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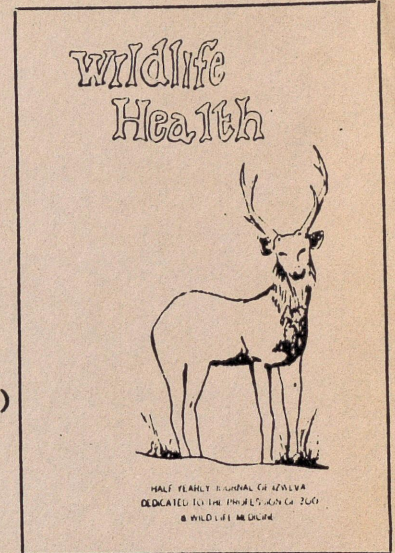
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## OBITUARY

Dr. R. K. Lahiri, a veterinarian and zoologist who was also one of the oldest zoo men in India breathed his last on 25 June 1987 at Siliguri on his way back to Darjeeling. A massive heart attack brought an end to an era of experience in zoo management in India.

The zoo community lost a man who understood the language both of men and of animals equally well. The veterinarians lost a man of vast experience, who was always willing to part with his knowledge even at the oddest hours.

Dr. Lahiri started his career right after the war and during the 26 years of service at the Calcutta Zoo, he demonstrated devotion such that a zoo which was almost lost during the war again was reckoned as a zoo of importance. Following his period at the Calcutta Zoo, he worked as a wildlife warden in West Bengal. He returned to zoo management to develop and manage a special Himalyan Zoo at Darjeeling. During his short period at the Padmaja Naidu Zoological Park, Dr. Lahiri initiated a number of endangered species breeding programmes the most notable being the Snow Leopard breeding programme.

A strict disciplinarian, yet with a sympathetic heart Dr. Lahiri was liked by all zoo men. He considered man management in a zoo as the first priority than animal management. He also considered the job of zoo veterinarian and a director the most difficult and demanding job in the world, yet till his death he worked with animals in a zoo. His zest for learning about animals made him friends from great to small people. He maintained even a shepherd boy knows some things about animals which one can never find in a book. He also believed in a simple but effective time-tested traditional methods of animal care and management which he combined successfully with modern scientific methods. With his humility to learn from everyone he met, he was an encyclopaedia of information on animals and their care.

We shall have no more of him to fall on in case of a difficult situation in animal care, but his thoughts and beliefs remain with us forever. The Indian Zoo and Wildlife Veterinarians Association (IZWLVA) mourns his sudden demise and conveys their heartfelt condolence to his bereaved family members.

Editor

O B I T U A R Y

It is with great regret that we acknowledge the sad demise of Dr. Salim Ali, the great ornithologist this past year in August. The wildlife field truly lost a great expert and conservationist.

Editor



## THE SECOND OPINION

The Expert Committee on Zoos, set up by the Indian Board for Wildlife in 1972, after making a detailed study of the maintenance of the zoos has classified them into A, B, C, and D categories.

Para 2.1 under Administrative Pattern reads as follows:

"The diversity of administration in the management of zoos in the country has mainly been responsible for various standards and lack of coordination in the maintenance of zoos. To avoid such diversity it would be desirable to have uniform pattern of administration for various zoos."

And so the Committee recommended that all "A" class zoos should have a veterinary officer to look after the zoo livestock.

As far as the Veterinary staff pattern is concerned, the Committee's recommendation to have a veterinary officer in all the "A" class zoos was right earnestly accepted by the zoo management authorities. But as time passes on, things also go on changing. The veterinary staff pattern of 1972 has lost its uniformity for the present. For example the post of Veterinary Officer of the Nehru Zoological Park, Hyderabad, Sri Chamarajendra Zoological Gardens, Mysore and Prince of Wales Zoological Park, Lucknow have been upgraded to that of Assistant Director, during these fifteen long years. Whereas the other three "A" class zoos are lacking this prestigious post.

Hence it is suggested that the Indian Board for Wildlife should consider this diversity once again and set the things right, in the interest of the zoo management and one of the zoo managements' primary Task Force -- the Veterinarians!

It may also be worthwhile to reconvene the Zoo Expert Committee to review to present zoological park set up and provide future guidelines for all aspects of zoo management.

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11/18  
DIRECTOR

DIET OF ELEPHANT IN CAPTIVITY  
By Dr. V. Krishnamurthy, Retd. Vetny. Officer  
Tamil Nadu Forest Department

If an elephant is to be kept in good health, it is essential above all other things, that he may be allowed plentiful supply of good food. Otherwise careful management in other respects will be of little use.

