



ULUSLARARASI
**5. HAYVAN BESLEME
KONGRESİ**

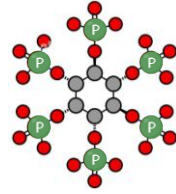
5th INTERNATIONAL ANIMAL NUTRITION CONGRESS

11-14 ARALIK 2025 / 11-14 DECEMBER 2025

Enhancing feed digestibility : *Exploring the potential of calcium humophosphate as a novel source of phosphorus*

Jetsabell GUTIERREZ VALLEJOS; Uğur KARAPIÇAK; Benjamin RIBEIRO; Amelie JUANCHICH, Edouard COUDERT

Sustainability: phosphorus bioavailability remains critical



Organic phosphorus

Present in plant-based feeds in phytate form

Low bioavailability for monogastric species (lack of endogenous phytase activity) → use of exogenous phytase in the feed



Inorganic phosphorus

Added to animal diets as supplements

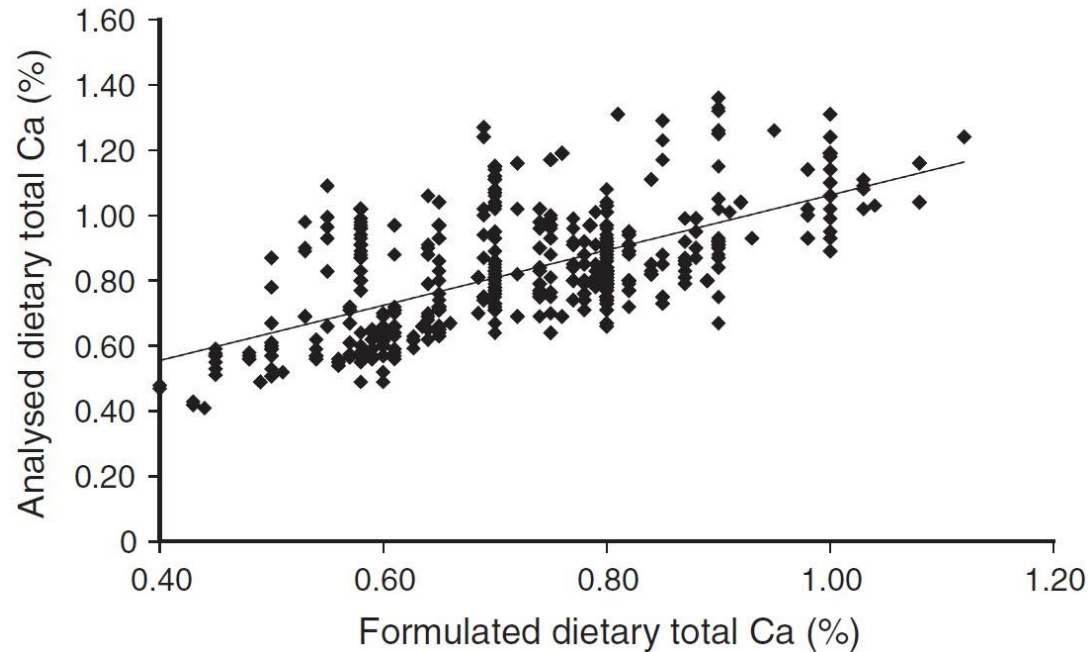
Moderate to high bioavailability

Allows precise adjustments in the diet

Environmental concerns

Proper phosphorus management in poultry diets is crucial for achieving both **efficiency** and **sustainability** in production.

Calcium (Ca): Variability in formulated diets



High variability between total **formulated** calcium and **analyzed** calcium

In 795 diets for broilers and pigs between 2010 and 2015: on average, **25% more total calcium than expected in the diet.**

*Example: diet formulated with 0.80% calcium
⇒ the analyzed value could be as high as 1.02%.*

Poor fulfillment of requirements

Calcium (Ca): Excess must be solubilized and absorbed

Ca

1

Solubilization (pH-dependent)

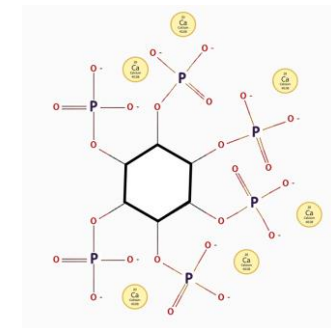
Greater calcium solubilization at low pH.

