

Salmon Poisoning in Dogs

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Thesis: Master of Science, 1925.

It has been known for a long time that if dogs or foxes eat raw salmon they are almost certain to become ill. Usually death follows after several weeks of illness, characterized by a loss of appetite, cachexia, nasal discharges and stupor. In view of this more or less common knowledge I was led to attempt a study of salmon poisoning in dogs that might throw some scientific light upon the problem which confronts dog owners generally, and especially those in the districts where salmon are abundant in the streams.

In order that the details of the symptoms might be seen at first hand, under controlled experimental conditions, three dogs were given one pound of fresh salmon each. The following protocol presents the typical picture of a dog dying from salmon poisoning.

Protocol No. I.

Dog No. 3. Age, about 9 months.

| | Weight | | Temp. | Resp. | Pulse | |
|----------|--|-----|-------|-------|-------|--|
| | Lbs. | Oz. | | | | |
| July. 23 | 14 | 8 | 101.4 | 28. | 180 | Was given 1 pound of fresh salmon. |
| July 25 | 14 | | 102. | 24. | 186 | Normal |
| Aug. 3 | 14. | 2 | 102.4 | 28. | 122 | Does not eat normally. |
| Aug. 15 | 13. | 6 | 102.4 | 32. | 118 | Dog eats but very little. |
| Aug. 28 | 13. | 4 | | ... | ... | Has cough and nasal discharge. Did not touch food given day previous. Cough worse. |
| Sept. 3 | 13. | | 103 | 30. | 140 | Dog very sick. Has not eaten for several days. No bowel movement for 5 days. Coughs. |
| Sept. 8 | 12. | 7 | 103.2 | 34. | 154 | Discharge from nose and eyes marked. Cannot stand alone. Had one bowel passage, mostly mucous, no blood. |
| Sept. 12 | Found dead this morning. Weight - 12 lbs. 2 oz. | | | | | |

A complete autopsy was done and microscopic sections were made of the tissues.

Working on the assumption that, possibly, the poisonous substance might come from some specific tissue of the fish, different parts of the salmon were fed to dogs. One group of dogs was given the skin, another the flesh and still another group was given the bones. The flesh only produced poisoning.

An attempt was next made to isolate the particular substance which causes the poisoning. Alcoholic extracts were made from the salmon flesh. This was then evaporated at 37 degrees C until the alcohol was completely removed. From this alcohol soluble substance and ether soluble one was taken (about 1/2 of the residue was found to be soluble in ether). These two fractions were then given to separate groups of dogs with the following results.

Protocol. No. 2.

Taken from one of three dogs, none of which were affected in any way.

Dog No. 9.

| | Pulse | Resp. | Temp. | |
|---------|---------|-------|-------|-----------------------------------|
| Oct. 11 | 120 | 72 | 103 | Was given ether soluble by mouth. |
| Oct. 15 | 110 | 70 | 103.2 | Appears normal. |
| Oct. 25 | 122 | 62 | 103 | Is normal in every respect. |
| Nov. 3 | Normal. | | | Was released for class work. |

Protocol. No. 3.

The following protocol was taken from a series of four dogs, all of which were poisoned directly from the ether soluble extract. All were killed.

Dog. No. 5. Age, about one year.

| | Weight Lbs. Oz. | Temp. | Resp. | Pulse | |
|---------|--|-------|-------|-------|--|
| Oct. 10 | 25 | 102.6 | 28 | 168 | Dog was given ether soluble fraction, from 1 lb. salmon by mouth. |
| Oct. 14 | 22 8 | 103 | 24 | 160 | Appears normal. |
| Oct. 17 | .. . | 103.1 | 24 | 136 | Lies very quietly. Has slight cough. |
| Oct. 19 | 22 | 103 | 27 | 148 | Does not eat normally. Is quite sick. Has discharge in eyes and nostrils. |
| Oct. 21 | .. | 104.4 | 31 | 180 | Cough much worse. A peculiar skin eruption has developed. |
| Oct. 22 | .. | | .. | ... | About same as day previous. |
| Oct. 25 | 19 3 | 103.2 | 30 | 154 | Corneal abscess has developed in right eye. Coughs with each expiration. Has not touched food for several days. |
| Oct. 30 | .. | 103.4 | 36 | 152 | Does not move about. Loud breathing. Left eye is becoming infected. |
| Nov. 3 | 17 4 | 104.1 | 34 | 160 | No bowel passage in 5 days. Very weak, will not move. Appears weak especially in hind legs. Coughs continuously. |
| Nov. 5. | Dog dead this morning. Weight - 16 lbs. | | | | |

A complete autopsy was done and microscopic sections were made of the tissues.

It was quite evident from the above data that the poisonous substance was contained in the ether soluble portion. The following experiments were carried on with the residue extracted directly with ether. This residue is an oily substance very much like Cod Liver Oil in appearance.

Two dogs were given one pound each of salmon flesh from which the

ether soluble fraction had been removed. These dogs did not show any symptoms of poisoning.

The first symptom that is noticed in a salmoned dog is a loss of appetite which has its onset about eight to twelve days after eating salmon. A general weakness follows and is progressive to death. The dogs have a characteristic mucopurulent discharge from their noses and eyes, which is accompanied by a cough and rise in temperature. These symptoms begin twelve to fifteen days before death and gradually become more marked. In all of the dogs a definite paralysis of the hind legs appeared from 36 to 48 hours before death. Opacities of the cornea were noticed in about twenty percent of the dogs. This is usually bilateral though occasionally only unilateral, and persists until death. The animals have only an occasional bowel passage after the acute symptoms arise. The faecal material is usually small in amount and of a mucous consistency. At no time was blood seen in the stools.

Pathology.

Gross.

