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AN EXPERIMENTAL PHARMACOLOGICAL APPRECIATION OF LEVITICUS XI AND DEUTERONOMY XIV *

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While engaged in an extensive research, which is still in progress, on the chemical and pharmacological properties of the blood and muscles of normal individuals and of patients afflicted with cancer, the writer became interested in investigating the comparative pharmacological actions of fresh muscle juices and of saline extracts of skeletal muscle tissues of different species of animals, both quadrupeds and birds. Inasmuch as zoological experiments with such extracts cannot be easily performed on account of protein reactions occurring after injections of such juices into animals and on account of bacterial and fungal contaminations, a new and novel approach to the problem was made by the special "phyto-pharmacological" methods employed by the author in the last thirty years (1, 2, 3). By phytopharmacology is meant the study of the action of drugs, poisons, toxins, sera, and various chemicals on living plant-physiological test objects, in contrast to animal or zoopharmacological test objects. By this method it has been found by the author and his co-workers that many toxic contituents can be detected in the blood and various body fluids of human beings which toxins cannot be readily demonstrated by animal experiments and even by ordinary physico-chemical methods. The simplest method employed for such work by the author is to study the effect on the root growth of seedlings of *Lupinus albus* grown in plant-physiological solutions containing the necessary salts and ions for their growth, with and without the addition of one or more per cent of the chemical to be investigated. Such seedlings grown under strictly controlled ecological conditions of light, temperature, etc., give very consistent results, statistically reliable. In this way, the author and his school have already discovered the presence of specific toxins in the blood of patients suffering from the very fatal disease emphigus (4), in patients afflicted with Pernicious Anemia (5), and in the blood of all psychotic patients (6). Such methods are at present employed in the research on the blood of normal and cancerous patients.

* Read before the annual meeting of The American Oriental Society, Washington, D. C., April 8, 1953.

In studying muscle extracts of fresh meats from various species of animals some very interesting findings were made. These are exhibited in the subjoined tables. To understand the significance of the tables one must bear in mind that the "phytotoxic index" means the ratio in percentages of root growth of *Lupinus albus* seedlings in a solution of unknown muscle juice dissolved in plant physiological saline to the growth of seedlings from exactly the same crop of plants grown in normal control solutions, at exactly the same conditions. The lower the index the more poisonous is the effect. An examination of the figures reveals data which are of considerable interest not only to the medical investigator but also to students of ancient Biblical literature.

It was found that muscle juices and saline extracts of skeletal muscles or "meats" from such domestic animals as the ox, calf, sheep, goat, and deer commonly employed as food, were practically non-toxic for the root

TABLE 1—QUADRUPEDS

PHYTOTOXIC INDICES OF 2% SOLUTIONS OF FRESH MUSCLE JUICES

Species of Animal	No. of Experiments	Index of Growth	Species of Animal	No. of Experiments	Index of Growth
Ox	20	91%	Swine	20	54%
Calf	20	82%	Rabbit	20	49%
Sheep	20	94%	Guinea Pig	20	46%
Goat	20	90%	Camel	20	41%
Deer (Venison)	20	90%	Horse	20	39%

growth of the Lupinus seedlings, i. e. did not inhibit their growth. On the other hand, the muscle extracts prepared in exactly the same way from the four quadrupeds specifically prohibited to be consumed as food in Leviticus XI and Deuteronomy XIV, namely, the hog, hare, coney, and the camel were very toxic for the seedlings. The coney is regarded by many Biblical scholars as closely related to the guinea pig. Camel meat was obtained by the writer directly from the Near East, shipped by air in a refrigerator. (Table 1)

Similar experiments with extracts of muscles from other quadrupeds, mostly wild ones, and beasts of prey were also found to be phyto-toxic. Specimens of fresh or frozen flesh were secured from the dog, cat, squirrel, white rat, ground hog, fox, opposum, hamster, black bear, and grizzly bear and rhinoceros. (Table 2)

Other experiments were made in exactly the same way with muscle extracts from various birds. Here again it was found that the extracts from the flesh of the chicken, the duck, goose, turkey, pigeon, and the quail were not toxic, while similar extracts from the flesh from birds of prey, for example, the owl, hawk, falcon, and the crow were quite toxic. (Table 3)

TABLE 2—QUADRUPEDS

PHYTOTOXIC INDICES OF 2% SOLUTIONS OF FRESH MUSCLE JUICES

Species of Animal	No. of Experiments	Index of Growth	Species of Animal	No. of Experiments	Index of Growth
Dog	10	62%	Fox (silver)	6	50%
Cat	10	53%	Opposum (*Didelphis virginiana*)	8	53%
Squirrel	6	43%	Hamster	4	46%
Rat (white)	8	55%	Black Bear (*Euarctos americanus*)	8	59%
Ground Hog (*Arctomys monax*)	6	53%	Grizzly Bear	8	55%
			Rhinoceros	8	60%

TABLE 3—BIRDS

PHYTOTOXIC INDICES OF 2% SOLUTIONS OF FRESH MUSCLE JUICES

Species of Animal	No. of Experiments	Index of Growth	Species of Animal	No. of Experiments	Index of Growth
Chicken	20	83%	Sparrow Hawk (*Falco parverius*)	6	63%
Duck (mallard)	10	90%	Red Tail Hawk (*Buteo borealis*)	8	36%
Goose (*Anser albifrons*)	6	85%	Owl	8	62%
Turkey	10	85%	Crow	10	46%
Pigeon	10	93%	Coot	8	88%
Quail (*Coturnix communis*)	20	89%	Wild Duck (*Aythia americana*)	8	85%
Canada Goose (*Branta canadensis*)	7	85%	Swan	6	87%