The rate of dissolution is influenced by particle size
(larger particles remain longer in the gizzard).

2

Absorption

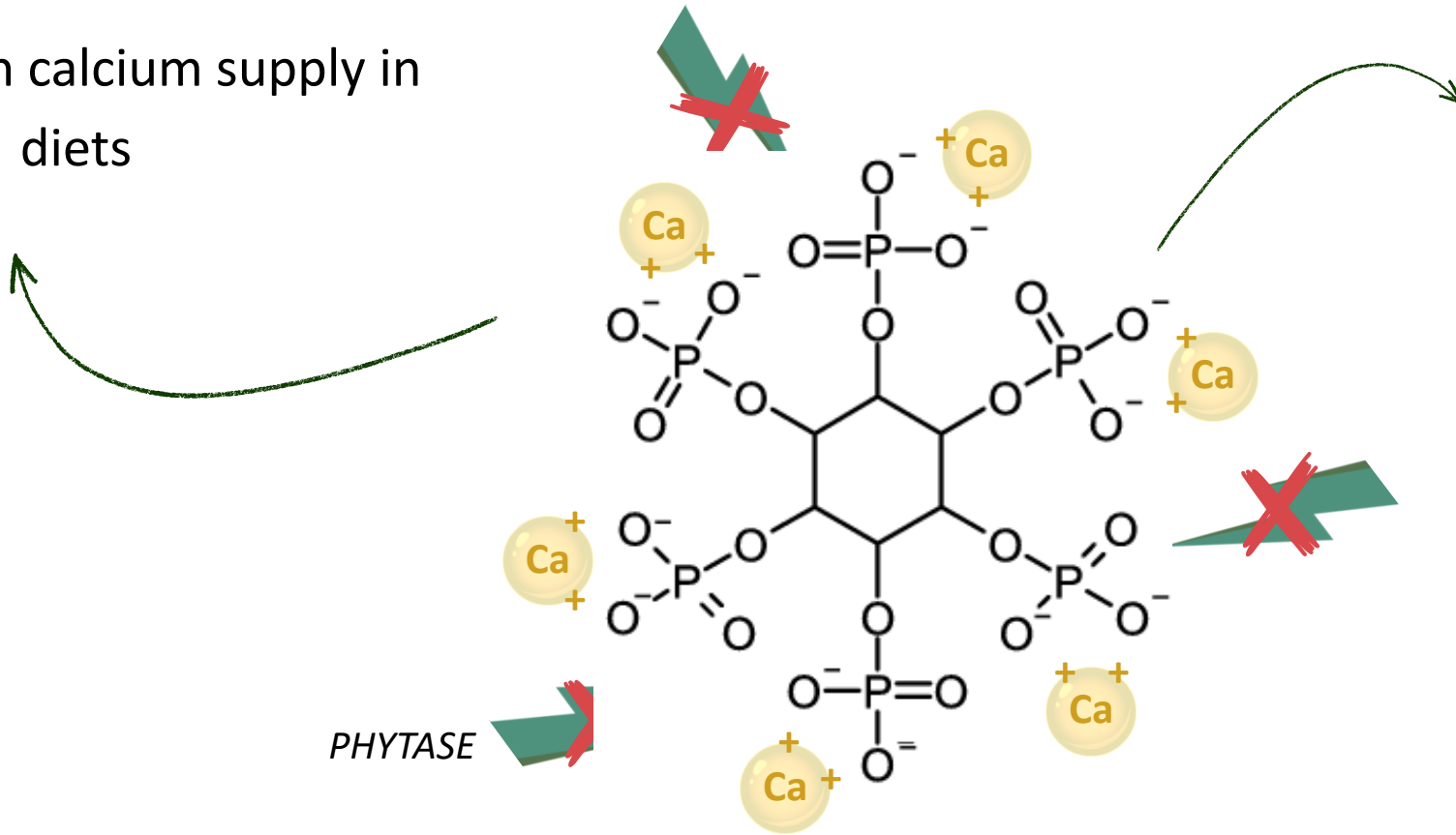
⚠ Increase in intestinal pH → formation of calcium complexes with anions such as phosphorus and phytic acid.



