

Pathologists Push Research

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Nitrite poisoned animals can be successfully treated. For many years veterinarians have been treating animals with nitrite toxicity with dramatic effects. Why, then, is this still a problem to the livestock industry in Arizona?

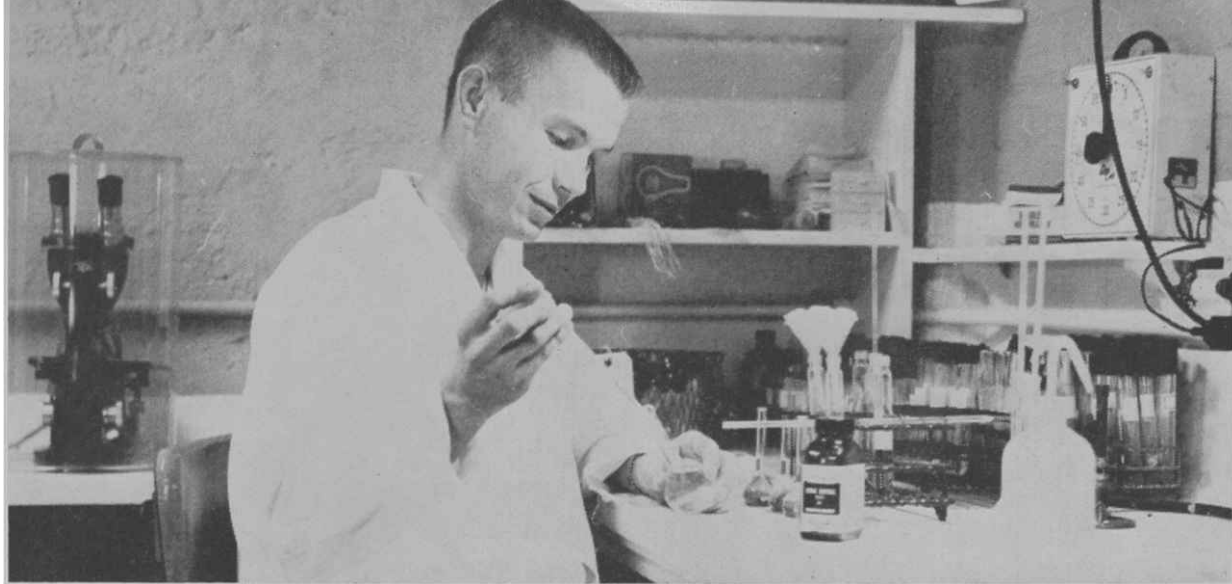
In the first place, any treatment presently available must be administered by injection, which necessitates restricting the animals. When cattle or sheep are suffering from severe nitrite poisoning they can't afford to be excited, as this accelerates the body processes. Any increased demand from these processes, under the conditions of nitrite poisoning, may result in death of the animal. Therefore, it is necessary to remove the source of nitrite. It is commonly recommended that animals be moved cautiously to another area on the range, that the range diet be supplemented with other roughage, or that the feed be changed for penned animals.

Need Easily-Applied Treatment

The question then arises, just when are our research efforts going to supply us with a treatment that may be more simply administered? This question cannot be answered satisfactorily until there is a better understanding of the nitrite picture. For instance, it is not known why an animal dies from nitrite poisoning. In order to summarize what is known about nitrite poisoning, let us look at the problem as the scientists would.

We realize that it is not nitrate that produces the poisoned condition, but rather nitrite. This material usually occurs as nitrate in plants. Some of the plants in Arizona that often contain nitrate are pig weed, patota, ragweed, Russian thistle, goat head, turnip, and young, rapidly growing barley and oats. Nitrate usually occurs in highest concentrations when the plants are young and growing rapidly.

It is also found to be more concentrated in the leaves and stems of plants in the early morning hours. When these plants are consumed by a ruminant ani-



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mal, the microbial action in the paunch reduces the nitrate to its toxic form—nitrite. Nonruminants, such as man and dog, generally cannot convert nitrate to nitrite. If these simple stomach animals are poisoned by nitrite it is usually because of the presence of nitrite in their food or water.

Affects Red Blood Cells

To further understand the nitrite picture, we must recall that the animal's blood contains two cell types, the white blood cells and the red blood cells. In nitrite poisoning we are concerned with the red blood cells. These cells contain hemoglobin which loosely binds the oxygen it picks up from the lungs and releases it in the body tissues. It can do this by virtue of the iron it contains in the ferrous (Fe^{++}) state. Some materials called oxidizing agents, such as nitrite, can produce a change in the state of the iron in the hemoglobin. In this new state, ferric (Fe^{+++}) iron, the hemoglobin is called methemoglobin. Methemoglobin imparts a dark brown color to the blood. The methemoglobin also binds oxygen but won't release it to the tissues. Therefore, it has been assumed that animals suffering from nitrite poisoning die because of a lack of oxygen.

Recent studies here in the Animal Pathology Department and at other stations¹ suggest that this may not be the case. We currently believe that when nitrite poisoning results in death, there would still be sufficient hemoglobin present to meet the animal's needs.

Why, then, do animals die from nitrite consumption? Studies are presently under way in our department seeking to answer this question. If we rule out methemoglobin formation as a possibility, then we can only speculate as to the cause of death.

Nitrite-Vitamin Level

One cause for speculation has been our observation that detectable methemoglobin only forms when nitrite enters the

blood in fairly high amounts. When the nitrite occurs in low amounts it is possible that certain of the vitamins may be destroyed. This nitrite-vitamin relationship has received considerable attention across the country in the last few years. Although we can't be certain at this time, it has been suggested that the commercial anti-oxidants may be of value in counteracting the oxidizing of the nitrite.

Nitrite may also affect chemical groups other than hemoglobin in the animal's body. Present in the body are compounds whose chemical nature is similar to that of hemoglobin. Some of these compounds have functions that are more critical to the animal's survival than that of hemoglobin if a part of them are destroyed.

From what we have said thus far it appears that basic information concerning nitrite poisoning is not available. This probably results from the presence of methemoglobin in the blood being so easy to observe that the investigator would not look for additional action of the nitrite. Indeed, if one sees the "brown blood" it is difficult to conclude that this change in the hemoglobin is not important to the animal's survival. Meanwhile, this observation may actually mask more important abnormal conditions.

Still Seek The Answer

Future investigations into the problem of nitrite poisoning must begin not with methemoglobin formation but with the actual appearance of nitrite and nitrate in the blood and tissues. Previously, this has been a rather difficult thing to do. Now the Animal Pathology Department has just developed a simple chemical method for determining the levels of nitrate and nitrite in body fluids. With this new tool at our disposal we are optimistic about answering the fundamental question: Why do animals die from nitrite poisoning? It may then be possible to devise more suitable therapeutic measures.

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¹Holtenius, P.: Nitrite Poisoning in Sheep, with Special Reference to the Detoxification of Nitrite in the Rumen. ACTA Agricultura Scandinavica VII, (1957):113-163.