The Digestiblity of Phosphorus in Dicalcium Phosphate in Pigs

A.S. Leaflet R1956

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Summary and Implications

The digestibiltiy of P in dicalcium phosphate, a P source considered to have a high relative bioavailability , was determined to be 68.1 % in pigs. The digestibility of the phosphorus was not altered by dietary calcium/available P ratio or stage of pig growth (10 vs 30 kg body weight).These data highlight the opportunity/incentive for technologies aimed at improving P digestibility in P sources (inorganic P sources) with high relative phosphorus bioavailabilities.

Introduction

In recent years, substantial progress towards improving the P digestibility in plant sources has been achieved through the use of dietary phytase additions. However, digestibility of P in inorganic sources has received little attention and is not well characterized. The bioavailability of P in dicalcium phosphate is considered to be 95 to 100% when expressed as a percentage of monosodium or monocalcium phosphate bioavailability. However, the actual digestibility of P in dicalcium phosphate is lower than 100%. Further questions arise concerning the impact of dietary calcium (Ca) concentration on dietary and/or inorganic P digestibility. Therefore, the objectives of this research were to determine the digestibility of dicalcium phosphate P in pigs and to determine the effects of dietary Ca/P regimen and stage of pig growth on its digestibility. These P digestibility estimates for a major inorganic P source will be useful in determining the opportunity/incentive for future technological advances for improving P digestibility in inorganic P sources.

Materials and Methods

Pigs were self-fed diets containing .2, .3, .4, .5, .6 or .7% bioavailable P (aP, based on analyzed P x % bioavailability of P in each ingredient) from 7 to 32 kg BW. The relative % bioavailability values assigned to P sources by the National Research Council (NRC, 1998) were used. Fifteen sets of six littermate barrows were allotted within litter to one of six P regimens consisting of a basal, corn-soy-whey diet (.56% analyzed P) supplemented with incremental additions of dicalcium phosphate (17.94% analyzed P) at the expense of starch-limestone. Dietary calcium was either fixed in each of the 6 diets at 1.15% (dietary Ca/aP ratios of 5.8, 3.8, 2.9, 2.3, 1.9, and 1.6, respectively) or adjusted in each diet to achieve a 2.5 to 1 Ca/aP ratio.

Dietary P digestibility and absorption-excretion were determined in each pig for 4 days at body weights of 10 and 30 kg. Digestibility of P in dical was estimated by subtracting basal diet contributions to P intakes and P absorption-excretions of each pig during each stage of growth and then regressing the daily intake of added dical P against dical derived P absorbed from the GI tract. The digestibility of dical P was estimated as the slope of absorbed dical P/ intake of dical P.

Results and Discussion

The digestibility of dicalcium phosphate P (slope of absorbed dical P/ intake of dical P, $R^2 = 0.89$) was estimated as 68.1 1.9% (inclusive of both Ca/P regimens and stages of growth). Digestibility of dical P in diets containing a fixed dietary Ca concentration (1.15%, dietary Ca/aP ratios of 5.8, 3.8, 2.9, 2.3, 1.9, and 1.6, respectively) was estimated to be 73.3 ± 5.8% (R^2= 0.77; Fig 1a) and 70.5 ± 3.5% (R^2 = 0.90; Fig 1b) for pigs at body weights of 10 and 30 kg, respectively. Similarly, digestibility of dical P in diets containing a constant 2.5 to 1 dietary Ca/aP ratio was estimated to be 72.1 ± 3.6% (R^2 = 0.92; Fig 2a) and 67.5 ± 4.9% (R^2 = 0.84; Fig 2b) for pigs at BW of 10 and 30 kg, respectively. With the observed standard errors for P digestibilities in this research, differences in the digestibility of P from dicalcium phosphate due to dietary calcium regimen or stage of pig growth were not discernible.

Conclusion

These data highlight the opportunity/incentive for technologies aimed at improving P digestibility in P sources (inorganic P sources) with relatively high phosphorus bioavailabilities.

