Effect of forage particle size on phosphorus retention and plasma and saliva levels in ewes

A García R, AH Ramírez-Pérez, SE Buntinx
Departamento de Nutrición Animal y Bioquímica
Facultad de Medicina Veterinaria y Zootecnia
Universidad Nacional Autónoma de México

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INNOVATION IN LIVESTOCK PRODUCTION: FROM IDEAS TO PRACTICE
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Presentation plan…

- Introduction…
- Materials and methods…
- Results and discussion…
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Objective…

To determine the effect of forage particle size on…

- the digestive availability of dietary P

- plasmatic and salivary P concentrations in ewes at maintenance

Phosphorus...

The most important mineral to animals…

Animal Production

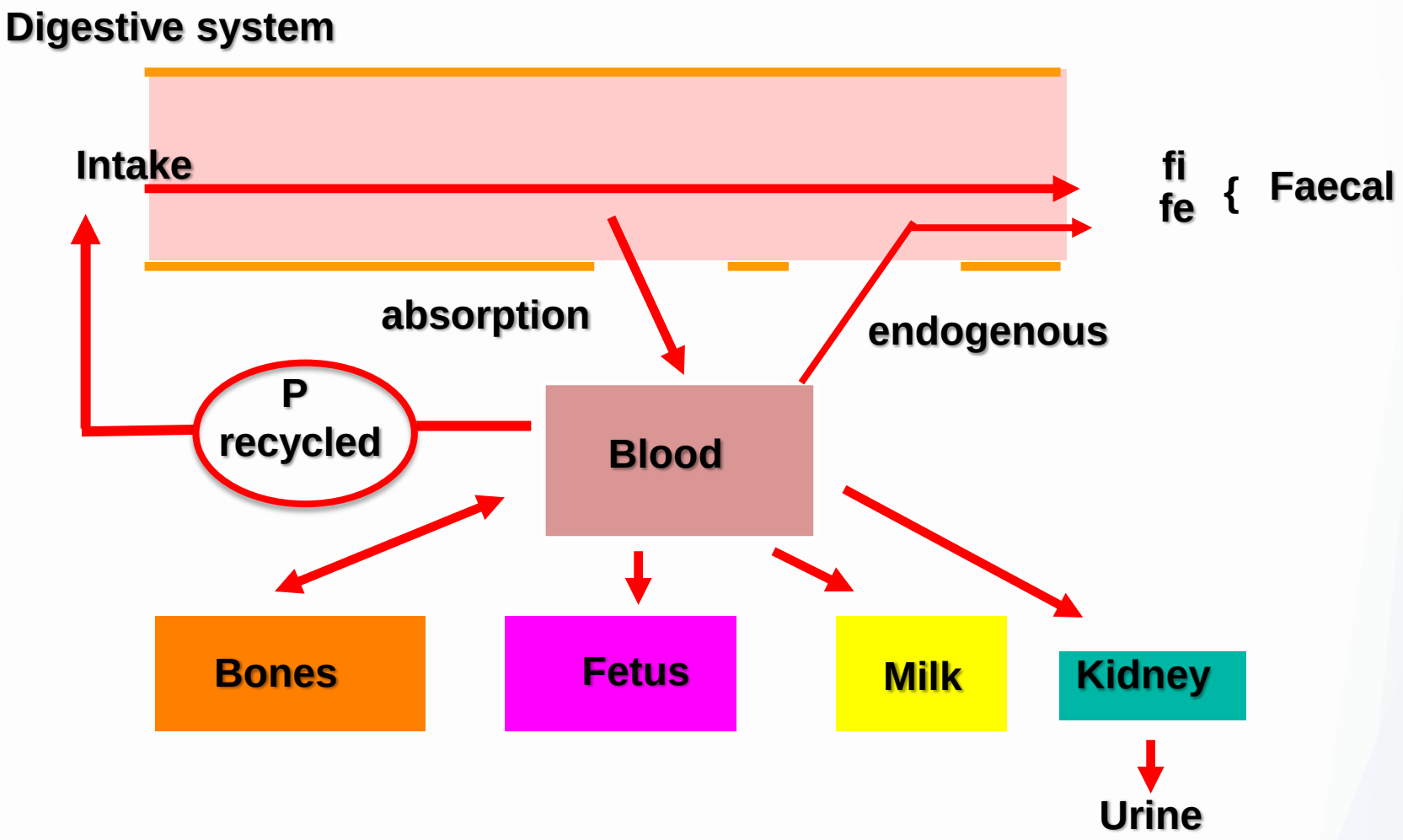
…1968

Nitrogen + Phosphorus

Research on feeding P regains its importance (2000)