In the case of wild elephants, they wander a good deal according to the season of the year, to various places, when fodder is obtained in luxuriant profusion; and without effort. Although the elephant is reputed to be an unspecialised feeder, it is reported that the food plants forming the bulk of its diet fall mainly into three natural botanical taxa - the families Poaceae (Graminac) and Leguminosae, and order Malvales (Sukumar 1952). Among the more important plants are the tall grasses Cymbopogon spp and Themeda spp, Bambusa spp, Numerous species of Acacia (Such as A.Suma, A.Leucophoca, A.Latornum and A.Sundra Phoenix spp, Grewia spp, Kydia Calycina Ficus spp etc.

Due to certain anatomical peculiarities, the elephant spends about 16||18 hours on feeding. Considering the size of the animal, the mouth of the elephant is relatively small, situated below and almost totally hidden by the base of the trunk. It is not capable of being opened very wide; and the mastitongue is large and mobile, but cannot be protruded beyond the lower lip. However, the limitation of the strength of the trunk (Sikes 1971).

The stomach is simple and the caecum ad colon are very capacious.

According to McKay (1973), and Nettasinghc (1973) the average mouthful of food, irrespective of type, being 150 G. According to Olivier (1978) the average weight of an elephant mouthful of palm leaves is 190 G.

Sanderson, as indicated by Evans (1919) carried out numerous experiments to determine the quantity of fodder, elephants would eat and found that about 346 KG of green fodder may be consumed by a full||sized elephant in a day.

Considering the above factors, an elephant in captivity normally has much less chance of getting all the varieties of fodder, if stall fed; and is subjected to the monotony of the same variety of fodder throughout.

In many States, the Government departmental elephants, apart from the concentrates fed to them, are let out for grazing in the jungle -|| for a short period during day time, when they are put to work and mainly during night times. The grain ration is fed to compensate not only for the loss of time that would have been spent by the elephants grazing but also for the energy spent for various types of work performed. Different states adopt varying

standards of feeding depending upon the availability of concentrates and also the cost factor.

In many states the elephants are fed only with paddy, the quantity varying from 5 to 6 KG per animal per time.

Apart from limited work carried out by Benedict (1936) who conducted feeding trials on an Asiatic Elephant called "JAP" very little scientific data is available for computing the feeding standards for a captive elephant.

The feed requirements were computed by trial and error methods, Gopalan (1962) conducted feed trials on a few captive elephants of the Tamil Nadu Forest Department.

Anantasubramanian (1979) under the auspices of the Kerala Agricultural University carried out feed trials on a few captive elephants ||- two adult elephants and two young calves maintained at Kodanad Camp in Kerala State by feeding them chopped palm leaf (*Caryota urens*) adlib. He continued his experiments based on his earlier observations on two adult elephants (average weight 3605 Kg.) and two young animals (Average wt. 1337 Kg.) Stationed at Punna thur palace Guruvayur (Kerala State). Some of his suggestions were:

1. Cereals can be safely omitted from the ration of adult and idle elephants.

2. A systematic investigation should be carried out to determine the nutrient requirements for supporting the most important physiological function of the elephant, viz, work.

In Tamil Nadu based on personal observations and limited feed trials, rations for captive Forest Departmental elephants were computed. It is on the assumption that an elephant consumes about 5% of its body weight as green fodder or approximately 1.5 to 2% of body weight on a dry matter requirements. Rations were computed for work elephants and other elephants. The elephants are fed with Horse gram, Ragi or Rice in cooked form. The concentrate part of rations is again computed as work ration and rest ration; - the quantity of rest ration being lower than the work ration, since the elephant on rest gets more time for natural grazing.

The effect of rations computed for various classes of animals is based purely on observations regarding the condition of the animals. In Mudumalai Wildlife Sanctuary, the weighments of elephants along with the height and girth measurements are recorded annually and in other places only height and girth measurements are recorded due to lack of facilities. It has been observed that young and growing animals have show satisfactory rate of growth and the adult working elephants maintained or increased in their weight. Only those elephants which were continuously used for joy rides did not show appreciable weight gain because, they are being tethered and given cut fodder.

In temple elephants of Tamil Nadu, elephants are not put to any work except for occasional processions and marches. They are given 6 Kg. of Rice with 100 grams of salt, 100 ml of gingelly oil, green grass and coconut palm leaves are provided, in addition. In Kerela, most of the privately owned and temple elephants are fed only with caryota urens palm leaves and only if they are sent for work, cooked rice is provided for them.

With regards to maintenance cost in Tamil Nadu, the cost of maintaining one working elephant is about Rs. 50 ||55 per day (cost of feed plus cost of two attendants) and the cost of dragging working out to about rs. 40 to Rs. 45/||M3.

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The table on the following page (Table I, p. 4) shows the rations prescribed for various classes of Elephants.

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This article was presented at the International workshop on Management of Elephants in the wild and in captivity, held at Jaldapara Sanctuary, West Bengal between 10th and 17th December, 1982.

