INSIGHTS INTO EUROPEAN PET FOOD TRENDS AND INNOVATION

PETFOOD FORUM EUROPE

6 May, 2024

Nuremberg, Germany

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Co-located with

Interzoo 2024

In vitro mineral accessibility in commercial vegetarian and vegan dry dog foods

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May 6th 2024

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GHENT UNIVERSITY

Vegan / vegetarian human food

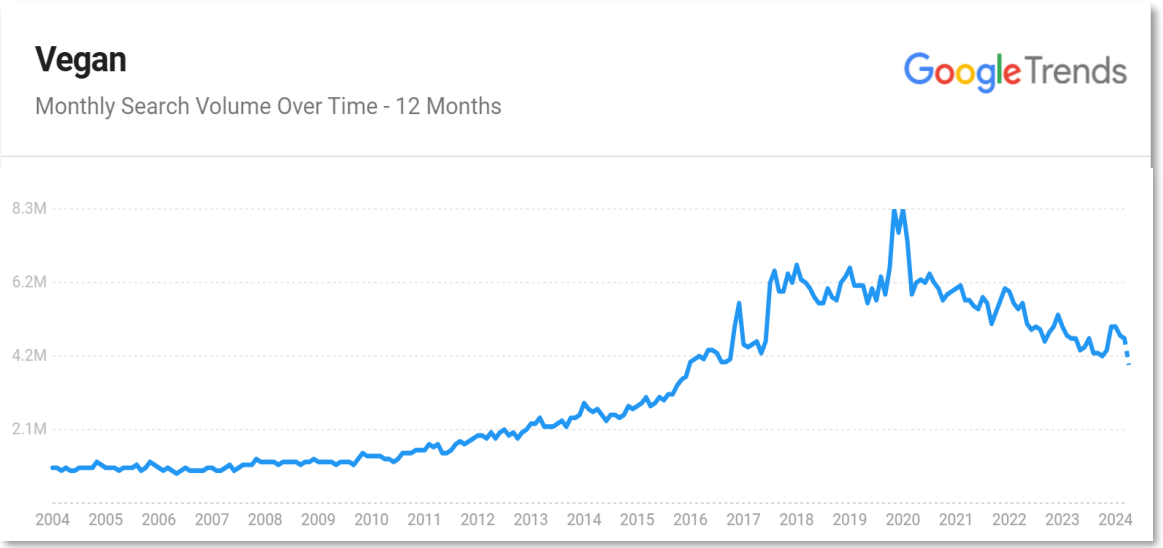
Sustainability benefits of transitioning from current diets to plant-based alternatives or whole-food diets in Sweden

Anne Charlotte Bunge, Rachel Mazac, Michael Clark, Amanda Wood & Line Gordon

Denmark: The major pork producer trying to wean itself off eating meat

1 December 2023

By India Bourke, Features correspondent



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(Bunge et al., 2024; Bourke, 2023)

Vegan / vegetarian petfood

Protein sources, e.g.
Peas
Soybean
Lentils
Corn gluten
Potato protein isolate
Rice protein isolate
Corn protein isolate
Pea protein concentrate

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Vegan /vegetarian pet food may contain ANFs

Phytic acid
2.1 - 9.8
6 - 21
2.7 - 15.1
15 - 16
10 - 20
Unknown
Unknown
Unknown

*mg g^{-1} DM

Big range

Phytic acid

Reduce bioavailab

Polyphenols

Reduce bioavailab

Lectins

Interfere with dig

Saponins

Reduce bioavailab

Protein sources, e.g.
Peas
Soybean
Lentils
Corn gluten
Potato protein isolate
Rice protein isolate
Corn protein isolate
Pea protein concentrate

