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Urolithiasis in Male Boiler Breeders

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Abstract: Mortality often is much higher in male than in female broiler breeders (36.2% vs. 11.1%), making it necessary to introduce additional males during the breeding cycle. While it is known that males perform better on low protein diets, they usually are fed the same diet as the hens in order to reduce feed transportation costs and eliminate the chance of the hens receiving the wrong feed. Hen diets are high in Calcium (Ca) which may be detrimental to male performance and may cause kidney damage as the males excrete the excess Ca. In an effort to understand the extent of kidney damage that occurs in male broiler breeders, 136 males that had been on commercial breeder hen diets for 41 or 42 wks were euthanized and their kidneys evaluated. Data collected included body weight, left and right kidney weights and the incidence of macroscopically visible uroliths within the ureters or ureteral branches. The bilateral symmetry of the two kidneys (heavy:light kidney weight ratio) was assessed as an indicator of subclinical kidney damage. The results revealed that only 55.6% of the males had kidneys that were bilaterally symmetrical (within 10% by weight). Left kidneys were significantly heavier than right kidneys (10.07 vs. 9.26 g, respectively) and the left kidney was larger in 76.3% of the birds. Uroliths were found in 7.4% (10/136) of the males. These results indicate that broiler breeder males fed high levels of Ca develop kidney asymmetry and urolithiasis, which can contribute to their high mortality levels.

Key words: Kidney, males, broiler breeders, feed

INTRODUCTION

In modern commercial broiler breeders flocks male are fed the same diet as the females. These diets are formulated to allow the hens to maximize production and contain high levels of calcium. While higher than needed levels of calcium have been shown to have little effect on male reproductive function (Wilson *et al*., 1969; Kappleman *et al*., 1982), research into possible kidney damage is lacking. Urolithiasis is defined as "an acquired degenerative kidney disease of pullets and laying hens involving focal mineralization of the kidneys, progressive obstruction of the ureters by uroliths (kidney stones) and kidney atrophy 'upstream' of the site of ureteral obstruction combined with compensatory hypertrophy by the undamaged portions of the kidney" (Wideman, 1986). Urolithiasis has been seen in laying operations in the past (Blaxland *et al*., 1980; Wideman *et al*., 1983; Mallinson *et al*., 1984; Cowen *et al*., 1987a). Diets that containing high levels of calcium used during the rearing period of laying pullets are one of the main causes of urolithiasis. This can be magnified if low levels of phosphorus are fed in conjunction with high levels of calcium (Shane *et al*., 1969; Wideman *et al*., 1985). Other potential causes of urolithiasis include nephrotrophic strains of Infectious Bronchitis virus (Mallinson *et al*., 1984; Brown *et al*., 1987; Cowen *et al*., 1987b; Glahn *et al*., 1988a; 1989), water deprivation (Julian, 1982), or metabolic alkalosis (Wideman and Cowen, 1987; Glahn *et al*., 1988b; Wideman *et al*., 1989; Lent and Wideman, 1993). It has also been shown the genetic strains of single white leghorns vary in their resistance to urolithiasis (Lent and Wideman, 1993).

Normal avian kidneys have six divisions that are symmetrical in size and color. However, when damage occurs to one part of the kidney the remaining parts can undergo compensatory hypertrophy (Wideman *et al*., 1983; Gregg and Wideman, 1990). Therefore asymmetrical kidneys can indicate that some damage has occurred, even if that damage is not grossly visible. Asymmetry is identified when the weight of the heavier kidney exceeds that of the lighter kidney by more than 10%.

Therefore the present study was undertaken to determine if there is any detrimental effect on the kidneys of male broiler breeders consuming a diet that is formulated for breeder hens, that contains an excess of nutrients.

MATERIALS AND METHODS

In this study 136 male broiler breeders that were reared at the University of Arkansas Poultry Research Farm were evaluated. These males were all of the same strain and had been maintained on industry guidelines for feeding and lighting for the previous 41 or 42 weeks. Males were fed a commercial breeder diet containing 16% protein, 3.25% calcium, 0.4% non-phytate phosphorus, with approximately 2860 kcal/kg. Males were euthanized according to approved procedures and

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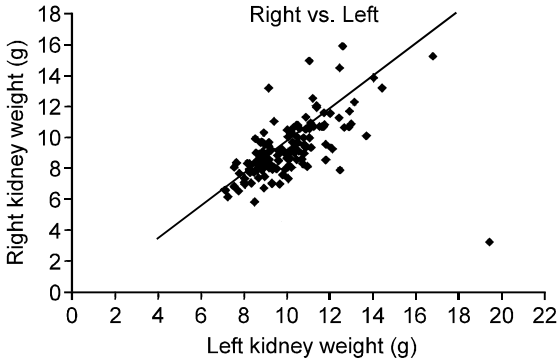

Fig. 1: The results of plotting the right kidney weight against the left kidney weight. The line indicates symmetry (equal right vs. left)

Fig. 2: Photo of a 64 week old male broiler breeder male with urolithiasis. Note the hypertrophy of the left kidney to compensate for the regression of the right kidney do to blockage or the ureter caused by a Uroliths

the kidneys were examined for grossly visible urolithiasis. The kidneys then were removed and weighed to the nearest 0.01 gram. The right and left kidneys were recorded separately so that the weights could be compared to determine symmetry.

RESULTS AND DISCUSSION

Right vs. left kidney comparison are shown in Fig. 1. These results show that 44.4% of the males had kidneys that were asymmetrical. This figure also shows that the left kidney was larger than the right 76.3% of the time. The mean weight of the left kidney (10.07 g) was significantly ($p<0.0003$) heavier than the right (9.26 g). Visible uroliths were observed in 7.4% of the males (10/136).

The results of this field study show that urolithiasis is present in male broiler breeders and may contribute to the elevated mortality seen in male breeders. Furthermore these results point to the high levels of Ca in the diet as a possible cause of urolithiasis in the males.

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