#### CORRIGENDUM

REF. "Gastro Intestinal Parasites of Zoo Animals," their impact, treatment and control) Published in Vol. 4, Nos. 1 & 2 of WILDLIFE HEALTH:

It is due to some mistake and confusion that in the above mentioned article on page 5 in paragraph 1 under "Methods and Material", Kanpur Zoological Park is wrongly metioned as established in the year 1913 by Mr. G. B. Allen. In fact Allen Forest where this Zoo is situated was established in 1913 by Mr. G. B. Allen and the State Forest Department constructed a Zoological Park in this Forest and opened it for public exhibition from February 1974. Themistake is regretted. Editor.

T A B L E I

FEED TABLE FOR VARIOUS CLASSES OF ANIMALS 1- TAMILNADU FOREST DEPARTMENT.

Class of Animals (By Height)	Approximate Body Weight	work Diet				Rest Diet				Fodder Requirer ments per day (allo- wing for wastage
		Horse gram Kg.	Ragi Kg.	Salt G.	Jaggery G.	Horse gram Kg.	Ragi Kg.	Salt M.	Jaggery. M.	
Above -255 Cms.	3500-4000 Kg.	5	18	200	100	3	14	150	100	300-350 Kg.
241-255 Cms.	3000-3500 Kg.	4	16	150	100	2	12	100	100	225-300 Kg.
226-240 Cms.	2500-3000Kg.	3	14	100	100	1	10	100	100	180-225 Kg.
211-225 Cms.	2000-2500 Kg.	2	12	100	100	1	8	75	100	150-180 Kg.
196-210 Cms.	1500-2000 Kg.	1	10	75	100	1	8	75	100	120-150 Kg.
181-195 Cms.	1000-1500 Kg.					1	8	75	100	90-120 Kg.
<b>Calves:</b>										
3-6 Years	500-1000 Kg.					1	6	50	100	50-90 Kg.
1-3 Years	350-500 Kg.					1	4	50	100	25-50 Kg.
6 Months 1 year	250-350 Kg.					-	2	30	100	15-25 Kg.

N B : The fodder requirements are for these animals which are stall fed.

OCCURANCES OF METABOLIC BONE DISEASE IN YOUNG FELIDS  
IN CAPTIVE CONDITIONS

By Dr. Mir Gower Ali Khan

INTRODUCTION

Nutritional disorders are very common in young felids in captive conditions due to higher nutritional requirements in the early stages of fast bodily growth. Especially a prolonged deficiency of calcium and vitamin "D" or an improper ratio of calcium to phosphorous in the diet results in poor body growth. The term "metabolic bone disease" is applied to such a condition. Various names are also given to this deficiency disease, such as follows:

1. Osteoporosis
2. Osteomalacia
3. Rickets
4. Cage paralysis
5. Bone atrophy
6. Osteo dystrophy
7. Osteodystrophia Febrosa Cystica

Metabolic Bone Disease should be considered to be a disease caused by dietary and husbandry management, characterised by Metabolic defects affecting the morphology and function of Bones (M. E. Fowler : 1978).

CASE REPORT:

A. The Animals and the Housing

A pair of Black panther (*Panthera pardus*) was purchased from Gauhati Zoo, Assam for the Nehru Zoological Park, Hyderabad in the year 1965. The animals on arrival were found to be full grown and perfect in shape. They were housed in an enclosure with a floor space of 3 m x 3.5 m and a height of 4.25 m. Four animal houses were also provided with the same housing facilities. Both these species were kept adjacent to each other.

B. Diet

The panthers were fed on 1/4 ltr. of milk with a raw egg in the morning. The afternoon feed was 3 kgs. of Beef muscle pieces along with 2 || 3 multivitamin tablets and a tea||spoonful of T.M 5 feed supplement.

C. BREEDING

The Black as well as the normal coloured panthers started breeding from the year 1966 and 1969 respectively. The breeding records are given in Table I and II. Mother panthers took good care of the cubs. They were seen suckling the young ones satisfactorily. The growth rate of the cubs were also normal.

#### D. Description of the Disease:

As mentioned earlier the growth rate of the cubs was normal but say from 8 || 12 weeks onwards they were found weak in the hindlimbs. They were reluctant to come of the animal houses. When forced, they started limping with one or the other hindlimbs. Later on as the case advanced dragging one or both of the hindlimbs was seen, giving the appearance of paraplegia (cage paralysis) (Fowler, E.M.). In the initial stage the appetite was normal.

The cubs were separated from the mother for close examination and treatment. No boney deformity such as fracture of bone or dislocation of the joints could be detected. Daily body temperature was recorded. Samples of blood and stools were collected, at intervals, and were examined under the microscope, but nothing significant could be detected except for light to heavy infection of Helminthic ova of Toxacara and Anchylostome species.

