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by

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AGRICULTURAL EXPERIMENT STATION
Oregon State College
Wm. A. Schoenfeld, Director
Corvallis

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URINARY CALCULI IN CATTLE

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The presence of calculi in the urinary system of animals, including man, has been recognized since very early times. These stone-like concretions may form in either the kidney or the urinary bladder and vary in size from dust-like particles to bodies several inches in diameter. Sand-like particles are very common.

Injury from urinary calculi is of three types: (1) The irritation caused by the calculi may lead to bacterial infection; bacteria are found in a high percentage of urinary bladders containing calculi, (2) the calculi may become large enough to impair the function of the containing organ, (3) calculi may become lodged either in the tubes leading from the kidneys to the bladder (ureters) or in the tube leading from the bladder to the exterior (urethra). When this occurs the passage of urine may be completely stopped resulting in uremic poisoning, rupture of the bladder, or other injury which causes death of the animal within a relatively short time. Many individuals carry urinary calculi for long periods of time without apparent injury.

Because the diameter of the urethra of the male is considerably less than that of the female of the same species, lodging of calculi in this tube occurs more frequently in the male. There is some evidence that castrate males are more frequently affected than are entire males. This could be explained on the basis of the castrate male having a somewhat smaller urethra, although differences in metabolism may be an important factor.

Chemical analyses of urinary calculi have proved them to consist of any of at least 16 different chemical substances, or mixtures of these 16 substances. Chemists throughout the world have found most urinary calculi of cattle and sheep to consist of calcium, magnesium, and aluminum salts of phosphoric acid (phosphates). It has been found that in a region having both sheep and cattle, sheep are most frequently affected.

Most experimental work with this problem has been conducted with sheep. This is because the occurrence of urinary calculi is more frequent

in sheep than in cattle, the composition of the calculi has been found similar, and sheep are better experimental animals because of their size and cost of maintenance. A review of the literature based on the work of eleven groups of workers in South Africa, Australia, New Zealand, England, France, Germany, and the United States is summarized as follows by Beveridge, an Australian worker.

"The evidence available suggests that vitamin A deficiency and imbalance of calcium, magnesium and phosphorus are probably the main factors operating in the formation of urinary calculi in sheep (phosphate). However, there is no direct evidence proving that these factors operating together or separately are responsible for the condition as it occurs, and it is possible that there are factors involved which are not yet recognized. Conditions leading to concentration of urine, such as dry concentrated feed rich in total minerals, hot, dry climate, and the drinking of water with appreciable concentrations of magnesium, calcium, or carbonates, may be contributing causes, though they are probably insufficient in themselves to cause the formation of calculi."

Experimental work with cattle has been quite meager. The Colorado Experiment Station has reported on several outbreaks. It says: "Throughout eastern Colorado, the disease is so common in the winter as to make some people believe that it is contagious." In one outbreak the affected steers were on alfalfa, bean straw, beet tops and pulp, corn, barley and wheat. Limestone and bone meal mixed with salt to make it more palatable were also given about ten days previous to the outbreak. No more cases occurred after removing the mineral and the steers were put on corn and alfalfa. They also report trouble in steers on corn, cottonseed cake, wet beet pulp, and alfalfa. The steers were on "exceptionally soft water." Lack of vitamin A or hard water could not be causative factors under such a feeding program.

Simms, in his report of the Bureau of Animal Industry, U. S. D. A., 1946, says: "The formation of calculi in the urinary tract of steers appears to be common in the Southwest. Experiments at Big Springs, Texas, over a period of years, conducted by the Bureaus of Animal Industry and Plant Industry, Soils, and Agricultural Engineering, and the Texas Agricultural Experiment Station, have shown rather definitely that the calculi problem is associated with the feeding of grain sorghums and that the calculi condition is accentuated when ground milo heads are used instead of threshed grain.

"Results of recent tests indicate that the feeding of supplemental phosphorus reduces the incidence of calculi, while the feeding of magnesium increases it. Varying amounts of limestone (calcium carbonate) have had little effect. The first series of tests showed that the feeding of bone meal at the rate of 200 grams (7 oz.) per head per day in the ration tended to check the calculi formation. The current year's test showed that when phosphorus was supplied in the form of phosphoric acid (75 percent strength) at the rate of 52 cubic centimeters per head daily, there was also a marked tendency toward the control of calculi. The phosphoric acid appeared also to add to the palatability of the ration."

These results indicate that feed and minerals play an important part in the formation of phosphate urinary calculi in cattle. Dr. I. E. Newsom, President of Colorado State College, says: "The wide use of mineral supplements during the past years, without knowing their composition or their need, may also have developed faulty metabolism in ways not yet understood."

Urinary calculi of siliceous composition occur in range steers in the intermountain region of this country. This type is known to occur in Montana, Idaho, and several of the eastern Oregon counties. Since only a limited number (about two dozen) from eastern Oregon have been analyzed, the exact extent of their occurrence is not yet known. The samples analyzed by the Department of Agricultural Chemistry, Oregon Experiment Station, have been relatively small in size but sufficiently large and numerous as to stop the urine and produce death in steer calves.

Affected calves show frequent attempts at urination and may dribble urine. There is evidence of pain--kicking at the belly and twitching of the tail. The animals go off feed, and in the later stages the abdomen may be distended with fluid.

Most of these cases occur in fall and winter. The cause is not known but is probably related to feed and mineral intake. Since the calculi are of the nature of sand or fine glass there is little chance for them to dissolve once they have formed. A surgical operation whereby the urethra is cut and brought outside just to the rear and above the scrotum is successful in many cases if the operation is performed early in the course of the trouble. This operation is being successfully performed in at least one eastern county.

Investigational work with this problem in Oregon has thus far been limited to field studies and a limited amount of blood and calculi analyses. Calculi of this chemical nature were produced by Dr. J. N. Shaw, Department of Veterinary Medicine, Oregon Experiment Station (1937), in sheep fed wheat straw, oats, and beet pulp. Calculi of this type have been observed by others in sheep in which they apparently occur more frequently than in cattle.

While it now appears that calculi formation probably involves a nutritional background, two facts with respect to the incidence of their formation are obvious:

- (1) While the over-all evidence is sufficiently indicative of a substantial economic loss from this trouble, the percent of incidence in any one locality appears sufficiently irregular to make experimental field attack of the problem difficult.
- (2) Since calculi probably form slowly, and a considerable period of time is required to develop symptoms, it obviously will be difficult to determine the extent to which this problem is influenced by:
 - (a) Range feeds.
 - (b) Fall pasture.

- (c) Winter feeds.
- (d) Water supplies.
- (e) Supplementary minerals.

Since surgical treatment when properly performed is successful in a high percentage of cases, it is recommended that watch be kept for early signs of the trouble and that a veterinarian be engaged for that work.

More information concerning the occurrence of urinary calculi in cattle in eastern Oregon is desirable. Those experiencing this trouble in their herds are urged to inform their county extension agents, who will forward samples of stones for chemical analysis.