacity of goats to differentiate saline water in a free choice system

Animals and Management

- 12 female Boer goats

- Age: 1 to 8 years

  ➢ Young (N=8) < 2 years

  ➢ Adult (N=4) > 2 years

- Body weight: 46.4 ±8.3 kg

- Housing: 3 rooms with 2 pens each (2.85x2m) straw bedding

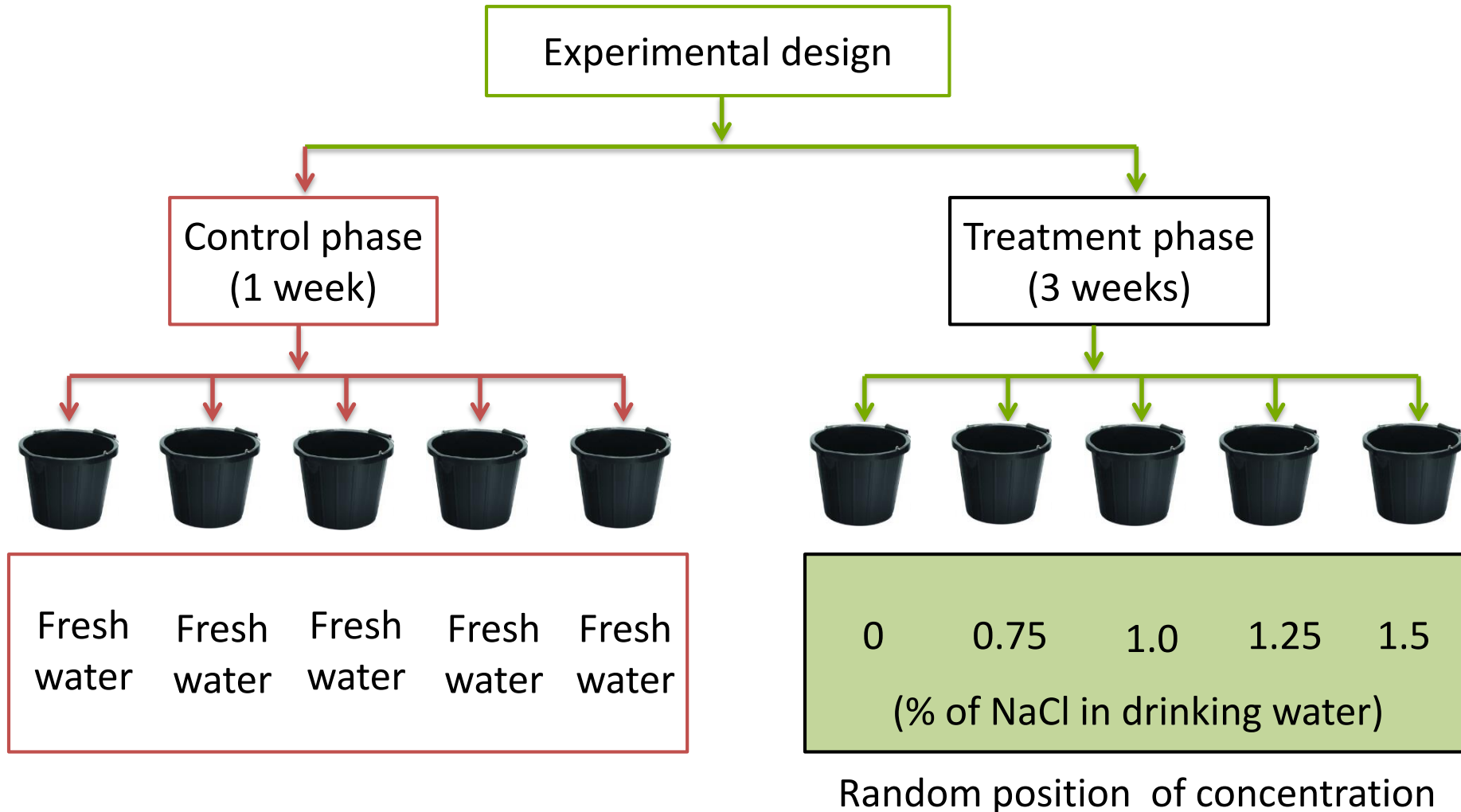- Hay and water *ad libitum,* and mineral supplement
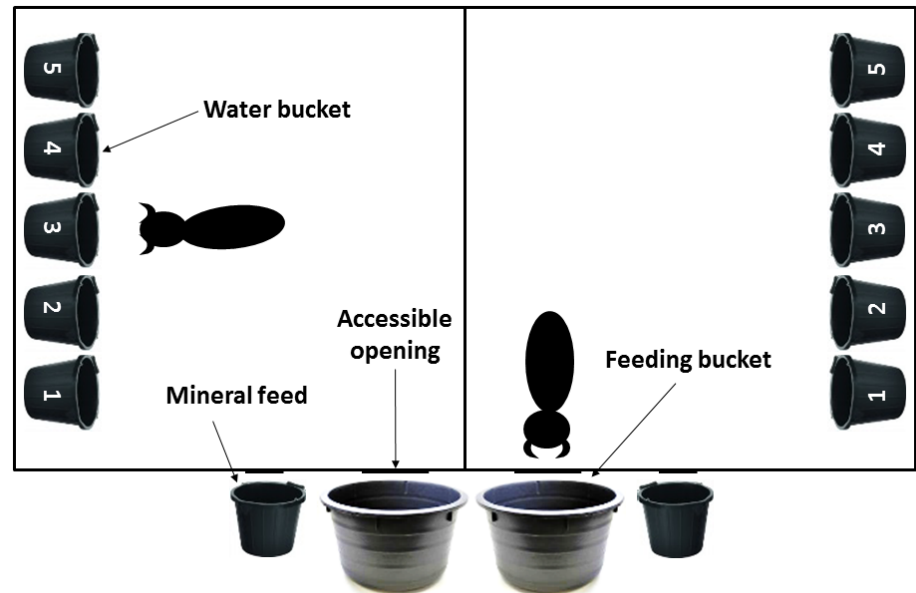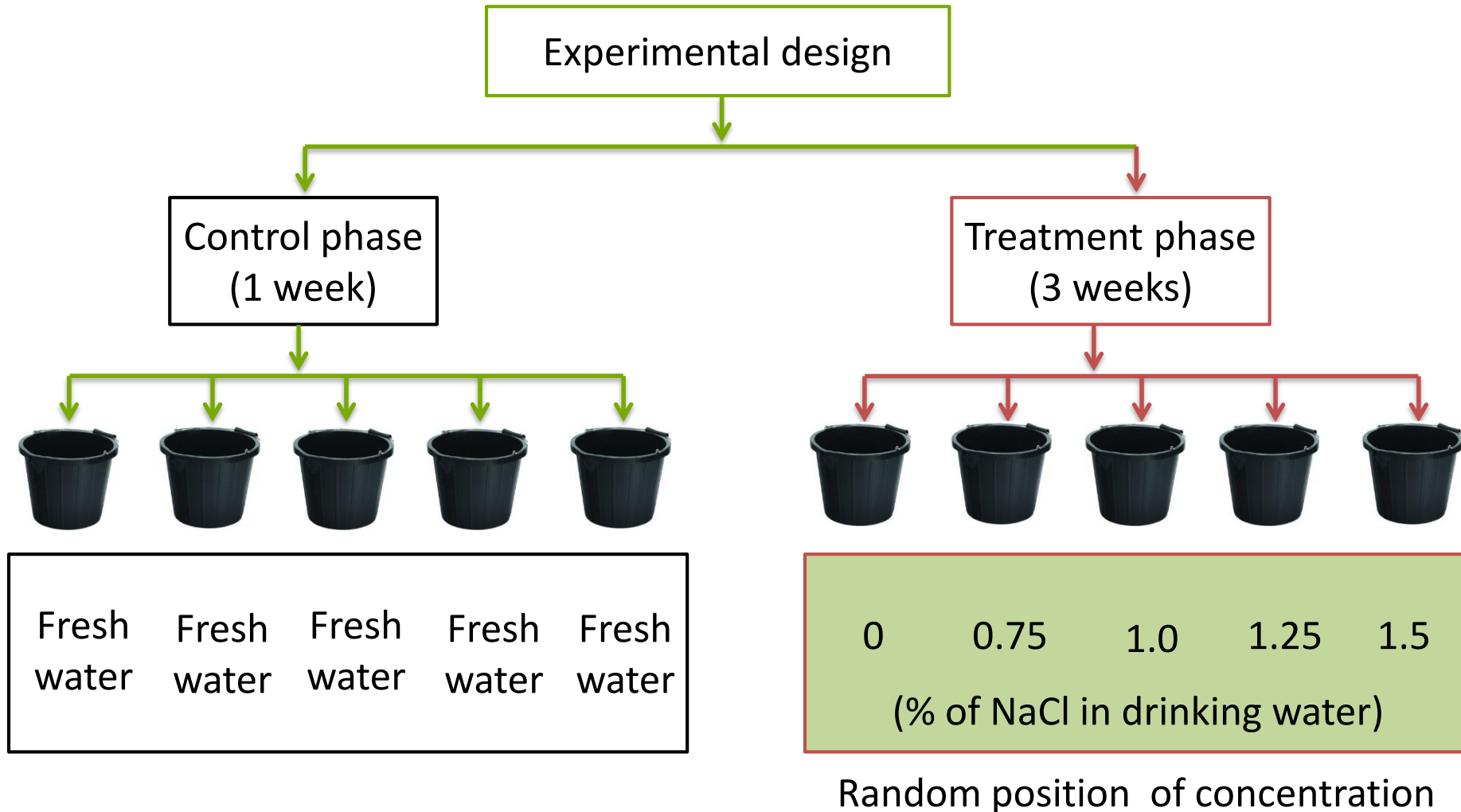