#### T R E A T M E N T

All the cubs were treated symptomatically as follows:

- i. Deworming the cubs with Neobidermine capsule, Bayers or Heimacid liquid or Helmacid Granules with Senna (Glaxo).
- ii. Injection of Broader spectrum antibiotics such as Terramycine (Pfizer) or Achromycin (Cyanamide).
- iii. Injection of Vit. 'B' Complex/Vit. 'B', B6, B12.
- iv. Massage of the back and hind quarters with Camphor In - Oil/Wintogeno.
- v. Application of Infra Red Rays for 1 || 3 minutes.

All the cubs which suffered from this kind of paraplegia and muscular dystrophy became weak day by day and died of weakness, exhaustion and complications from bed sores. Autopsies conducted on all these cubs could not reveal any specific infection except of Gastro enteritis nd pneumonia. (See Table I and II)

When this same "leg weakness" was observed in the zooborn two months old cubs (2,1,3) of puma (*Felis concolor*) in April 1976 a second thought was given to nutritional aspect. Available literature on cat nutrition showed that muscle meat is found to be deficient in Vitamin A and poor in calcium content. The ratio of calcium to phosphorous is also found to be poor, i.e., instead of being 2:1 it is 1:16. A few workers colleagues are quoted below:

1. BLAND SUTTON (1888) has nicely described the skeletal changes referred to as "Rickets" in cubs and a young lion (*Panthera leo*) of 8 weeks as follows:

"Instead of playing with its companions, it preferred to remain quiet. When attempting to walk, it advanced a few steps then staggered, the hind quarters rolled over and convulsions some time occurred.

This cub died at the age of 12 weeks. Some cubs to which he gave supplements of bone dust and codliver oil made a good recovery and were alive and active without any signs of paralysis two years later.

2. FIENNES AND GRAHAM JONE (1960) have also made a careful study of pathology of lions suffering from this disease and distinguished the light bones of the cats reared in captivity from the heavy bones of those shot in the wild. And the captive lions have shown gross deficiency of calcium when compared with the wild lions.

3. PATRICIA P. SCOTT (1968): who worked on cat nutrition in London Zoo, puts her findings as follows: ||

"When muscle meat or heart is given to animals the total amount of calcium provided is very small indeed. It is therefore not surprising that growing kittens and cubs fed exclusively on meat suffer severely from calcium deficiency without obvious signs of Rickets."

Hence in the light of the above referred findings the feed of the three puma cubs was supplemented as follows:

1. Osto calcium syrup with Vit. B12 (Glaxo) 30 ml daily in milk in the morning to each cub.
2. Vitamin A and D capsule (Glaxo) 3 capsule to each cub in a small muscle piece in the afternoon.
3. Raw liver 100 gms per cub each day.

N.B.: Injections of broader spectrum antibiotics, Vitamin B. Complex, etc., as mentioned under the sub||heading "Treatment" were not administered to the Puma cubs.

After the continuous administation of the above feed supplement, Vitamins and Minerals for a period of about 4 months, all the three cubs recovered fully. They could walk, run, and jump normally. They grew into marvellous specimens and have bred successfully in the Nehru Zoological Park, Hyderabad.

#### S U M M A R Y

Occurrence of Metabolic Bone Disease (Rickets/Osteodystrop||hia fibrosa) in cubs of panther and puma are described in this article. Diagnosis is made on clinical signs and on evaluation of the diet (i.e., muscle beef which is highly deficient in calcium content and a poor ration of calcium and phosphorous). Radiographic findings were not done. The boney outgrowth and

curvature as seen in pups are totally absent in young felids. Instead, muscular dystrophy with limping and dragging the hindlimbs are the prominent symptoms.

This condition is due to long standing deficiency of calcium and Vit. D and poor ratio of calcium to phosphorous. Hence when the diet of all the three puma cubs 2,1,3 aged about 8 weeks was supplemented with ostocalcium syrup with B 12 Vit. and Vits. a and D for a period of about four months the cubs returned back to their active life.

Later, the occurrence of metabolic bone disease in the Panther and Puma cubs, their symptoms and the successful line of treatment was confirmed by work of Fowler, M. E. (1978) and Gass, H. (1982)

#### ACKNOWLEDGEMENTS

The author acknowledges his sincere thanks to the continuous encouragement and pursuance of Sri Pushp Kumar, the then Curator of Nehru Zoological Park, Hyderabad in the conclusive diagnosis of this nutritional problem.

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TABLE - I SHOWING THE DETAILS OF THE BIRTH AND MORTALITY OF THE PARTNER CUBS  
(BLACK COLOURED) AT THE NERUR ZOO PARK,  
HYDERABAD A.P.

