

**RELATIONSHIPS BETWEEN INTAKE AND EXCRETION FOR NITROGEN AND PHOSPHORUS IN HORSES. L. Lawrence, J. Bicudo, J. Davis and E. Wheeler. Presented at the 18<sup>th</sup> Equine Nutrition and Physiology Symposium, June 2003.**

To examine the relationship between intake, excretion and retention of nitrogen and phosphorus, refereed and non-refereed publications were searched for data pertaining to N and P excretion by horses. To be useful, each data set had to 1) provide information on the age of the horses or ponies used; 2) describe whether the horses were exercised; 3) describe the daily amount of nutrient consumed per kg of BW; and 4) describe the daily amount of nutrient excreted in urine and feces per kg of BW. Most data sets reported only mean values for treatment groups and thus only mean values were used in this summary. Data were separated into two data sets for each nutrient: SED, included only horses and ponies that were not receiving regular exercise and EX, included horses and ponies receiving regular exercise. Within each data set for each nutrient the relationship between intake and excretion was examined using linear regression. Excretion values represented the sum of losses in urine and feces and did not account for other avenues of loss.

For N, eight research reports were found that presented 46 paired intake and excretion values. There were 32 N values for SED and 14 for EX. Daily N intake ranged from 0.13 to 0.53 g/kg BW. These N intakes represent crude protein intakes of 406 to 1656 g/d for a 500 kg horse. Mean N retention was higher ( $P < 0.05$ ) for EX (0.093 g/kgBW) than SED (0.053 g/kgBW). Because only urine and fecal losses were accounted for here, these values probably overestimate true retention. Other routes of daily N loss include sweating and hair shedding. For SED, N excretion was related to intake by the relationship  $y = 0.586x + 0.0554$  ( $r^2 = 0.76$ ), where  $y =$  N excretion in g/kg BW/d and  $x =$  N intake in g/kg BW/d. For EX, the equation was  $y = 0.492x + 0.0429$  ( $r^2 = 0.94$ ). NRC (1989) recommends crude protein intakes of 656 g/d for 500 kg horses at maintenance and 984 g/d for horses at moderate work. Using the equations above and the NRC (1989) recommended intakes, the horse at maintenance would have an estimated daily excretion of 89 g/d, compared to 99 g/d for a 500 kg horse at moderate work.

Fifteen reports were reviewed that contained more than 120 paired values for P intake and P excretion. Daily P intakes ranged from 19 to 200 mg/kg BW (or approximately 9.5 to 100 g/d for a 500 kg horse). Daily mean P retention was 4.7 mg/kgBW and was not different between SED and EX. Because there were no differences between SED and EX for retention, all values were used to determine the relationship between P intake and excretion which was represented by the equation:  $y = 0.793x + 4.56$  ( $r^2 = 0.85$ ); where  $y =$  P excretion in mg/kgBW and  $x =$  P intake in mg/kg BW. The NRC (1989) recommends P intakes of 14 g/d and 21 g/d for 500 kg horses at maintenance and moderate work, respectively. Using the relationship described above, the estimated daily P excretion would be 13 g/d for a horse at maintenance and 19 g/d for a horse in moderate work.

One of the purposes of this review was to obtain estimates of N and P excretion for comparison to currently published sources on manure composition in horses. Two sources of information on manure composition are the ASAE Standard on Manure Production (2001) and Characteristics and the Midwest Plan Service Livestock Waste Facilities Handbook (1985). In both references, values for daily nitrogen and phosphorus excretion exceed the values estimated here. Published values for manure composition may be used by regulatory agencies to determine environmental impacts of horse operations. When dietary intakes can be determined, the equations presented here may provide a more accurate means of estimating N and P excretion than some currently available reference sources.