UNIVERSITÄT HOHENHEIM

Determination of phosphorus availability in poultry

–The view of the European Working Group No. 2 of WPSA–

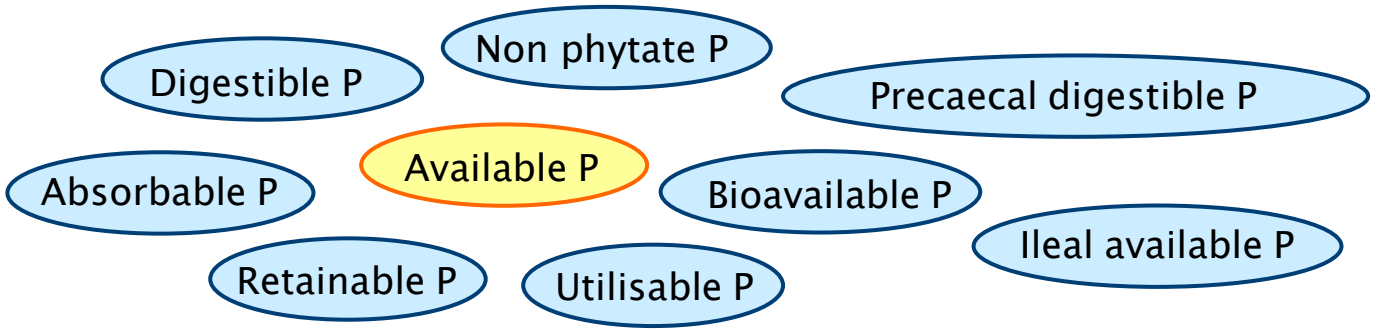
Markus Rodehutscord

First steps in P evaluation systems

- Differentiation by chemical analyses (NRC 1994, GfE 1999)
  - Total P
  - Phytate P ($InsP_6$)
  - Non phytate P (NPP), calculated as the difference
- Presumptions on efficiency of utilisation
  - Phytate P: 0%
  - NPP: 70% (or “high”)
  - Not more than rough approximations

This simple differentiation was an improvement, but not close enough linked to the digestive capacity of the animal.

- Framework
  - Increasing awareness about limited global raw phosphate stores
  - High cost of feed phosphates
  - Relevance of P excretion for the environment
  - Great variability in P availability of feed raw materials
  - Diversity of available P systems/requirements/determination



- WPSA Working Group No 2: Nutrition initiated a sub-committee to standardise and suggest an available P system (ESPN 2009 in Edinburgh)

Definition

Available P

Available P is the part of dietary total P
that, at marginal level of P supply,
can be utilised to cover the P requirement of an animal.

- It is a feed quality criterion and describes the potential of a diet or a raw material.

Available Phosphorus System

- A standard system of **available P** links raw material evaluation, phytase evaluation, and requirement modelling
- The three working packages of the P sub-committee
  1. Suggest harmonisation of P evaluation and develop a **standard protocol** for the determination of available P
  2. Compile a **feeding table** of available P of feed raw materials
     - based on published literature
     - identification of need for further experiments
  3. Model the **requirement** of available P of different poultry species/categories

- Members of the P sub-committee of the Working Group No. 2

  - Mike Bedford, UK
  - Machiel Blok, The Netherlands
  - Franco Calini, Italy
  - Evelyn Delezie, Belgium
  - Dieter Feuerstein, Germany
  - Maria Francesch, Spain
  - Pierre-André Geraert, France
  - Agnès Narcy, France
  - Yael Noy, Israel
  - Markus Rodehutscord, Germany
  - Sanna Steenfeldt, Denmark