*Phytic acid also has affinity for other cations, but **calcium is the most abundant.***

Calcium (Ca) and Phosphorus (P): Factors that favor complex formation

Variability in calcium supply in diets



Increase in pH

Transition from stomach to intestine: from 2.5 to 6.5

CaCO₃ Acid-Binding capacity

Impact on phytase efficacy

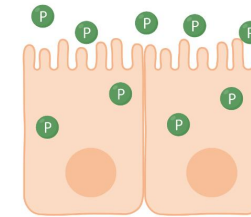
An inorganic phosphate that interacts with feed nutrient inside the gut

Properties to improve mineral and plant-based phosphorus utilization

Calcium humophosphate (CHP)

Limits Ca recomplexation in the gut

Promotes total P absorption



Allows to reduce IFP incorporation

Limits P release in the litter

≈ - 15% vs MCP¹

≈ - 40% vs DCP¹



While maintaining/improving animal performances

¹ PHOSPHEA unpublished data, 2021-2025

Digestibility trial in broilers

Replacement of MCP by Calcium humophosphate (CHP)

EXPERIMENTAL PROTOCOL

Source of



CHP: Organo-mineral complex

MCP: Mineral phosphate



Spain 2023



200 Cobb500
(10 cages of 10
broilers / treatment)

1-10 days

11-21 days

Starter
diet

Experimental
diets
MCP or CHP

- 2950 kcal AMEn/kg

- 1.22% dig LYS

- 0.94% Ca; 0.58% P

- 3030 kcal AMEn/kg

- 1.08% dig LYS

- 0.72% Ca; 0.49% P

DIET FORMULATION (11 - 21 days)

Ingredient (%)	MCP	CHP
Corn	62.9	62.8
Soybean meal	31.8	31.9
Soy oil	2.24	2.27
Limestone	1.20	1.23
Monocalcium phosphate	0.53	-
HumPHORA	-	0.55
Sodium chloride	0.35	0.35
DL-Methionine	0.28	0.28
Premix ³	0.40	0.40
L-Lysine HCl	0.21	0.21
L-Threonine	0.08	0.08
L-Valine	0.02	0.02
Calculated chemical composition (%)		
Moisture	12.5	12.5
Ash	4.66	4.71
Crude Protein	20.1	20.1
Ether extract	5.0	5.1
Neutral detergent fiber	7.99	7.98
Calcium	0.72	0.72
Phosphorus	0.49	0.49
Digestible phosphorus	0.23	0.23
Sodium	0.15	0.15
Chloride	0.29	0.29
AMEn (kcal/kg)	3030	3030
AID amino acids		
Lys	1.08	1.08
Met	0.56	0.56
Met+Cys	0.83	0.83
Thr	0.72	0.72
Trp	0.20	0.20
Ile	0.74	0.74
Val	0.86	0.86
Arg	1.18	1.18

isoP and isoCa

Supplemented with 1000 FTU/kg of phytase

Digestibility trial in broilers

Replacement of MCP by Calcium humophosphate (CHP)