d starch

d carbohydrates

nt absorption

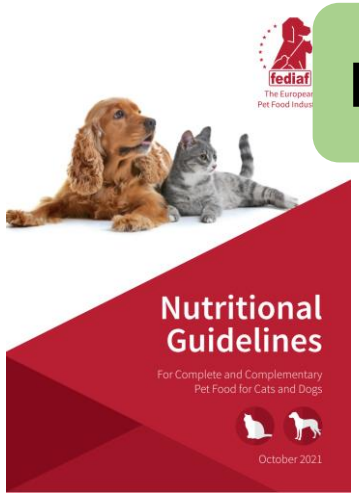
vitamins

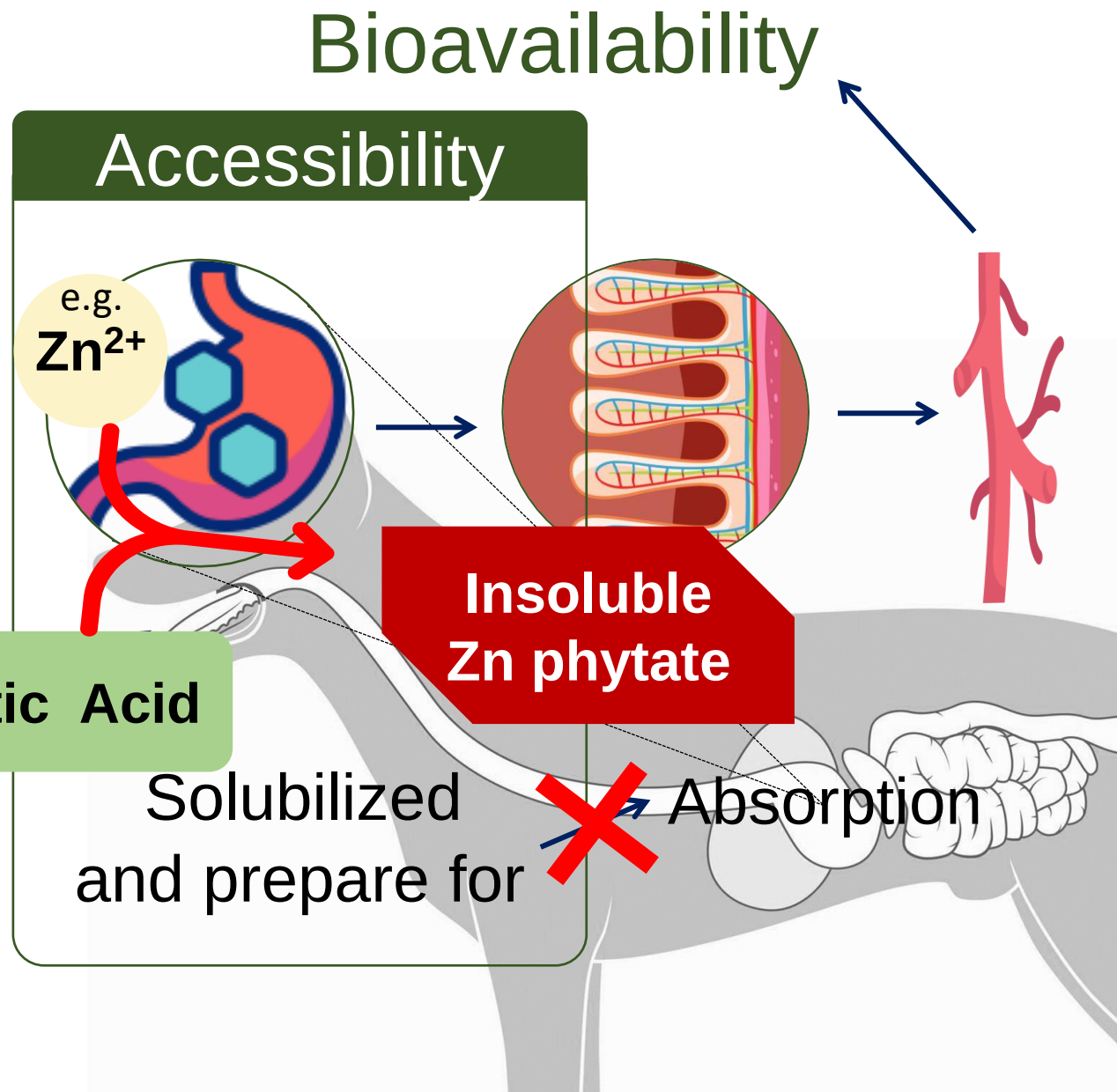
(Tomaz et al., 2022; De Angelis et al., 2021; Samtiya et al., 2021; Muttagi & Ravindra, 2020; Hejdysz et al., 2015; Staessen, 2014; Phillippy et al., 2004)