S.No.	Batch no. of Litter	Date of Delivery	No. of cubs born	Sex ratio of the cubs	Death within a month	From 1966-1976		Remarks	
						Death after a month			
						Date of death	Age at death Y.M.D.		
I	I	24-7-66	2	2:0	Nil	i) 27.12.67 ii) 15.2.68	1-5-3 1-6-21	The common P.M. findings were	
	II	13-5-68	1	1:0	Nil	i) 4-12-68	0-6-21	1. Bed sores 2. Enteritis with gastritis 3. Pneumonia	
	III	1-11-69	2	2:0	Nil	i) 25-9-70 ii) 14-2-71	0-10-24 1-3-13	-do-	
	IV	1-3-71	3	2:1	Nil	i) one 20-6-72	1-3-19	Two cubs survived	
	V	11-11-72	2	1:1	Nil	Nil	-	Both the cubs survived	
	VI	10-5-76	1	0:1	Nil	One 28-8-76	0-3-13		

TABLE - II SHOWING THE DETAILS OF BIRTH AND MORTALITY OF PARTNER CUBS  
(NORMAL COLOUR) AT THE NERUR ZOO PARK, HYDERABAD (A.P)

S.No.	Batch no. of Litter	Date of Delivery	No. of cubs born	Sex ratio of the cubs M:F	Death within a month	From 1969-1972		Cause of death	
						Death after one month			
						Date of death	Age at the time of death Y.M.D.		
1.	I	23.4.69	2	2:0	Nil	i) One 20-4-70	0-6-22	The common P.M. findings were 1. Bed sores 2. Gostritis 3. Enteritis and Pneumonia.	
	II	12.10.70	2	2:0	Nil	i) 15-6-71 ii) 13-7-71	0-3-3 0-9-1		
	III	21.10.70	2	2:0	Nil	i) 18-3-71 ii) 12-11-71	0-9-27 1-0-21	-do-	
	IV	20-8-71	2	2:0	Nil	i) 16-2-72 ii) 5-5-72	0-5-26 0-6-15	-do-	
	V	8.3.72	1	1:0	Nil	i) 21-1-73	1-1-16	-do-	

## GASTRO INTESTINAL PARASITES OF ZOO ANIMALS :

### TREATMENT AND DEWORMING SCHEDULE

(A further Report from Kanpur Zoological Park, Kanpur)

by Dr. H. K. Goirala

#### TREATMENT :-

Treatment is at once adopted in positive cases as evinced in the routine fecal examination. The infestation may be single or mixed and the worms load may not be high enough to cause disease symptoms but treatment of the whole flock is necessary to check and eradicate the parasite. Choice of the anthelmintic drug is based on the facts that:-

1. It is effective against the parasite infestation.
2. It is well tolerated by the host species.
3. It is easily taken by the affected animals.

EFFICACY: Although the selection of <sup>an</sup> effective drug is made easier with the availability of various broad spectrum Anthelmintics, <sup>the</sup> use of specific anthelmintics have their own value. Piperazine, available in various salt forms, is indicated only against Ascarids (Ascaris sp. and Toxocara sp.) and pin worms (Enterobius sp.) but is greatly effective than any other broad spectrum anthelmintics. It is generally given as single dose at the rate of 100-200 mg. per Kg. in Carnivores and Felids; 100-125 mg. per kg. in Primates, Artiodactyles and other mammals; 300-440 mg. per kg. in Birds and 55-88 mg per kg. in Reptiles. Some authors have advised for 3 days treatment in Felids at a dose rate of 200 mg. per kg. and in Bears at 50 mg per kg. body weight. Phenothiazine marketed by ICI as phenovis is effective against Hetrakis sp. in Birds and caecal worms in elephants and Artiodactyles. It is given at a dose rate of 2.2gm per Kg. in birds, 600-700 mg per kg in

Deers and Bovids and 66 mg per kg. in Zebra as a single dose. In elephants phenovis is given in a dose of 54-108 gms, according to size, in 4 divided doses for 4 days. Disophenol marketed by Cyanamide in 4.5% solution as Anchylol, the only presently available injectible dewormer, is specific against hookworms (Ancylostomum) sp and Bunostomum sp). It is given as subcutaneous injections in Canines and Felines at a dose rate of 10 mg per kg (2:2 ml of Anchylol per 10 kg) and Elephants as 4.4-3 mg per kg for gape worms in perching birds it is given at a dose rate of 60-80 mg per kg. Dichlorophen available as cestophene and Dicestal; and niclosamide (Yomesan) available as Niclosan are the drug of choice for tape worm infestations in Carnivores, birds and reptiles. The dose of Dichlorophen in carnivores is 200 mg per kg and in birds as 300-800 mg per kg in a single dose. Niclosamide is given in primats, Carnivores and birds at a dose rate of 150 mg per kg and in reptiles as 150-200 mg per kg. Country drugs like Kamala and arecanut in tape worm infestation have also been tried in Bovian, carnivores and birds.

In caecal coccidiosis Nitrofurans (Bifuran, SKF) Amprolium (Amprolosal MSD) and codrinol (Hoechst) are specific while sulpha drugs give good results in intestinal coccidiosis. The specific drug of choice for treatment of Entamoeba sp. and Giardia sp infestation, commonly found in **primates**, is **Metronidazole** available in market in various forms of tablets and syrups.