Phosphorus metabolism…

Ruminants…



Phosphorus…

- The P requirement of cellulolityc bacteria is important:

4.5 g of available P/kg DOM

There is a relationship between forage particle size and salivary flow…

Duric et al. (1994): sheep

Yano et al. (1991): sheep

Maekawa et al. (2002): dairy cows

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- Center for Teaching, Research and Practical Work in Animal Production and Health (Mexico City)

- 6 ewes at maintenance (Pelibuey × East Friesian)
  - Age: 2.5 yr
  - Average BW: 49 ± 1.91 kg
  - BCS: 3.0 (±0.5)
  - Healthy and dewormed

  - Randomly assigned to 3 experimental treatments in a double (3 × 3) latin square design

Diets (0700 and 1600 h)

Ingredient	g/kg DM
Oat hay	803.30
Ground corn	91.50
Soybean meal	49.40
Coconut meal	50.70
Mineral mix	5.10

Item	/kg DM
CP (N × 6.25; g)	81.60
NDF (g)	369.10
ADF (g)	197.90
Ca (g)	8.20
P (g)	1.80
Gross energy (Mcal)	5.52

Ad libitum

Experimental treatments:

Small, S = 2.54 cm

Medium, M = 5.08 cm

Coarse, C = coarse

M & M…

- 3 sampling periods
- 7 days of digestibility trial (García-Robledo et al., 2013)…
- 14 days to make a change in diet…
- Blood (plasma) sampling from the jugular vein:
  - 0600 (P_{0600}) and 0800 h (P_{0800})
  - Plasma stored at -20 C
- Sampling of saliva
  - 0600, 0800 h
  - Filter paper, 11 µm pore size, 1 min

M & M, Statistical analysis…

- Data were analysed by ANOVA, PROC GLM. Minitab 16, 2010…
  - Latin square effect
  - Animal effect
  - Period effect
  - Treatment effect
  - Experimental error
- P_{0600} plasmatic concentrations were used as covariable for P plasmatic concentrations observed after feeding (P_{0800})
- Significance level: $p < 0.05$
- Trend: $p < 0.1$

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Plasmatic phosphate concentrations at fasting (P_{0600}) and two hours post-*prandium* (P_{0800}) in Pelibuey × East Friesian ewes at maintenance fed different forage particle sizes

	Forage particle size						
Item	**S**		**M**		**C**		
	Mean	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**	**P**
P_{0600} (mg/L)	56.30	5.99	52.53	2.17	54.07	5.21	0.656

S = 2.54 cm; M = 5.08 cm; C = coarse.

SEM, standard error of the mean.

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- Plasma P concentrations were normal (40 - 90 mg/L; Underwood and Suttle, 2010).
- Scott et al. (1984). Sheep…
  - Adequate P supply and higher than requirements: 49 – 94 mg/L plasma
  - Adequate P supply and lower than requirements: 43 – 77 mg /L plasma

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  - Salivary P = 581.2 ± 249.0 mg/L

Apparent digestibility of crude protein, neutral detergent fiber and gross energy in Pelibuey × East Friesian ewes at maintenance fed different forage particle sizes

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	Mean	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**	
Crude protein (N× 6.25; CP)							
Intake (g/day)	89.47	8.22	78.80	5.49	78.51	6.02	0.324
Faecal (g/day)	37.39	1.61	34.86	2.58	34.47	3.99	0.592
Digestibility (g/kg CP)	578.8	63.40	554.0	25.8	564.6	25.5	0.700

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Neutral detergent fiber (NDF)							
Intake (g/day)	693.8	45.1	602.8	41.2	604.4	45.0	0.275
Faecal (g/day)	267.8	13.2	246.6	10.8	245.5	20.8	0.585
Digestibility (g/kg NDF)	613.2	22.5	581.5	15.1	594.7	12.9	0.157

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Gross energy (GE)							
Intake (Mcal/day)	5.941	0.436	5.123	0.350	5.176	0.383	0.271
Faecal (Mcal/day)	2.783	0.152	2.581	0.094	2.484	0.160	0.354
Digestibility	0.53	0.02	0.48	0.02	0.51	0.02	0.120

Apparent digestibility of dry matter, crude protein, neutral detergent fiber and gross energy in Pelibuey × East Friesian ewes at maintenance fed different forage particle sizes

Item	Mean	SEM
Dry matter (g/kg DM)	542.25	7.61
Crude protein (g/kg CP)	565.80	25.65
NDF (g/kg NDF)	596.50	16.86
Digestiblility of energy	0.52	0.02

Phosphorus balance in Pelibuey × East Friesian ewes at maintenance fed different forage particle sizes

	Forage particle size						
Item	**S = 2.54 cm**		**M = 5.08 cm**		**C = coarse**		**P**
	Mean	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**	
Phosphorus							
Intake (g/day)	1.886	0.149	1.928	0.134	1.669	0.126	0.309

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Faecal (g/day)	1.795	0.060	1.719	0.115	1.711	0.185	0.787

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Digestibility (g/kg P)	47.716	37.973	103.584	38.611	**-20.435**	**61.594**	0.080

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Urinary (g/day)	0.014	0.003	0.014	0.002	0.015	0.003	0.944

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Retained (g/day)	0.080	0.070	0.190	0.080	**-0.060**	**0.110**	0.081

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Forage particle size did not affect plasmatic or salivary P concentrations.