Guidelines and theory

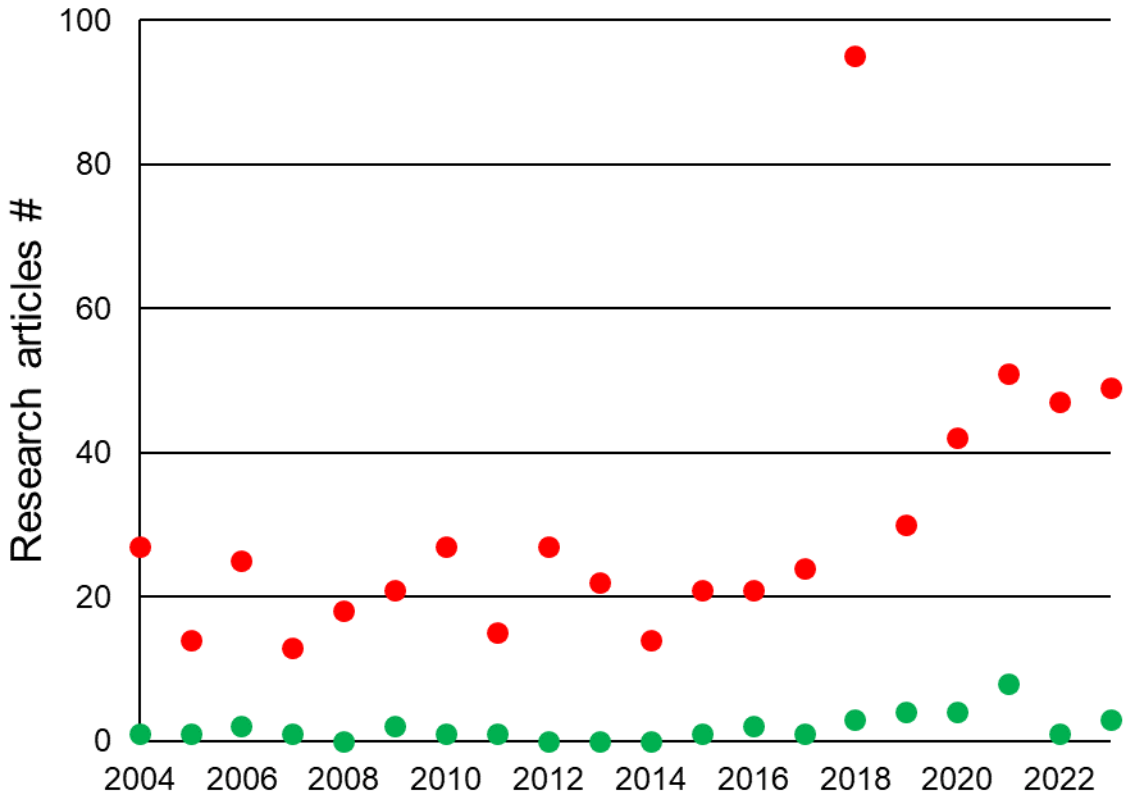
Footnotes

g. The bioavailability of minerals should be carefully considered in diet formulas where the concentration of these nutrients is close to the recommended amounts. For example, in high fiber diets and in formulas where plant based raw materials rich in phytate are used as the main source of phosphorus.