Of special interest were experiments made with muscle juices and also blood solutions obtained from many species of fishes. Fifty-four species of fishes were so far studied in regard to the toxicity of their meat extracts. It was found that the muscle extracts of those fishes which possess scales and fins were practically non-toxic, while the muscle ex-

TABLE 4

TOXICITY OF FISH MUSCLE EXTRACTS

No.	Common Name	Scientific Name	Phytotoxic Index %
1.	"Alewife"	Pomolobus pseudoharengus	82
2.	Banded drum	Larimus fasciatus	80
3.	Black bass	Micropterus dolomieni	80
4.	Black drum	Pogonias cromis	105
5.	Bluefish	Pomatomus saltatrix	80
6.	"Bonito"	Auxis thazard	78
7.	Bowfin	Amia calva	90
8.	Butterfish	Poronotus triacanthus	81
9.	Carp	Cyprinus carpio	90
10.	*Catfish*	Amelurus catus	48
11.	Channel bass	Sciaenops ocellata	80
12.	"Chub"	Chaenobryttus coronarius	91
13.	Cod	Gadus callarias	90
14.	Croaker	Micropogon undulatus	90
15.	*Eel*	Anguilla rostrata	40
16.	Flounder	Paralichthy dentatus	83
17.	Flying fish	Prionotus carolinus	87
18.	Gambusia		89
19.	Goldfish	Carassius auratus	88
20.	Haddock	Melanogrammus aeglefinus	80
21.	Hake	Urophycis regius	98
22.	Halibut	Phatysomatichthys hippoglossoides	82
23.	Herring	Clupea harengus	100
24.	Kingfish	Tarpon atlanticus	83
25.	Menhaden	Brevoortis tyrannus	90
26.	*Moonfish*	Vomer setipinnis	51
27.	"Mullet"	Erimyzon sucetta	87
28.	Pike	Esox americanus	98
29.	Pompano	Trachinotus carolinus	110
30.	*Porcupine fish*	Diodon hystrix	60
31.	Porgy	Stenotomus chrysops	80
32.	*Puffer*	Spheeroides maculatus	51
33.	Rainbow trout	Salmo gairdneri irideus	81
34.	"Robin"	Lepomis gibbosus	91
35.	Rock	Roccus saxatilis	100
36.	"Salmon trout"	Cynoscion nebulosus	96
37.	Sand flounder	Lophopsetta maculata	85
38.	*Sand skate*	Pteroplates maclura	59
39.	Smelt	Menidia menidia	90
40.	Sea bass	Centropristes striatus	103
41.	Shad	Alosa sapidissima	100
42.	*Shark* (dogfish)	Mustelus canis	62
43.	Silver squeteague	Cynoscion nothus	84
44.	Spadefish	Chaetodipterus faber	80
45.	Spanish mackerel	Scomberomorus maculatus	98
46.	Spot	Leiostomos xanthurus	80
47.	*Stingaree*	Dasyatis say	46
48.	Sturgeon	Acipenser oxyrhynchus	87
49.	*Toadfish*	Opsanus tau	49
50.	Tuna, bluefin	Thunnus thynnus	88
51.	Weakfish	Cynocion regalis	97
52.	White perch	Pomoxis nigromaculatus	81
53.	Whiting, Carolina	Menticirrhus americanus	84
54.	Yellow perch	Perca flavescens	87

tracts from fishes without scales and fins were highly toxic for the growth of *Lupinus albus* seedlings. Such fishes were catfish, eel, moonfish, puffer, skate, sharks, stingaree, toadfish, and porcupine fish (7). Similarly, studies on 1% solutions of blood from a number of fishes were found to give a similar difference in toxicity (8); the blood from fishes

TABLE 5

TOXICITY FOR LUPINUS SEEDLINGS FOR FISH BLOOD 1% SHIVE'S SOLUTION FROM FISH WITH SCALES AND FINS

No.	Common Name	Scientific Name	Phytotoxic Index %
1.	Kingfish	Tarpon atlanticus	70
2.	Bumper	Chloroscombus chrysurus	74
3.	Butterfish	Poronotus triacanthus	80
4.	Sea Robin	Lepomis gibbosus	87
5.	Pike	Esox americanus	82
6.	Goldfish	Carassius auratus	80
7.	Chub	Chaenobryttus gulosus	75
8.	Carp	Cuprimus carpio	75
9.	Flounder	Paralichthys dentitus	75

TABLE 6

TOXICITY OF BLOOD FOR LUPINUS SEEDLINGS OF FISH WITHOUT SCALES AND FINS

No.	Common Name	Scientific Name	Phytotoxic Index %
1.	Skate	Pteroplatea macdura	60
2.	Sand Shark	Carcharias littoralis	31
3.	Hammerhead Shark	Sphyrna zygaena	34
4.	Puffer	Spheroides maculatus	44
5.	Stingaree	Dasyatis say	55
6.	Catfish	Ameiurus catus	59
7.	Eel	Anguilla chrisypa	50
8.	Porcupine Fish	Diodon hystrix	60
9.	Toad Fish	Opsanus tau	50

with scales and fins was but slightly inhibitory to the root growth of the seedlings, while the blood specimens obtained from a number of fishes without scales or fins were highly toxic. (Tables 5 and 6)