The animals were greatly emaciated. Areas over the body where the hair had fallen out leaving an irritated sore were of frequent occurrence. Corneal abscesses and opacities were seen in twenty percent of the autopsies. A muco-purulent discharge was present in the eyes and the nostrils.

In the abdomen there were no noteworthy changes except a small amount of extra-peritoneal fat which was extremely yellow. The intestines were normal, there being no evidence of dysentery, or any other acute intestinal infection. They contained a small amount of bile-stained mucous. The stomach had no noteworthy changes. There was no evidence of hemorrhage in any part of the gastro-intestinal tract.

The lungs lay free in the plueral cavity. Their margins were white and feathery. In general, the parenchyma was of a dark purplish red. There were irregular consolidations formed in all of the lobes, these were small yellowish nodules surrounded by hemorrhagic areoli. On sectioning the lungs there were numerous small areas of pus, apparently coming from the bronchi. The bronchial lymph nodes were all swollen and dark red in color. No noteworthy changes were found in the thymus, thyroid, and heart. The pleura was not covered by fibrin and there was no excess fluid in the cavities.

The liver was usually moderately swollen and of a pinkish red hue. Small irregular, yellowish areas, apparently abscesses, were sometimes seen at the margins of the lobes. Numerous sections of the parenchyma disclosed a moderate hyperemia and cloudy swelling.

The spleen was shrunken in character but no evidence of the underlying pathology was present.

The kidneys appeared slightly congested and much softer than normal. On sectioning there was evidence of a marked cloudy swelling. The capsule stripped readily, disclosing many hemorrhagic areas. The bladder and adrenals appeared normal.

Microscopis.

Gastro-intestinal. There was no evidence of any pathology. The mucosa was intact and there was no evidence of cellular increase or hemorrhage.

Spleen. There was a marked increase in the fibrous tissue. Malpighian corpuscles were not clearly made out. Blood destruction was evident because of the increased amount of blood pigment present. There appeared to be an actual destruction of the splenic tissue.

Liver. The general picture was that of a marked destructive process. Evidence of sloughing and necrosis was seen throughout. The individual cells in a larger percentage of the tissue had lost their normal markings and appeared as clumped, non-functioning masses. A large amount of pigmentation was present. The portal and hepatic systems were totally destroyed in many areas and were only marked by their fibrous stroma. The blood vessels were distended with blood.

Kidneys. The picture here was much the same as that of the liver. The tubules showed marked evidence of a destructive process being present. They had lost their distinct outline and in many instances were clumped together and disorganized. The glomeruli presented two different pictures, some were congested with blood and had evidence of function, while others were small and shrunken and appeared fibrous in character.

Bone Marrow. The megalokaryocytes were increased in number, which, is evidence of hyperplasia. There was some congestion but otherwise negative.

Lungs. The lungs were not always involved, but when they were the microscopic picture was that of bronchial pneumonia.

Brain and Cord. A low grade meningitis was all that was observed.

Heart and Skeletal Musculature, Bladder, Thyroid and Adrenals.

All were negative.

Blood count just before death.

| | |
|-------|--------------------------|
| Red | 4,004,000 |
| White | 35,000 |
| | Polys. 75 percent |
| | Small lymph. 21 percent. |

(This was the average count of two dogs taken before death, both showing evidence of bronchial-pneumonia at autopsy.)

Immunization.

The fact that two old dogs were encountered that did not show any symptoms after eating salmon, led to the assumption that these dogs had possibly been poisoned with salmon and upon recovering possessed some form of immunity. With this in mind an attempt was made to immunize dogs in the laboratory. Eleven young dogs were used. They were each given three drops of the ether soluble extract subcutaneously. This was repeated after two weeks. Between three and four weeks elapsed before fresh salmon was given them. This was followed in two weeks by a second portion, and in another week by a third portion. None of these dogs developed symptoms of poisoning. This evidence seems sufficient to conclude that a process of immunity had been developed.

Discussion.

The only reference to salmon poisoning found in the literature attributes the causative factor to parasites. (1 and 2). In both cases the experimental evidence seems entirely inadequate to justify the conclusions. The evidence here presented has been carefully gathered from a large number of animals under close observation. There would seem to be a possible pitfall in precursory experimental work, in that, among adult dogs, infrequently one comes upon an animal that is not susceptible to salmon. Judging from the results obtained in experimentally produced immunity, it is not too much to assume that there will be found an occasional animal that has become immune. This is further born out by the fact that such immunity was never found among puppies that had had no opportunity to eat salmon. C.H. Donham was led to believe that only sore back salmon produced the poisoning. In these experiments both fresh and sore back salmon have been used with no apparent difference in the toxicity that followed.

Further, with an ether extract there can be no possibility of parasitic infection. These animals poisoned with the extract ran a similar course and showed identical symptoms to those given raw salmon. There would seem to be further indication that C. H. Donham's dogs did not have typical salmon poisoning, from the intestinal pathology reported by him. In none of the animals here presented was there evidence of gastro-intestinal pathology, either before death or at autopsy.

The immunity produced in a series of animals reported here cannot at this time be classified. Two possibilities suggest themselves. The first is that we are dealing with a pure toxin to which it is possible to produce immunity. The other possibility is that we are encountering a lipid to which an immunity may be developed in the sense of building up a tolerance. Further work in progress will no doubt throw light upon this point.

Conclusion.

1. Raw salmon is poisonous for dogs.
2. Dogs given either raw salmon or the ether extract of raw salmon die in the course of from three to five weeks in a cachectic condition.
3. Neither the symptoms nor the pathology found at autopsy point to a definite localization of the lesion that causes death.
4. It is possible in dogs to develop immunity to salmon.
5. The poisonous substance is soluble in ether.

Bibliography.

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