Current knowledge



Scopus

Dog + Food + Mineral

Dog AND food AND mineral AND NOT plant-based AND NOT vegan AND NOT vegetarian

Dog + Food + Mineral + Vegan / Vegetarian

Dog AND food AND mineral AND plant-based OR vegan OR vegetarian

***In vitro* selenium accessibility in pet foods is affected by diet composition and type**

Mariëlle van Zelst[1], Myriam Hesta[1], Lucille G. Alexander[2], Kerry Gray[2], Guido Bosch[3], Wouter H. Hendriks[3,4], Gijs Du Laing[5], Bruno De Meulenaer[6], Klara Goethals[7] and Geert P. J. Janssens[1*]

Article

Iron Bioaccessibility and Speciation in Microalgae Used as a Dog Nutrition Supplement

Thomas Dalmonte *, Carla Giuditta Vecchiato, Giacomo Biagi, Micaela Fabbri, Giulia Andreani and Gloria Isani

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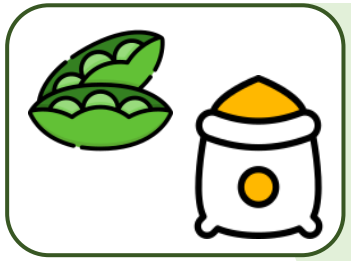
Limited data available on mineral accessibility

Study aim

Understand mineral accessibility in commercial vegan / vegetarian dog foods

Animal- vs. plant-based foods



Entire grain flour vs. protein concentrate/isolate

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Study design

Product inventory

ICP

In vitro incubation

ICP

Google
zooplus
VegaVriend
Dé webshop voor vega huisdieren

Recorded from labels:
-Main protein sources
-ME content

Food base	Protein sources, e.g.
7 × Animal	Chicken, poultry
8 × Plant | Entire	Soybeans, peas, lentils
7 × Plant | Conc. / isol.	Protein isolate (rice, potato), corn gluten

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Study design

Product inventory

ICP

In vitro incubation

ICP

Gastric phase with pepsin

↓

Intestinal phase with pancreatin and bile acid

↓

Filtration

ICP-OES:
Mineral content analysis

$[M]_{food}$ $[M]_{residue}$

Mineral accessibility

$$1 - \frac{[M]_{residue}}{[M]_{food}}$$

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Calculations

Mineral content

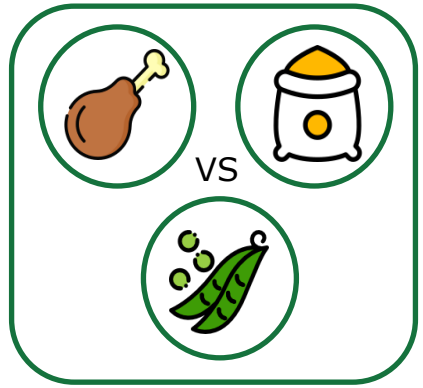
v.s.

Recommended allowance

Accessible mineral

v.s.

Minimal requirement



Allowance. An Allowance or Recommendation for daily intake (RI component tha nutritional nee reflects the minimum requirement plus a safety margin for differences in availability between individual animals and for nutrient interactions. In practice this would be translated as

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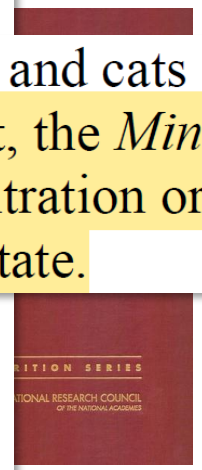
The nutrient requirement data for dogs and cats are provided in four distinct categories, presented in tabular form. First, the *Minimal Requirement* (MR) is given; this term is defined as the minimal concentration or amount of a bioavailable nutrient that will support a defined physiological state.