Source: Runa *et al*., 2018

Methods

Free choice test

Experimental Design

Experimental Design

Experimental design

Control phase (1 week)

Treatment phase (3 weeks)

| Fresh water | Fresh water | Fresh water | Fresh water | Fresh water |

| 0 | 0.75 | 1.0 | 1.25 | 1.5 |

(% of NaCl in drinking water)
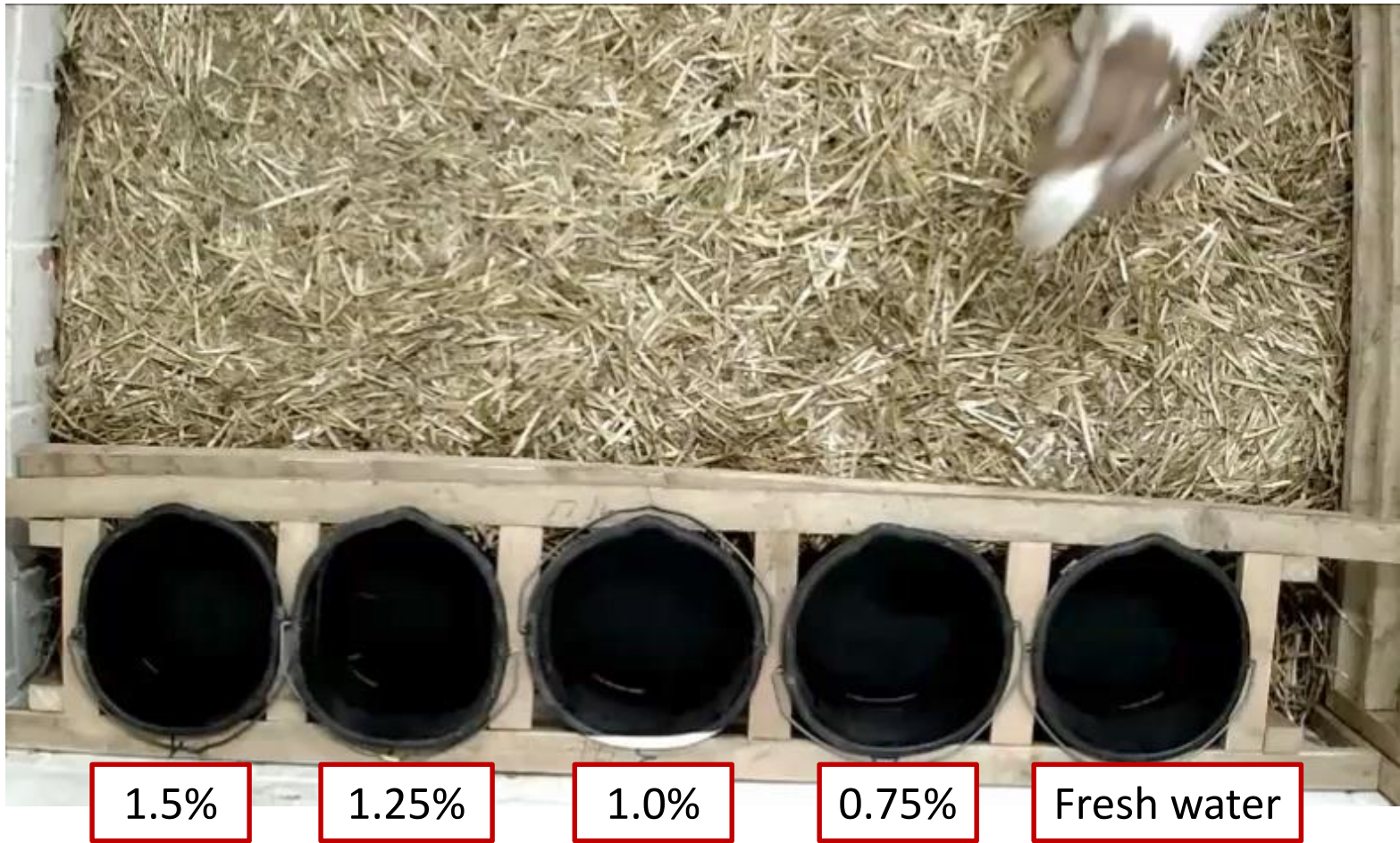
Random position of concentration