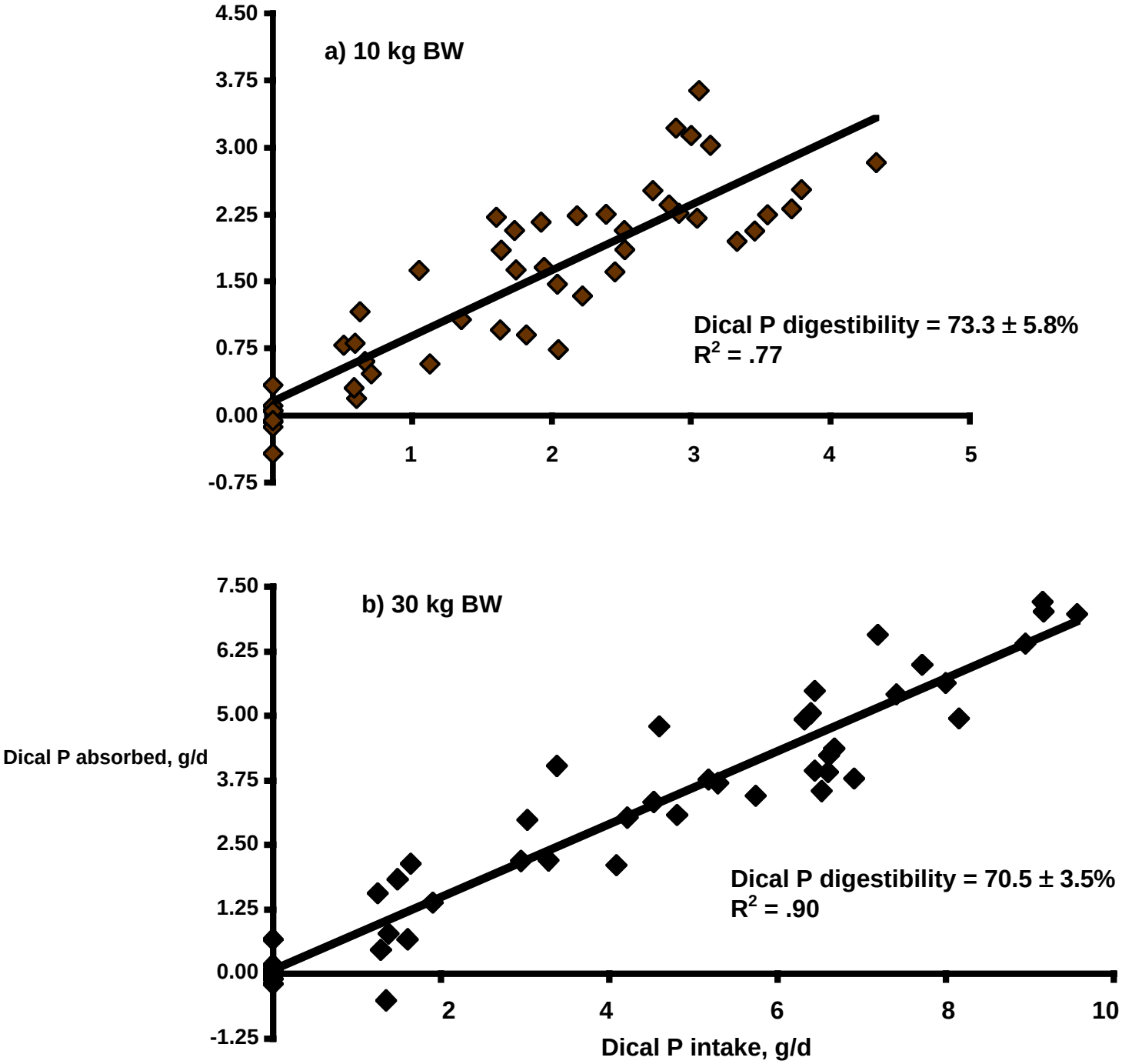

Fig. 1) Digestibility of dicalcium phosphate P in pigs at 10 and 30 kg BW and fed diets containing a constant concentration of dietary Ca