MEASURED PARAMETERS

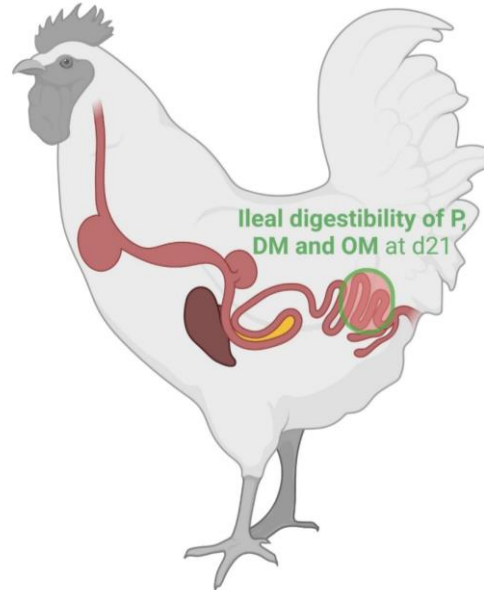
Performance parameters:

Body weight (BW)

Consumption (FI)

Average Daily Gain (ADG)

Feed Conversion Ratio (FCR)



Digestibility parameters:

$$\text{Ileal digestibility}_x (\%) = 100 - \left(\frac{T_{i_{\text{diet}}} \times X_{i_{\text{ileal}}}}{T_{i_{\text{ileal}}} \times X_{\text{diet}}} \times 100 \right)$$

P, Ca, dry matter and organic matter digestibility

STATISTICAL ANALYSIS

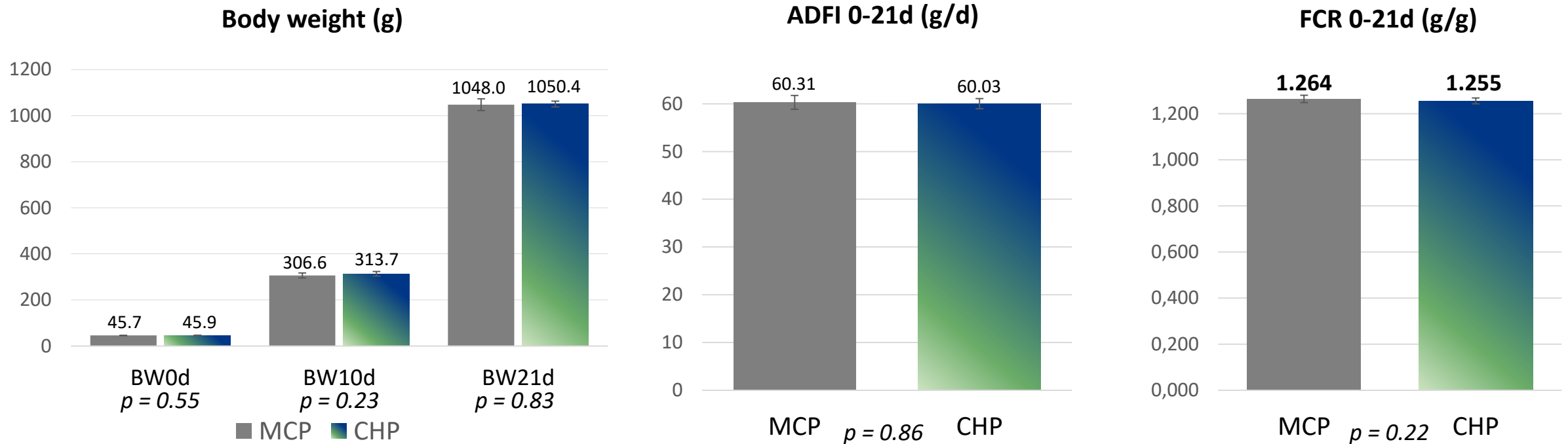
Statistical individual = cage of 10 birds

Comparison of means using Mann-Whitney U test

Digestibility trial in broilers

Replacement of MCP by Calcium humophosphate (CHP)