Experimental Traits

- Daily water intake (WI, kg)

- Daily feed intake (FI, kg)

- Daily sodium intake (NaI, g)

- Body weight (kg) and body condition score (BCS) weekly

Statistical Analysis

- WI, FI, NaI and saline water intake during treatment phase (2-4 weeks)

    → PROC Mixed model

- SAS (version 9.3)

1.5% 1.25% 1.0% 0.75% Fresh water

Results

Traits	Experimental phase			
	Control phase	Treatment phase		
	Week 1	Week 2	Week 3	Week 4
Body weight (kg)	48.31 ± 2.23	47.36 ± 2.23	47.39 ± 2.23	47.84 ± 2.23
Body condition score (points)	3.28 ± 0.08	3.09 ± 0.08	3.09 ± 0.08	3.03 ± 0.08
Dry matter intake (g/kg BW$^{0.75}$/day)	46.05 ± 1.27[a]	47.79 ± 1.16[a]	51.83 ± 1.16[b]	57.30 ± 1.16[c]
Total water intake (g/kg BW$^{0.82}$/day)	88.12 ± 3.64[a]	126.48 ± 3.33[b]	108.37 ± 3.33[c]	122.27 ± 3.33[b]
Total Na$^+$ intake (g/kg BW$^{0.75}$/day)	0.05 ± 0.02[a]	0.55 ± 0.02[b]	0.37 ± 0.02[c]	0.44 ± 0.02[d]