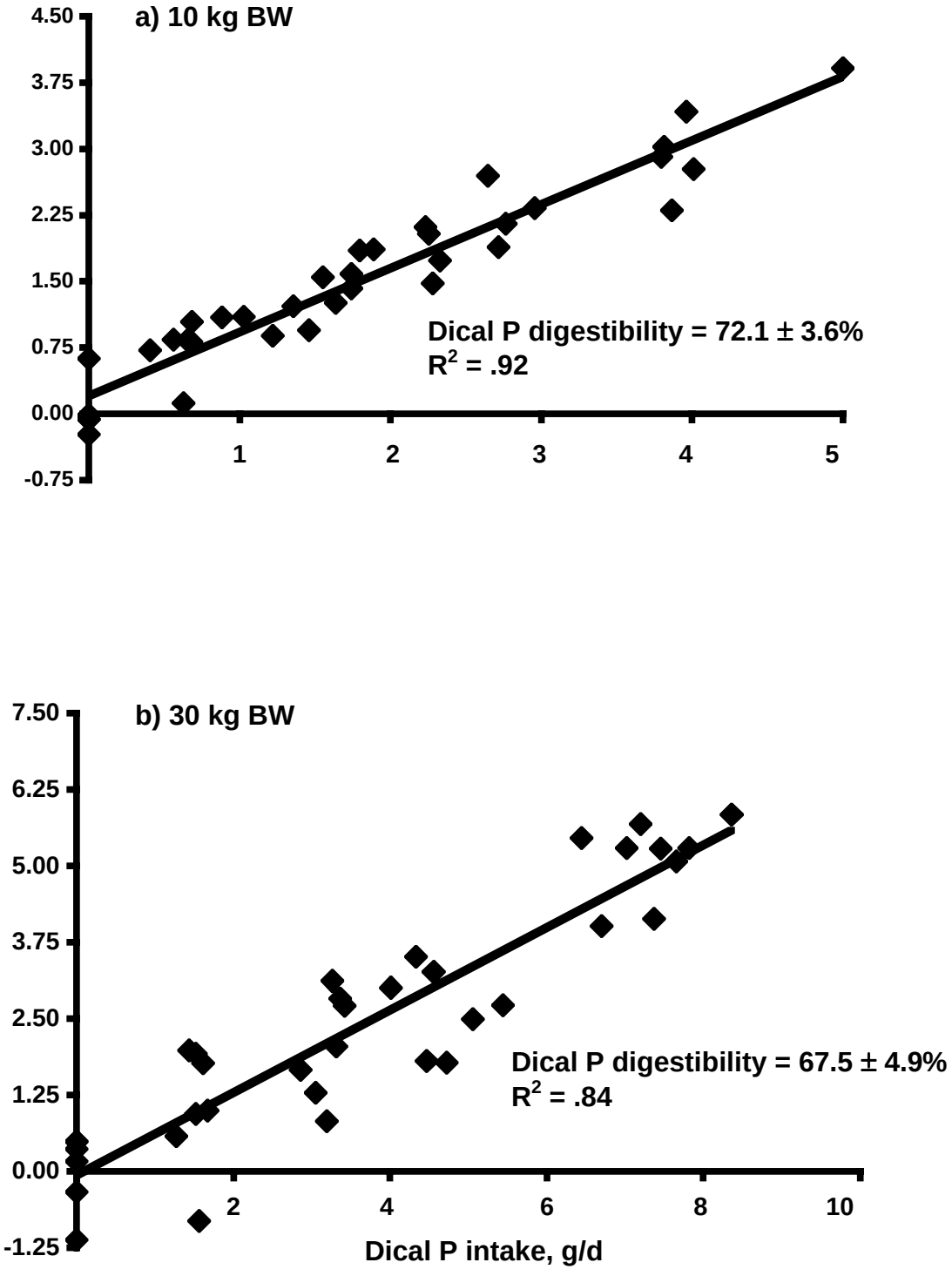

Fig. 2) Digestibility of dicalcium phosphate P in pigs at 10 and 30 kg BW and fed diets containing a constant dietary Ca/aP ratio