There are various broad spectrum anthelmintics<sup>c</sup> also, available in market these days for all types of animals. Various literature is available for their common usage in zoo animals. They have been used frequently in this Zoo. They are mainly of Benzimidazole and Imidathiazole groups. Following table is given for their details, forms of availability and range of efficacy in zoo animals.

TABLE - 6

Sl. No.	MEDICINE	MARKETED BY	PROPIORATORY NAME AND CONTENT STRENGTH	ORDER OF EFFICACY ON DIFFERENT SP.
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BENZIMIDAZOLE group:

1.	Mebendazole	CONCEPT	ZOLEX BOLUS 500 mg. ZOLEX POWDER 10%	Ascarids sp, Ancylostoma sp, Strongyloide sp. (Primates only) Haemonchus sp. Bunostomum sp.
		CADILA	WORMIN Tablet 100 mg. WORMIN BOLUS 500 mg.	Trichuris sp. (Canines and primates only) Gizzard worm Capillaris sp.
2.	Thiabendazole	M.S.D.	THIBENDOLE Bolus 2 gn.	Ascarids sp. Ancylostome sp. Strongyloide sp.
			THIBENDOLE Powder 75%	Oesophagostome sp. Haemonchus sp.
			MERTAZOL tablet 500 mg.	Bunostomum sp. Trichuris sp. (Primates only) gape worms.
3.	Parbendazole	S.K.F.	Helatec Powder 4%	Ascaris sp. Bunostomum sp. Haemonchus sp. Oesophagostomum sp. Strongyloide sp. Trichostrongylus sp. Trichuris sp.
4.	Fenbendazole	HOECHST	PANACUR Powder 25%	Haemonchus sp. Oesophagostomum sp. Bunostomum sp. Capillaris sp. Trichuris sp. Tape worm Moniezia sp.
5.	Albendazole	WOCKHARDT	ANALGON Suspension 2.5%	Haemonchus sp. Trichostrongylus sp. Bunostomum sp. Oesophagostomum sp. Tape worm Moniezia sp. & Trematode sp.

contd.....

IMIDATHIAZOLES GROUP:-

1. Tetramisole	I.C.I. SARABBAI ETHMOR	MILVERM Powder 30% CURAMINTH Powder 30% DECARIS child tab 50 mg. DECARIS adult tab 150 mg	Haemonchus sp. Ancylostome sp. Stron- gyloide sp. (Primates) Trichostrongylus sp. Gizzard worm, Hetrakis sp. Ascaridia sp. Cape worms.
2. Tetramisole-L or Levamisole	P.C.I.  I.C.I.	HEMISOL-sus- pension of Hydro- chloride 1.5%  KETHAX Tab 50mg. (Levamisole hydrochloride)	Haemonchus sp.  Trichostrongylus sp. Bunostomum sp. Ascaris sp. Oeso- phagostoms sp. Trichuris sp. Capillaria sp. Gizzard worm, Ascaridia sp. Hetrakis sp.

The following table summarizes their close rates in various zoo animals which is followed in this Zoological Park:-

TABLE 7: Doses in mg. per kg body weight

GROUP OR SPECIES	HEBEND	THIABEND	PARBEND	FENBEND	ALBEND	TETRAMI SOLE	LEVAMISOLE
Canines & Felines	15-20mg (2 days)	50- 100mg	-	-	10- 20mg	10- 15 mg	11 mg.
Primates	15mg (2 days) 3mg (10 days)	100mg 25-35mg (4 days)	-	-	-	12- 15 mg	-
Artio- dactyles	10- 15mg	50- 100mg	30mg	5- 10mg	5- 10mg	15mg	3 mg
Hippopo- tamus	3- 10mg	50mg	30mg*	5* mg	-	3- 10mg	-
Rhinoceros							
Giraffe							

contd.....

Bears	10mg	60- 120mg	-	-	-	-	-
Zebras	3mg	50- 75mg	-	5-10mg*	5-10mg	9 mg	-
Elephants	-	44mg	-	-	-	4.4- 6.6mg	-
Birds	5- 10mg	100mg	-	-	-	100- 150mg	20- 30mg
Reptiles	100mg (3 days)	55mg	-	30- 50mg	-	100- 300mg	-

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\*Doses self ascertained and tried

It is quite evident from Table 6 that most of the parasites are covered by broad spectrum anthelminites *Trichuris* sp. and *strongyloides* sp. are resistant for treatment and some authors advice 3-7 days treatment for their eradication. Most of the other adult worms are destroyed by single dose treatment. For mixed infections broad spectrum anthelminties are most suitable. Every treatment regimen for endoparasites includes a second dose of appropriate anthelmintic in two to three weeks to rid the host of maturing parasite.

TOLERANCE:- Almost all the anthelmintics enlisted in the preceeding paras have been used at Kanpur Zoological Park, Kanpur in the given doses and no alarming reaction has ever been noticed except some salivation and restlessness at times with Tetramisole in cheetah and white tiger. Piperizine has been reported toxic in cheetah, lions and Pumas.