LS means ± SEM; [a,b,c] Means within the same row with different superscripts differ significantly by *P<0.05*.
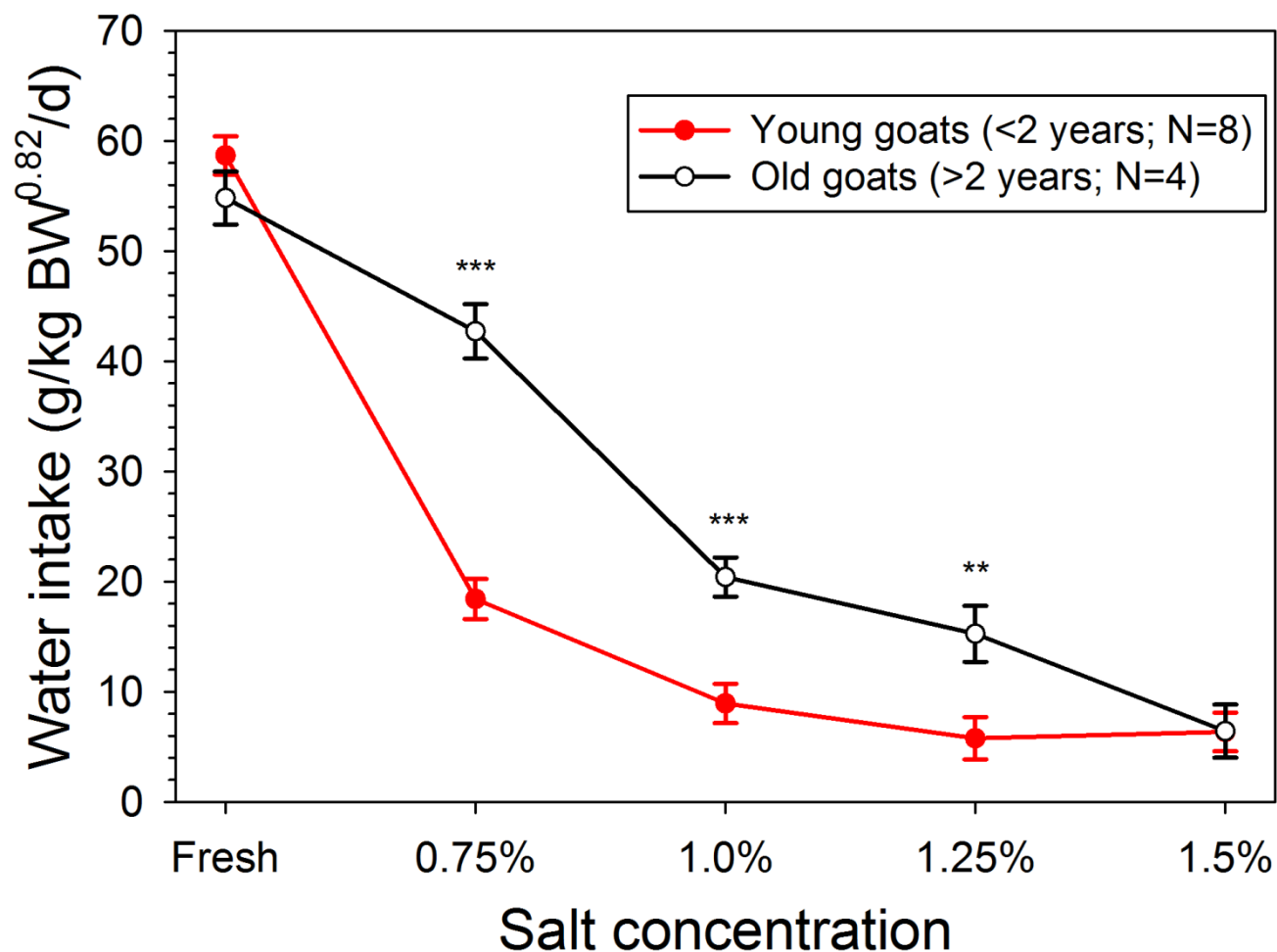
Source: Runa *et al.*, 2018