Standard protocol for the determination of available P

- Completed

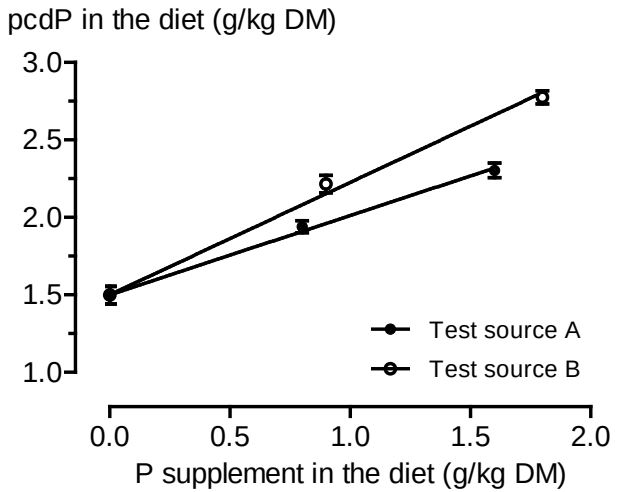
10.1017/S0043933913000688

Working Group Report

Determination of phosphorus availability in poultry

Working Group No 2: Nutrition of the European Federation of Branches of WPSA

- Recommendation: determination of precaecal P digestibility (**pcdP**) as the measure of P availability
- Principle:
  pcdP of a given feedstuff tested by a linear regression approach



Standard protocol for the determination of available P

- Technical details of the protocol
  - Animals (broilers)
  - Pre-experimental and experimental feeding, including limitations for P and Ca
  - Examples for test diets and favourable feed ingredients
  - Duration of experiments
  - Digesta collection details
  - Calculations
  - etc.
- Specific details for testing of supplemented phytase
- Unresolved questions

Standard protocol for the determination of available P

- Relevance
  - End of *confusio lingarum* about P availability
  - Standard for the evaluation of feed raw materials, effects of technological treatment and/or feed additives
  - Results from different labs will be better to compare
  - Limited global research resources can be used more effectively
- Consideration by the scientific community and in the editorial work of scientific journals
- Protocol is open for improvement/adjustment to new findings (no “closed shop”)

Do Research !

Feeding table of available P of feed raw materials

- Working steps
  - Comprehensive review of the literature
  - Selection of data based on standards set with the new protocol or similar to it
  - Precaecal digestibility or retention
- 68 references were eventually considered, providing data for approximately 40 raw materials
- Still the data set is very heterogeneous

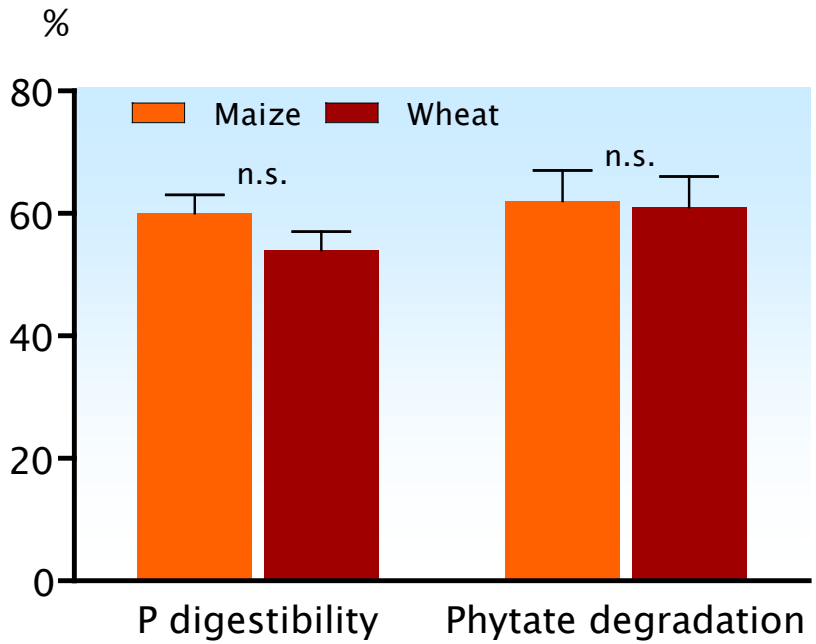
Literature data on P utilisation of broilers (%)

	Mean	Min.-Max.
Maize *(n=7)*	42	27 – 73
Soybean meal *(n=20)*	56	27 – 71
$CaNaPO_4$ *(n=3)*	60	55 – 63
$CaHPO_4$ anh. *(n=4)*	51	29 – 65

WPSA-Working Group (unpublished)

This can only be understood by looking at phytate degradation and factors affecting it