RESULTS – Performance

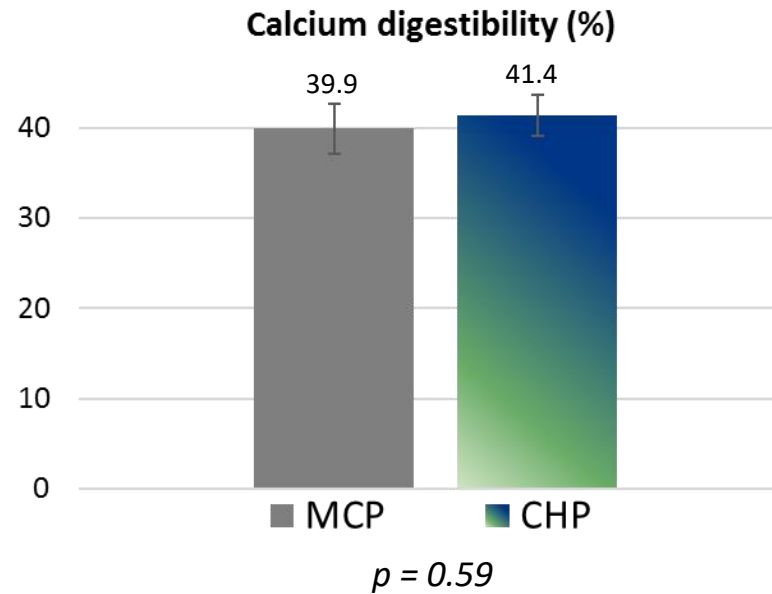
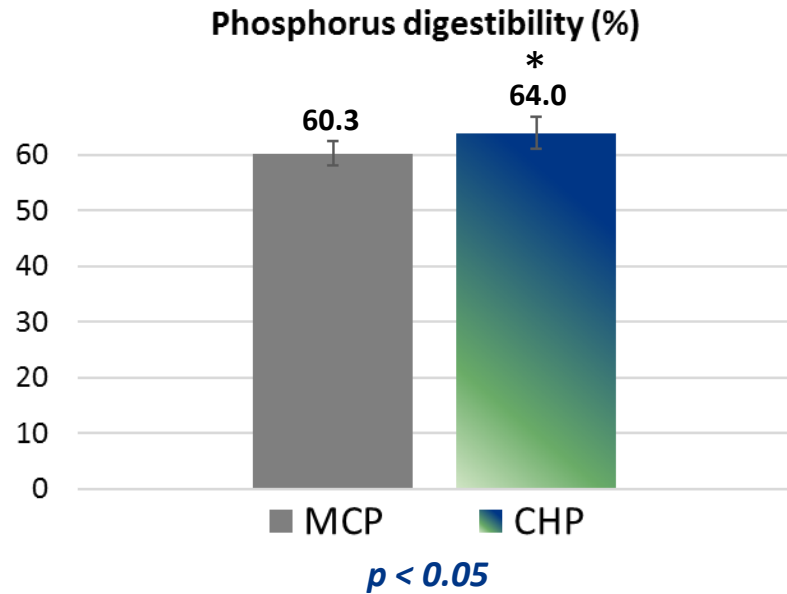


Calcium Humophosphate
✓ Maintains broiler performances

Digestibility trial in broilers

Replacement of MCP by Calcium humophosphate (CHP)