Results – consumption of saline water
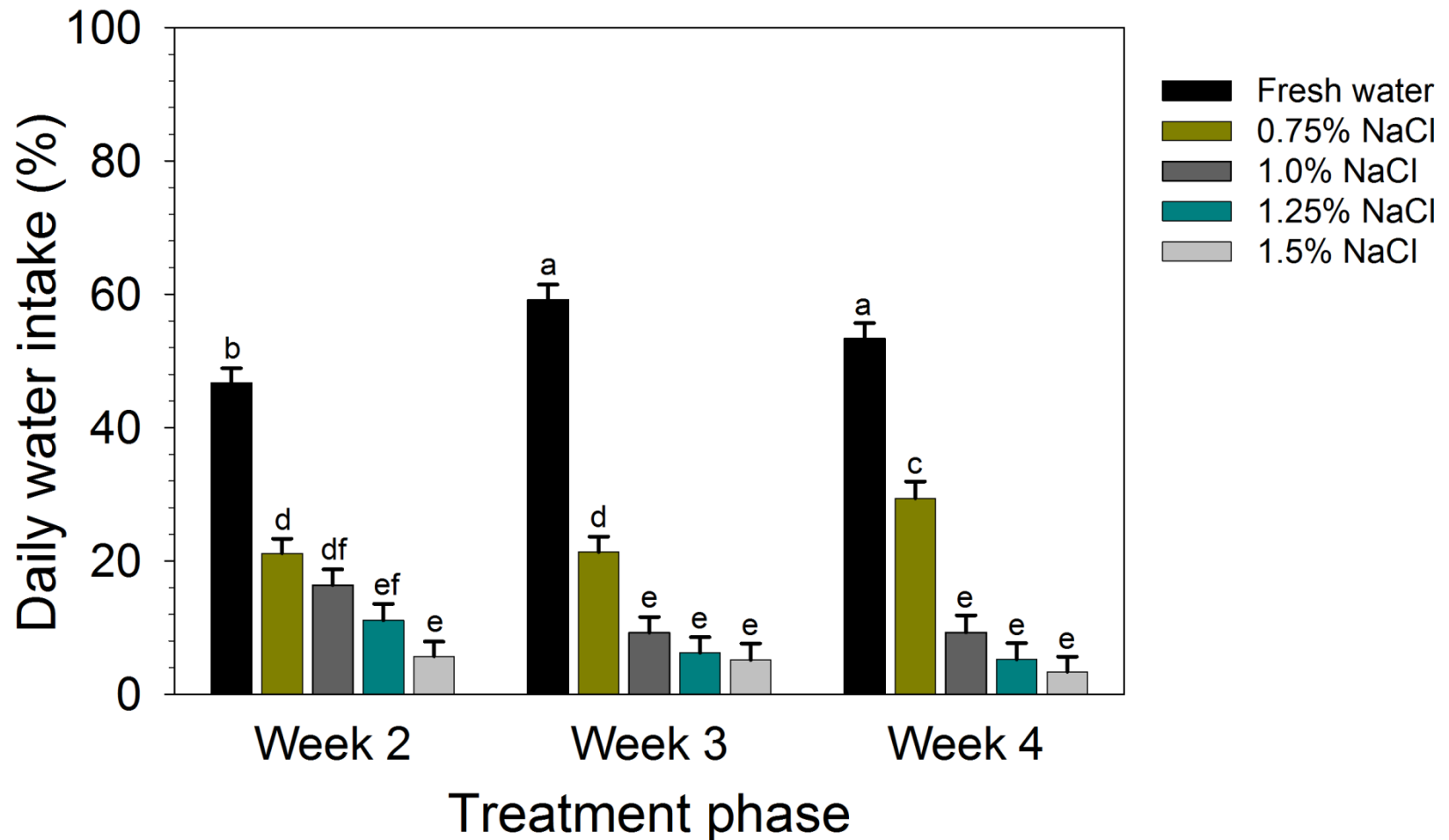
a,b,c,d e,f significant differences between intake of salt concentrations across weeks, *P<0.05.*
  Source: Runa *et al*., 2018

Results – response by ages

** $P<0.01$; *** $P<0.001$ for comparison between ages for salt concentration
Source: Runa *et al.*, 2018

Discussion

- Fresh water intake higher → distinguish between fresh and different concentrations of saline water

- Choices variable with preferences for lower (0.75%) salt concentration

- Lowest water intake at 1.25% and 1.5% → rejection threshold (Goatcher and Church, 1970a)

- Preferences for 0.85% and 1.25% in goats and sheep (Goatcher and Church, 1970b), rejection threshold 3.12-3.50%

Conclusions

- In a free choice system

  ➢ Differentiate between saline water concentrations.

  ➢ Balance their sodium intake by quick adjustment in self-selection.

- Young goats showed higher sensitivity to saline water than older ones.