Broiler's potential for phytate hydrolysis



Broiler study

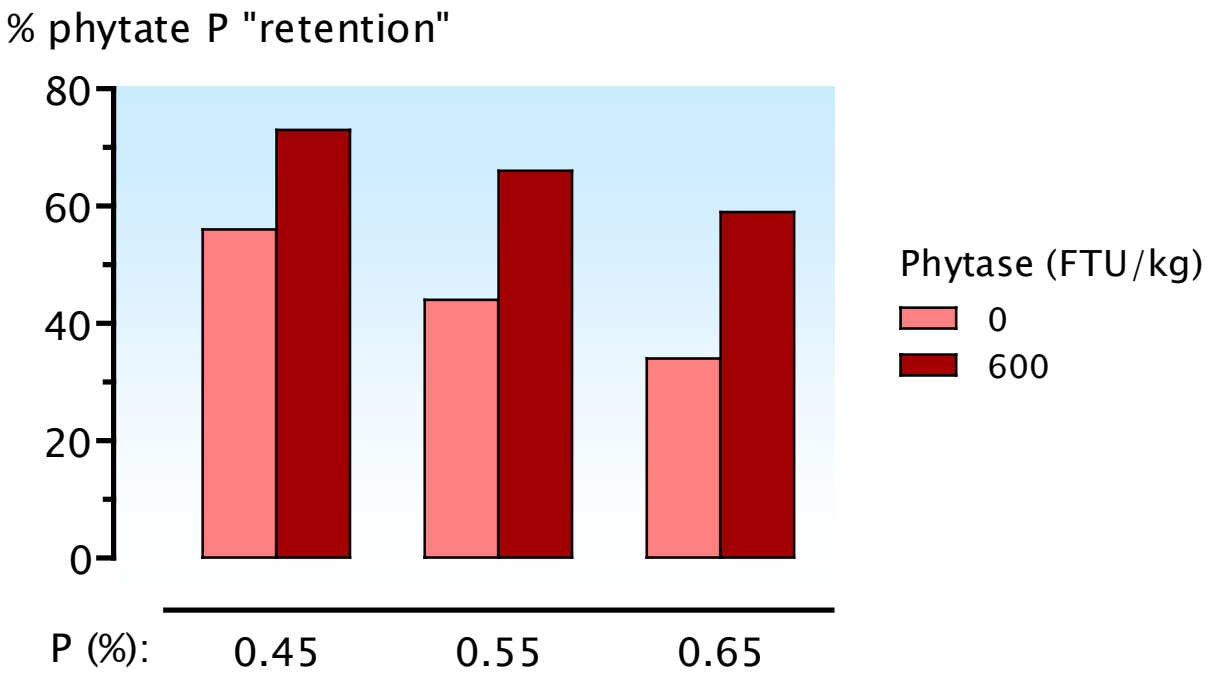
2 types of diet
- Maize-based: <100 FTU/kg
- Wheat-based: 702 FTU/kg

No mineral P supplement

Measurements in the terminal ileum

Shastak et al. (2014)

Effects of P supplements



Data pooled across Vit. D levels

Mitchell & Edwards (1996)

Feeding table of available P of feed raw materials

- Very high variability for some raw materials
  - Care in using mean values in feed formulation
  - Need for understanding the reasons of variability and for the development of prediction approaches
- Can the data set be extended by consideration of bone data (relative bioavailability)?

- Working steps
  - Only tibia, toe and foot ash data were used (since 1980)
  - Selection criteria for studies similar to the other data set
  - 109 publications were considered
- Recalculation (transformation)
  - Relative bioavailability of the test P source
  - Availability of the reference P source taken from the quantitative data set (if existent)
  - Calculation of availability of the test P source based on both
- Comparison of raw materials that have both recalculated data and quantitative data

Can the data set be extended by consideration of bone data (relative bioavailability)?

No

Working package 3:
Model of requirement of available P

- Awaits to be started
- Initial model will be on broilers and based on published information on growth, body composition, bone development

Summary

- Important milestones have been reached
  - Agreement on what “available P” is
  - Standard protocol for the determination developed
  - Literature survey on relevant data completed
- Requirement modelling still needs to be done before the whole system can be implemented
- Expected benefits
  - More and comparable information for the industry both on raw materials and requirements
  - Better use of limited research resources
  - Contribution of the sector to sustainable food production through saving limited global resources