RESULTS – Digestibility



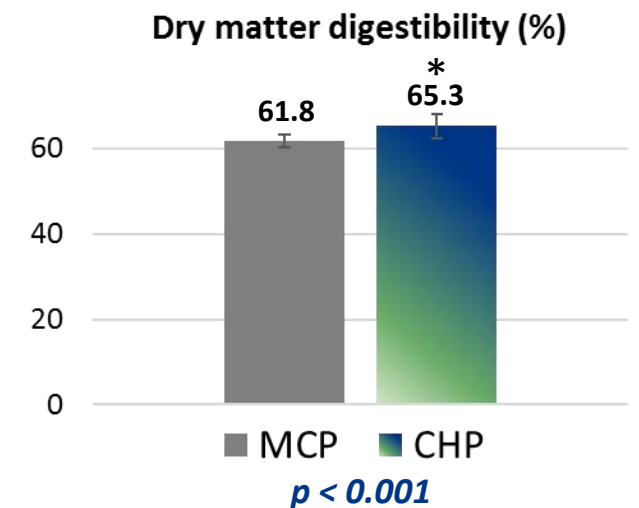
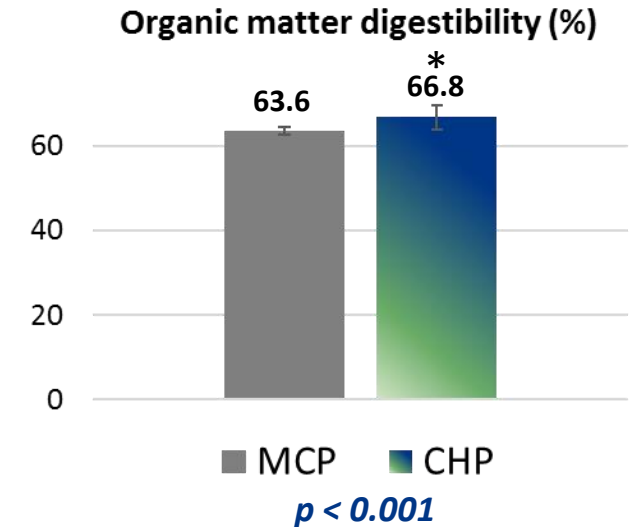
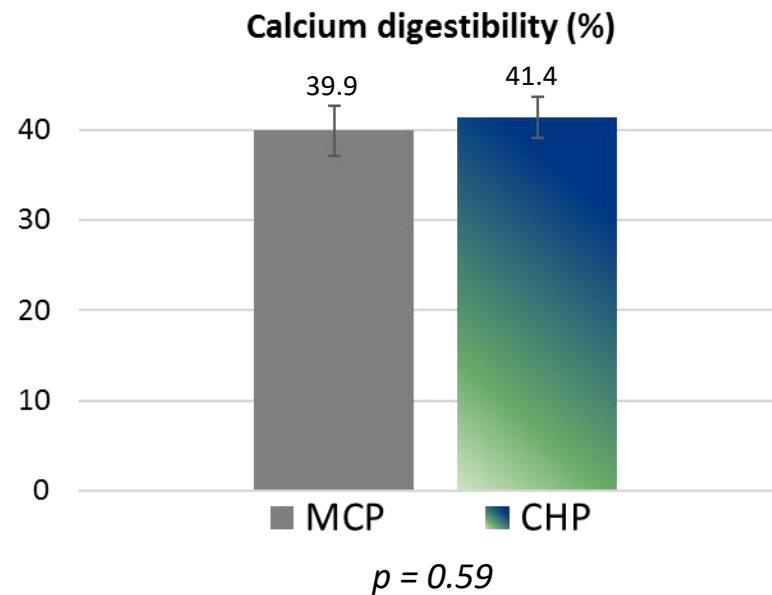
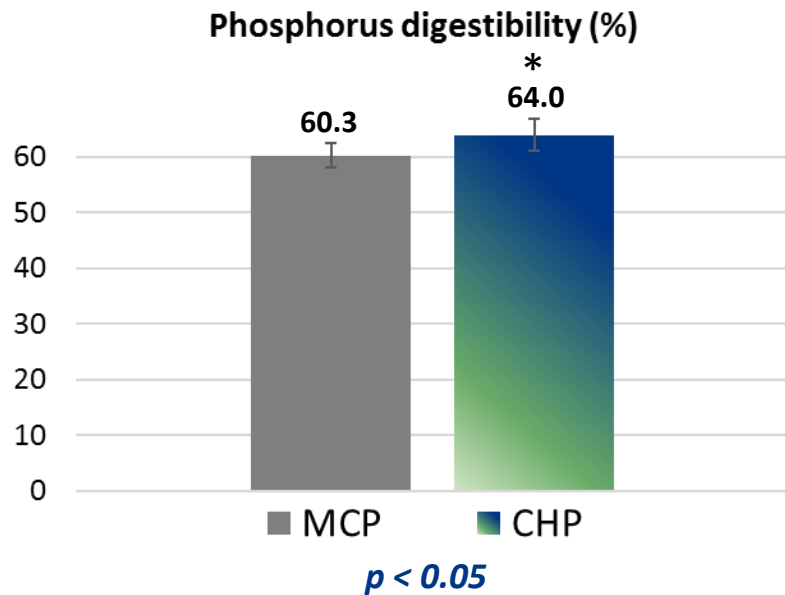
Calcium Humophosphate