VA
nt
-Flour vs. Isolate

Mineral content

Animal-based

- Four out of 7 foods are below Mg or K recommendation

Plant-based

- Eight out of 15 plant-based foods are below Ca, Mg, K, Zn, or Cu recommendation
- Larger variation than animal-based dog foods

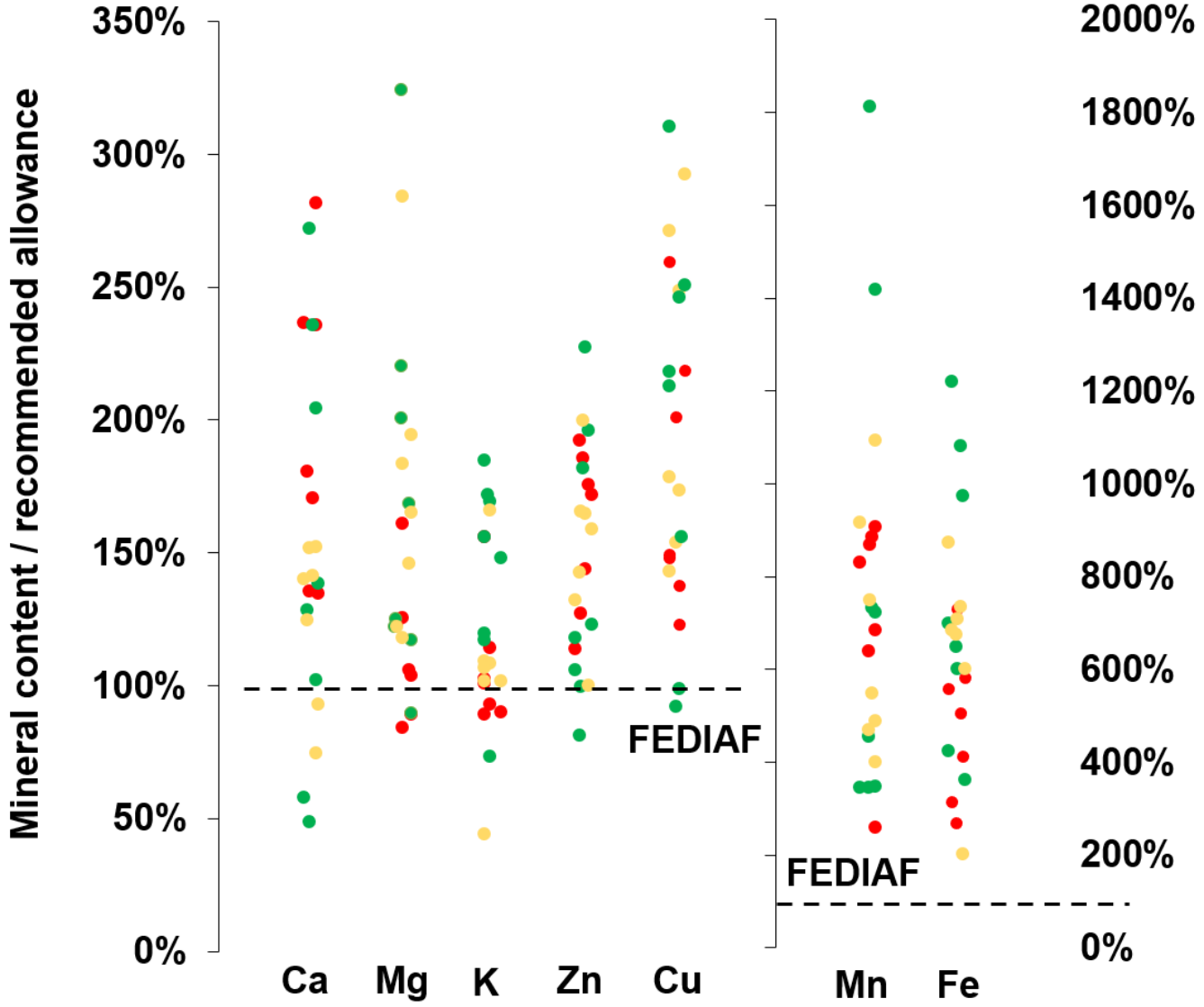


Table VII-17$_d$
Recommended nutrient levels for complete food for adult dogs based on a MER of 95 kcal ME/kg$^{0.75}$