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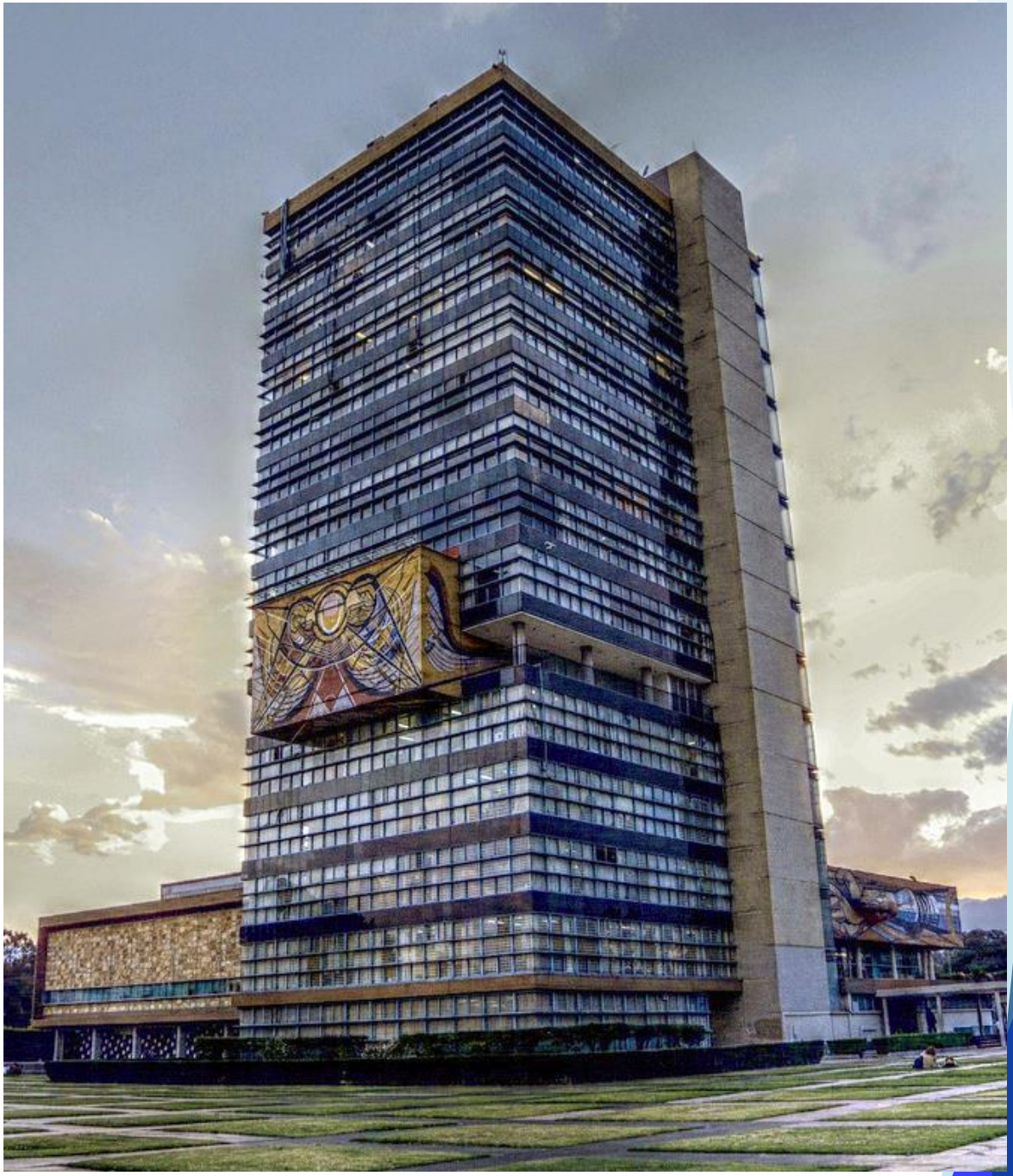
Thanks to…

the

Organizers

UNAM



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