✓ Better **P digestibility** than broilers fed with MCP

Digestibility trial in broilers

Replacement of MCP by Calcium humophosphate (CHP)

RESULTS – Digestibility

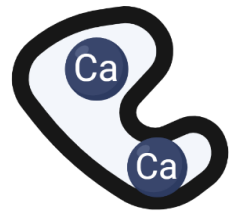
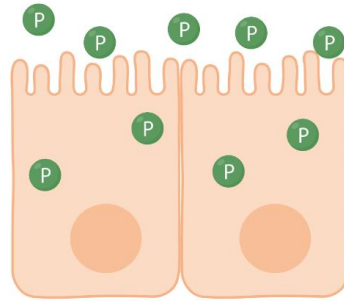
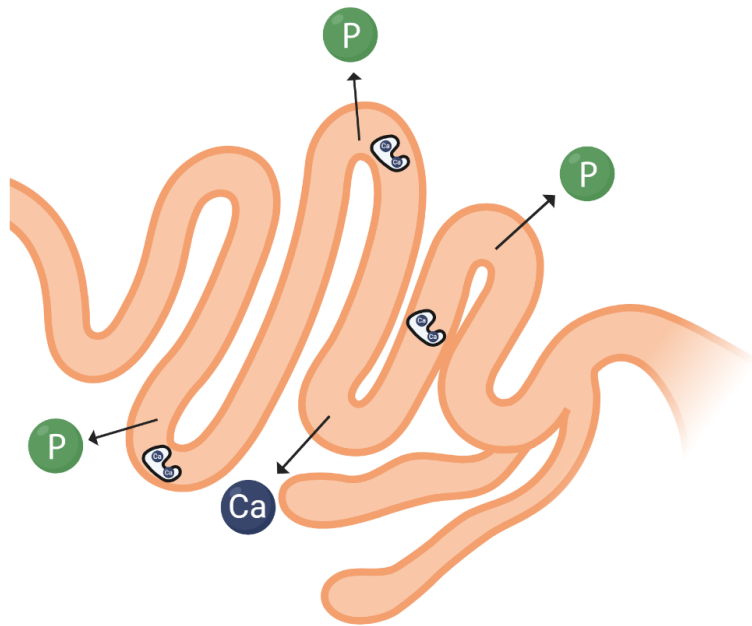


Calcium Humophosphate

- ✓ Better **P digestibility** than broilers fed with MCP
- ✓ Improvement of **dry matter** and **organic matter digestibility**

Conclusion

- ✓ Inclusion of **calcium humophosphate** in substitution of MCP as the unique source of phosphate in broiler grower diet:
 - ✓ might be used to **improve P digestibility**
 - ✓ **improves dry matter and organic matter digestibility** (protein, amino acids, ...)



Humic acids can increase nutrient absorption by enhancing villus length and ultimately **improve growth performance** (Arif *et al.*, 2019)

Chelating properties of CHP, i.e. bind with some cation minerals in excess could serve as an effective **calcium trap** → **reduces** the occurrence of **insoluble mineral complexes** (Ca-phytate protein)

Çok teşekkür ederim



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Jetsabell Gutiérrez Vallejos

Poultry Product Manager (Phosphea)

jetsabell.gutierrezvallejos@phosphea.com