(FEDIAF, 2021)

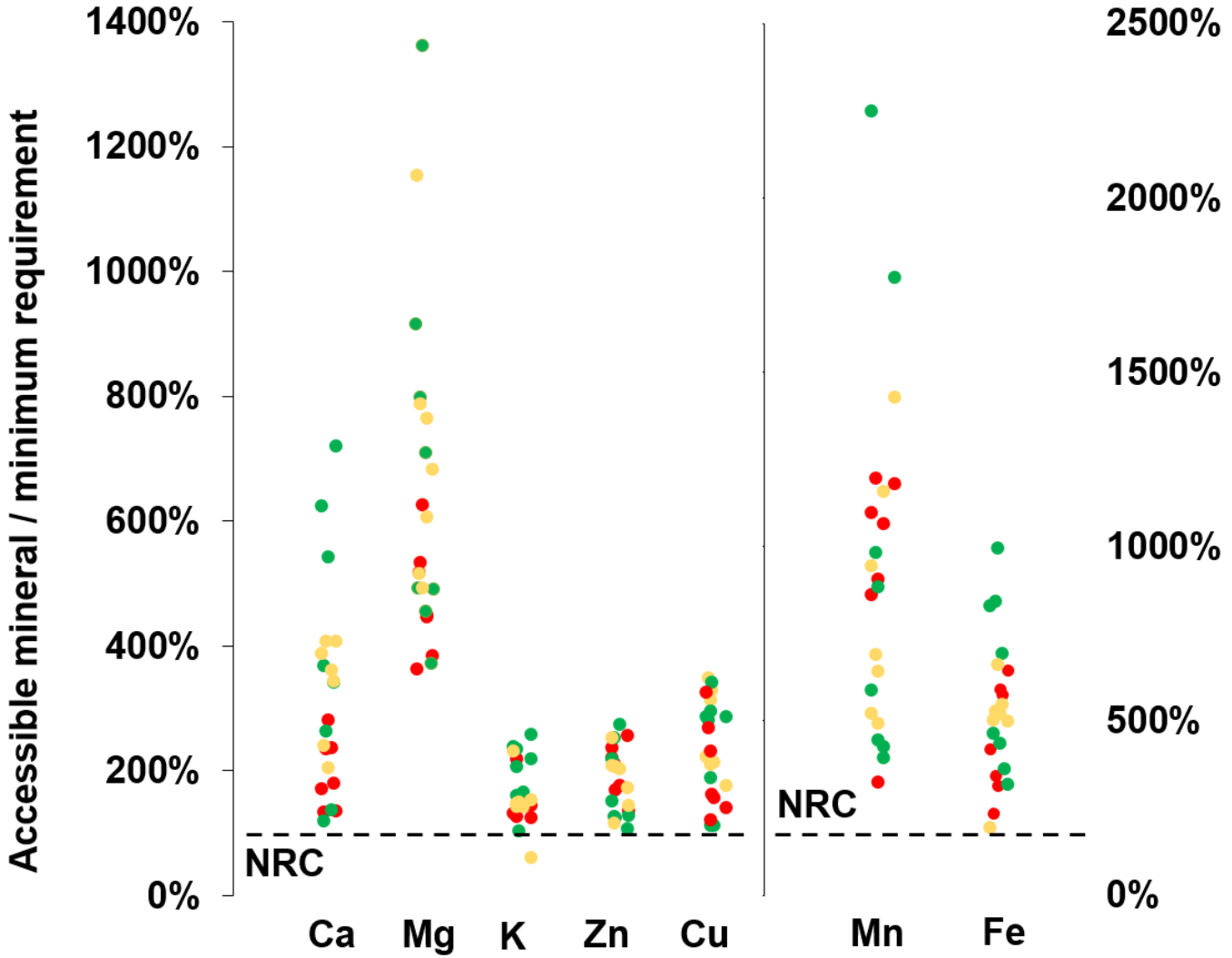
Accessible minerals

Animal-based

- All above minimal requirement

Plant-based

- Larger variation than animal-based in Ca, Mg, Mn, and Fe
- One of 15 plant-based foods below minimal requirement



