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FREE GOSSYPOL FROM COTTONSEED MEAL MAY ADVERSELY AFFECT VITAMIN A, E AND β -CAROTENE IN COWS AND CALVES

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Background. Cottonseed meal and whole cottonseed contain a substance known as gossypol which can be toxic to some livestock. Cottonseed meal is also considered to be lacking in some nutrients, including vitamins A and D. It is recommended when feeding cottonseed meal that livestock have access to good quality forage (National Cottonseed Products Association). In the early 1900's, symptoms similar to gossypol toxicity were seen in cattle fed rations low in vitamin A, but which contained no cottonseed products. In the present study the objective was to assess plasma retinol (vitamin A), α -tocopherol (vitamin E) and β -carotene (pro-vitamin A) in cows consuming cottonseed meal, containing 4 grams (g) free gossypol/head/day (FGHD), and in their suckling calves.

Eight Brahman cows were randomly allotted to one of two dietary treatment groups approximately 90 days prior to expected calving dates. Four cows consuming 0 g FGHD, from soybean meal (SBM), and four cows consuming 4 g FGHD, from cottonseed meal (CSM), had been selected based on low red blood cell fragility in the 0 g FGHD group, and high red blood cell fragility in the 4 g FGHD group at 84 days on feed prior to calving. Cows were maintained on their respective supplements through day 112 after calving. Calves were separated from their dams daily at feeding to prevent calves from consuming the concentrate supplements. In addition to dietary supplements, cows were maintained on Coastal bermudagrass pastures until first frost and then maintained on ryegrass pastures with access to Coastal bermudagrass hay. Water and mineral supplementation (containing > 90,000 IU vitamin A) were available free choice. Blood plasma samples were collected on day 84 on feed prior to calving, at calving and on day 28 postcalving (PP) in cows, and at calving, day 7 and day 28 PP in their calves. Retinol (ug/dL), α -tocopherol (mg/dL) and β -carotene (ug/dL) were analyzed by high performance liquid chromatography.

Research Findings. Plasma retinol did not differ ($P>.10$) between dietary treatments in cows. At day 84 on feed prior to calving, α -tocopherol differed ($P<.05$) with 0 g FGHD cows having higher ($2.6\pm.4$) concentrations than 4 g FGHD cows ($1.3\pm.4$). At calving and on day 28 PP, α -tocopherol did not differ ($P>.10$) between diets. At 84 days on feed prior to calving, β -

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carotene was lower ($P<.04$) in 4 g FGHD (1518 ± 383) than 0 g FGHD cows (3049 ± 383). At calving and on day 28 PP, no differences ($P>.10$) were detected in β -carotene between diets in cows. Retinol did not differ ($P>.10$) between diets in calves. At birth, α -tocopherol did not differ ($P>.10$) between diets in calves. By day 7 PP, α -tocopherol tended to be lower ($P<.10$) in 4 g FGHD ($.08\pm.03$) than 0 g FGHD calves ($.18\pm.03$) and while both groups increased on day 28 PP, α -tocopherol continued to tend to be lower ($P<.09$) in 4 g FGHD ($.10\pm.04$) than 0 g FGHD calves ($.23\pm.04$). At birth, β -carotene did not differ ($P>.10$) between 4 g FGHD (6.0 ± 9.8) and 0 g FGHD calves (22.4 ± 9.8). By day 7 PP, 4 g FGHD calves had lower ($P<.04$) β -carotene concentrations (15.4 ± 6.8) than 0 g FGHD calves (41.6 ± 6.8). β -carotene remained depressed ($P<.001$) on day 28 PP in 4 g FGHD (9.4 ± 3.6) compared to 0 g FGHD calves (40.5 ± 3.6). Prior to calving and following 84 days on feed which contained 4 g FGHD, cows had lower plasma α -tocopherol and β -carotene concentrations compared to 0 g FGHD cows. Calves from cows receiving 4 g FGHD tended to have lower α -tocopherol and had depressed β -carotene concentrations on day 7 and 28 PP compared to calves from cows receiving 0 g FGHD.

Application. Cottonseed meal, containing free gossypol, may adversely affect plasma α -tocopherol and β -carotene concentrations in cows as well as their suckling calves, while not necessarily affecting retinol status. It appears that some of the nutritional requirements of the suckling neonate may be compromised as a result of the dam receiving solvent extracted cottonseed meal as the sole protein supplement. Additional vitamin and mineral supplementation may be required for pregnant and lactating cows consuming diets containing cottonseed products and possibly an A, D, E shot for their calves. Additional investigations need to be conducted to further delineate between the dietary effect of feeding cottonseed products and the effect of gossypol on vitamin and mineral metabolism and milk composition.