Following precautions are taken to avoid any chance of over-dose and reaction:-

1. Doses are calculated as far as practicable individually on the correct estimated weight of the animal.
2. Lower limit of prescribed dose rate is taken for high weight animals and higher limit for lowweight animals.
3. The animals are dosed individually and mass treatment in feed or water is avoided as far as practicable.
4. Strict watch and care is taken so that no animals is dosed twice. If any animal has taken only a portion of the drug dose, it is repeated only after a gap of one week with full doze.
5. In cases of trials with new drugs utmost care in calculating the dose is taken and one animal is taken at a time. After dosing, it is kept under strict watch for 24 hours.

ADMINISTRATION:- Great skill and experience is required to administer the anthelmintic drugs. Almost all are given by oral route except Ivermectin (moxidectin) which is given subcutaneously and is specific for hook worms only. Unlike domestic animals Zoo animals cannot be drenched. It is by persuasion and deception only that they can take the drug. Prerequisites for an oral anthelmintic for Zoo animals are that it should not be obnoxious to smell and taste and should be lesser in volume. Preparations like the bendole Zodex, Helatac and Panacur are odourless and tasteless and so best suited for all zoo animals.



TABLE 8:

DEWORMING SCHEDULE

Followed at Kanpur Zoological Park, Kanpur

MONTH OF DOSING	ANTIPARASITIC DRUGS USED				
	For Group I animals*	Group II animals*	Group III animals*	Group IV (Birds)	Group V (Reptiles)
January	Piperizine or Albendazole	-	-	-	-
February	-	Piperizine	-	Pheovis (in fowls & Pheasants Mebendazole (others)	-
March	-	-	Parbendazole (Giraffe only) Thiabendazole (others)	-	Mebendazole
April	Thiabendazole	-	-	-	-
May	-	Thiabendazole	-	-	-
June	-	-	-	Piperizine	-
July	Mebendazole	-	Phenovis (Elephant) Piperizine (others)	-	-
August	-	Piperizine	-	-	-
September	-	-	-	-	Thiabendazole
October	Tetramisole or Levamisole	-	-	Dichlorophen or Niclosomide or Levamisole	-
NOVEMBER	-	Mebendazole	Mebendazole or Fenbendazole or Albendazole	-	-
December	-	-	-	-	-

\*Group division as per Table 1.0.1, Wildlife Health vol. 4 (1982): 4-9

The deworming programme is carried out mostly in the first week of the month and a manageable number of animals are taken in one day. Felines and canines are generally dewormed on Wednesday i.e. next day of their fasting day Tuesday.

The preceding regimen of schedule is being followed at Kanpur Zoological Park for last three years. It has given definite improvement in the level of mortality of parasitic infestation as evinced by the result of necropsies of the animals died during past five years at this Zoo as detailed in the following table.

TABLE I

Sl. No.	Year	Species	Total strength	Total deaths	Deaths due to Endoparasites		% of Total mortality
					No.	% of total Death	
1.	80-81	MAMMALS	443	86	4	4.65	19.4
		BIRDS	758	233	41	17.6	30.7
		TOTAL	1201	319	45	14.1	26.56
2.	81-82	MAMMALS	418	48	3	6.25	11.4
		BIRDS	879	187	7	3.75	21.2
		TOTAL	1297	235	10	4.25	18.11
3.	82-83	MAMMALS	395	50	-	-	12.65
		BIRDS	706	91	5	5.49	12.88
		TOTAL	1101	141	5	3.55	12.80
4.	83-84	MAMMALS	395	67	-	-	17.4
		BIRDS	690	62	-	-	9.0
		TOTAL	1075	129	-	-	12.0
5.	84-85	MAMMALS	537	32	-	-	9.5
		BIRDS	742	85	4	4.7	11.45
		TOTAL	1079	117	4	3.42	10.84

SALMONELLOSIS IN ADULT INDIAN RHINOCEROSSES \*\*

(Rhinoceros unicornis)

By\* N. Lakshmana Char; S. Ramanathan; M. Rama Krishna Rao;  
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INTRODUCTION:

Zoo animals are known to suffer from salmonella infection in many parts of the world. Literature pertaining to the incidence of salmonellosis in rhinoceroses in India is scant. As such, there is no record of the infection due to *S. typhimurium* and *S. enteritidis* in rhinoceroses causing fatalities. This is a report on the mortality of three adult Indian rhinoceroses stationed at Nehru Zoological Park, Hyderabad, Andhra Pradesh State, as a result of salmonella infection.

Clinical History: In August 1983, three adult Indian rhinoceroses, two males aged 12 and 25 years and one female aged 20 years, died after an illness of 8-10 days duration, within a span of 15 days, one after the other.