Thank you
for your attention
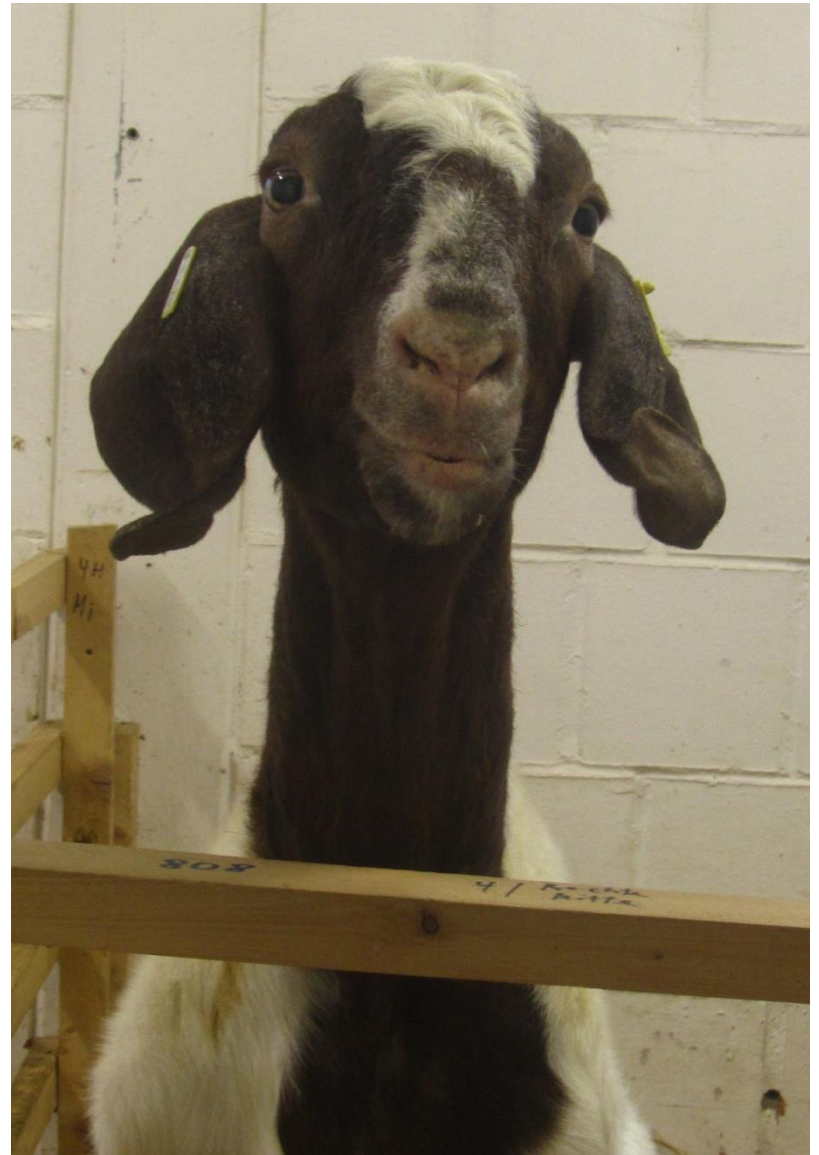
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Experiment 1: Statistical Model

Model 1 (all traits)

$$Y_{ijklm} = \mu + R_i + W_j + A_k + (RW)_{ij} + (W*A)_{ik} + (R*A)_{ik} + G_l + e_{ijklm}$$

Y_{ijklm} = observation value

μ = mean

R_i = fixed effect of test run (i = 1, 2)

W_j = fixed effect of week (j = 1 to 4)

A_k = fixed effect of age (k = young, old)

(R*W) = interaction test run * week

(W*A) = interaction week * age

(R*A) = interaction test run * age

G_l = random effect of the goats (N=12)

e_{ijklm} = random error

Experiment 1: Statistical Model

Model 2 (sodium intake)

$$Y_{ijklm} = \mu + R_i + P_j + A_k + (R*P)_{ij} + (P*A)_{ik} + G_l + e_{ijklm}$$

Y_{ijklm} = observation value
μ = mean
R_i = fixed effect of test run (i = 1, 2)
P_j = fixed effect of phase (j = control, treatment)
A_k = fixed effect of age (k = young, old)
$(R*P)$ = interaction test run * phase
$(P*A)$ = interaction phase * age
G_l = random effect of the goats (N=12)
e_{ijklm} = random error