- Animal-based dog foods
- Entire legume flour-based dog foods
- Concentrate / isolate-based dog foods

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TABLE 15-5 Nutrient Requirements of Adult Dogs for Maintenance

(NRC, 2006)

Mineral accessibility comparison

	Animal-based	Plant-based
Ca	95.1%[a]	90.6%[b]
Mg	94.7%[a]	92.2%[a]
K	97.5%[a]	96.1%[a]
Zn	91.4%[a]	88.2%[a]
Cu	80.5%[a]	88.5%[b]
Mn	93.4%[a]	89.7%[b]
Fe	67.1%[a]	58.5%[b]

	Entire	Conc. /isol.
Ca	89.2%[a]	92.3%[a]
Mg	91.5%[a]	93.1%[a]
K	96.0%[a]	96.2%[a]
Zn	88.5%[a]	88.1%[a]
Cu	87.2%[a]	90.1%[a]
Mn	89.8%[a]	89.7%[a]
Fe	59.6%[a]	57.5%[a]

*Numbers in the same row with different superscript differ significantly.

- Ca, Mn, and Fe less accessible in plant-based dog foods
- Cu more accessible in plant-based dog foods
- Similar values for plant-based foods with entire and conc. / isol. protein sources

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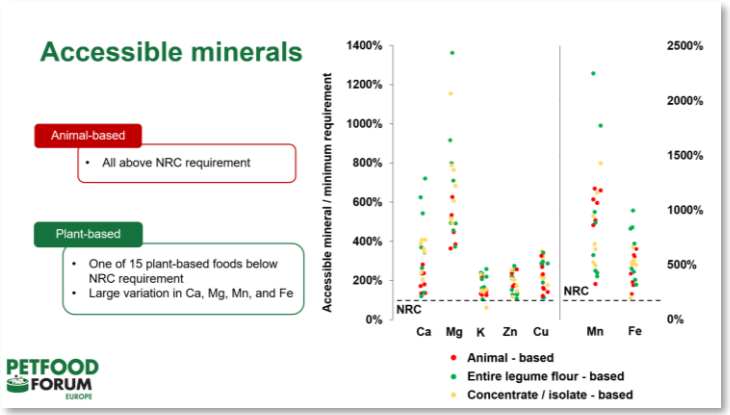
Adapting for plant-based ingredients

Plant-based dog foods follow traditional guidelines ?



Consider a larger safety margin for allowance?

Mineral accessibility comparison

	Animal-based dog foods	Plant-based dog foods
Ca	95.1%[a]	90.6%[b]
Mg	94.7%[a]	92.2%[a]
K		
Zn	91.4%[a]	88.2%[a]
Cu	80.5%[a]	88.5%[b]
Mn	93.4%[a]	89.7%[b]
Fe	67.1%[a]	58.5%[b]

	Concentrate/isolate -based dog foods	Entire legume flour -based dog foods
Ca	92.3%[a]	89.2%[a]
Mg	93.1%[a]	91.5%[a]
K		
Zn	88.1%[a]	88.5%[a]
Cu	90.1%[a]	87.2%[a]
Mn	89.7%[a]	89.8%[a]
Fe	57.5%[a]	59.6%[a]

*Numbers in the same row with different superscript differ significantly.

- Ca, Mn, and Fe less accessible in plant-based
- Cu more accessible in plant-based
- Same between concentrate/isolate based and entire legume flour-based

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Further research?

Examine ANFs quantity and variation in accessibility

Explore more factors such as processing effect on ANFs & mineral ratio

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Takeaways

1. Lower mineral accessibility (except Cu) in plant-based dry dog foods.
2. Reflect on better adherence to guidelines.
3. Reflect on safety margin for recommended allowance.
4. Extend knowledge on mineral accessibility.

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Thank you!

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