Early clinical signs noticed were dragging of both hind limbs, shivering of body and forelimbs with intermittent convulsions, and recumbency which lasted till death. Grinding of the teeth and increased rate of respiration were observed. Petechiae of the visible mucous membranes, mucoid lacrimation and nasal discharges, was noticed. A few days before death, the animals became weak as a result of diarrhea and dehydration. On the day of death, hematuria and yellowish discoloration of the body coat was observed.

Treatment included tetracycline, antibiotics, vitamins, corticosteroids, electrolytes and saline, which were given both orally and parenterally. Despite

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continued therapy, the animals died without showing any response to treatment.

Necropsy Findings: Extensive submucosal and subserosal petechial hemorrhages were noticed. The heart and spleen were congested and edematous. The liver was enlarged and congested. Hemorrhagic enteritis was seen and the entire lumen of the small intestine was packed with a heavy infestation of tapeworms. Mesenteric lymph nodes were swollen, edematous and congested. All three rhinoceroses revealed the same type of lesions except one, the lungs of which showed multiple abscesses of varying sizes from 1-6 cm, with considerable amounts of blood tinged exudation from cut surfaces. In the other two, the lungs were consolidated with pleural adhesions showing pneumonic lesions. In the female, amphistomes were observed in the stomach. The uterus was gravid with an 8-month fetus. In general, all the organs were severely congested indicating septicemic infection.

Histopathology Examination: In the intestines, congestion of blood vessels in the lamina propria and submucosa was seen. At some foci, there were hemorrhages in the lamina propria and a few of the macrophages were laden with golden yellow hemosiderin pigment. Infiltrations of mononuclear cells, mainly lymphocytes and macrophages were evident.

In the heart, mild congestion of blood vessels was observed in the musculature, subepicardium and between myofibrils. There was severe congestion of blood vessels in the interstitial spaces of the kidneys. The lungs of one rhinoceros had granulomatous foci with Langhan's

giant cells and acid fast organisms. The liver and spleen were congested.

Laboratory Investigations: Lung abscesses of the male rhinoceros contained acid fast organisms morphologically indistinguishable from Mycobacterium tuberculosis on Ziehl-Neelsens method of staining.

The tapeworms which were found fully packed and interwoven throughout the lumen of the small intestines of all three animals were identified as Anaplocephala species. Amphistomes found in the stomach of the female rhinoceros were identified as Cotylophoron species.

Heart blood, liver and intestinal contents of the three animals were subjected to detailed bacteriological examination. Based on biochemical and sugar fermentation tests, the organisms isolated were identified as Salmonella species'. These isolates, sent to National Salmonella and Escherichia Centre, Kasauli, were identified as S. typhimurium and S. enteritidis, with antigenic formulae 1,4,5,12:i:1,2 and 1,9,12: g.m. respectively.

In vitro, antibiotic sensitivity tests for the isolates were conducted by conventional paper disc diffusion method as described by Cruickshank<sup>2</sup>, using discs supplied by Span Diagnostics, Surat. S. typhimurium and S. enteritidis, were both found to be sensitive to gentamicin, neomycin followed by furadantin, and Chloramphenicol. Complete resistance was encountered with oxytetracycline, chlorotetracycline, streptomycin, ampicillin, erythromycin and penicillin.

Materials from all three animals sent to the Indian Veterinary Research Institute, Myskreswar, for investigation of probable viral infections, were found to be negative for viral agents.

Discussion: From the available literature and statistical data, enteric infections in man and animals are most frequently caused by infection with the salmonella group of organisms. There is not an abundance of literature on salmonellosis in zoo animals and rhinoceroses. Salmonellae have been reported in young rhinoceroses<sup>4</sup>, although not as the cause of fatalities. Schmidt and Hartfiel<sup>3</sup> attributed the death of an infant rhinoceros born at San Antonio zoo to acute salmonellosis, though no salmonella organisms were isolated.

In the present investigation, S. typhimurium and S. enteritidis were isolated from all three adult rhinoceroses which died showing septicemic lesions. One male rhinoceros had extensive localised tuberculous lesions in the lungs, and a pregnant female had amphistomes (Cotylophoron sp) in the stomach. Further, all three animals had heavy infestation of tapeworms (Anaplocephala sp.). The multiplicity and chronicity of these disease entities may probably have lowered the vitality of the animals, allowing the salmonella organisms present in the intestines to proliferate causing mortality among these animals.

The rhinoceroses were located in an area with a pond of stagnant water. There is a possibility for rodents, mongoose and bandicoots, which act as carriers of salmonella organisms, to move freely in the premises.

Human infection may pose a threat to the captive animals. Though the source of the salmonella infection was not established in this study, the authors are of the opinion that poor environmental sanitation and other factors might have contributed to the deaths of the three adult Indian rhinoceroses from salmonella infection.

#### SUMMARY

Mortality of three adult Indian rhinoceroses, S. typhimurium and S. enteritidis infection is reported.

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