

ANIMAL DIET: PROTEIN REQUIREMENT IN ZOO ANIMALS (ANN-607, Date- 27.10.2020, Unit -1)

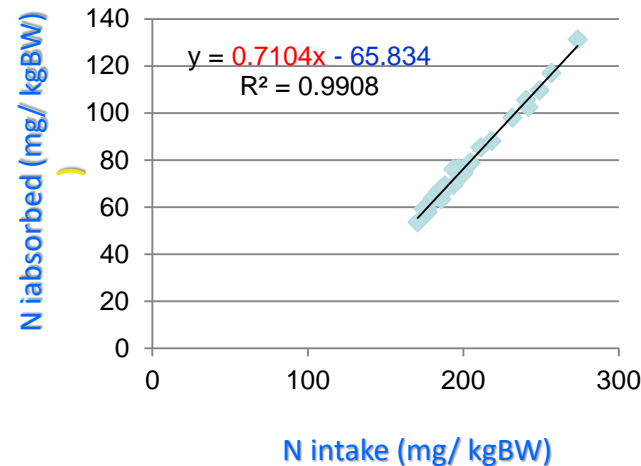


DR. SANJAY KUMAR

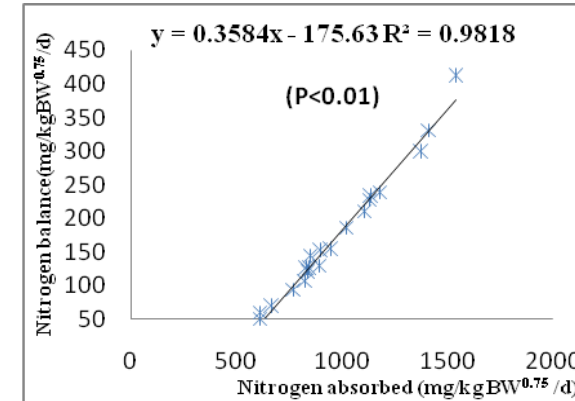
sanjayvet29@rediffmail.com

**DEPARTMENT OF ANIMAL NUTRITION
BIHAR VETERINARY COLLEGE,
BIHAR ANIMAL SCIENCES UNIVERSITY, PATNA, BIHAR, INDIA**

Estimating protein requirements of zoo animals



true protein digestibility= 0.71
MFN=65.8 mg/kg BW



Efficiency of utilization= .036
EUN= 176 mg mg/kg BW 0.75

Minimum CP requirement can be calculated as per the model of Robbins *et al.* (1993)

CP % in diet = {[EUN +dermal loss)+ MFN (DMI) * 6.25]/DMI/TPD} * 100.

Where, EUN: endogenous urinary nitrogen; MFN: metabolic faecal nitrogen; TPD, true protein digestibility

MFN can also be estimated as the fraction of fecal N that is soluble in neutral detergent solution

**Intake and utilization of N in Indian
rhinoceros fed three season specific diets**

Parameters	Sugarcane	Berseem	Jowar
N intake (g/d)	208.23±22.27	361.04±40.26	262.95±30.98
MFN (g/d)	86.89±10.6	117.6±12.5	96.93±10.3
EUN (g/d)	35.6±3.10	35.77±3.11	35.97±3.04
Total endogenous loss	122.5±13.70	153.3±15.57	132.91±13.25
CP % Diet	5.51 ^a ±.10	6.44 ^b ±.06	5.54 ^a ±0.08
			Kumar, 2012

- NRC (1989) recommends 8% CP for maintenance of adult horse
- NAG (1997) recommends 10-12 % CP for maintenance of adult white rhinoceros

Intake and utilization of N in Asian elephants

Parameters	Dietary treatments		
	Group-I	Group-II	Group-III
N-intake (g/d)	617±79.1	631±27.2	624±27.4
N in faeces (g/d)	396±23.3	390±22.5	391±23.1
MFN (g/d)	269±14.6	274±14.6	275±14.4
EUN (g/d)	60.7±3.43	60.7±3.44	60.6±3.43
Dermal losses (g/d)	14.8±0.83	14.8±0.84	14.73±0.83
Total endogenous loss (g/d)	344±18.8	349±18.9	350±18.4
True Protein Digestibility (%)	80.4±0.88	81.9±1.11	81.7±1.30
Minimum CP (% in diet)	5.8±0.09	5.9 ±0.09	6.0 ±0.14

† All the elephants were allowed to forage for 6 h/ d and were fed cut branches of Rohini tree ad lib. However, the amount of WR fed to the elephants in groups I, II, and III was 0.18, 0.12 and 0.06% of BW, respectively.

Das et al., 2014

NAG (1997) recommends 8 -10% CP for maintenance of adult Asian elephant

Intake and utilization of N in Blackbuck

Parameter	Groups†		
	I	II	III
N intake* (g/day)	8.27 ^a ± 0.25	12.27 ^b ± 0.30	16.42 ^c ± 0.36
N in faeces (g/day)	5.67 ± 0.24	6.27 ± 0.20	6.21 ± 0.12
MFN (g/day)	5.55 ± 0.22	5.86 ± 0.19	5.57 ± 0.11
EUN (g/day)	1.75 ± 0.06	1.71 ± 0.05	1.79 ± 0.05
Minimum CP (% diet)	8.28 ± 0.11	8.72 ± 0.23	8.27 ± 0.17

Overall, CP content of the diets was 6.9%, 10.4% and 12.7% i
respectively.

Das et al., 2012

NAG (1997) recommends 14-17% CP for medium intermediate grazers

Should we relook into the earlier recommendations or we wait for further
research data ??

CP content of diets fed to Indian Rhinoceros as compared to minimum CP content of diets required for maintenance

Zoo	CP% in diet	Requirement
Kanpur	9.73	8.1*
		5.8 **
Assam	9.96	
Patna	9.32	

* NRC(1989) requirement for horses

** Estimated requirement for Indian rhinoceros from the present study

CP % in diet	Roughage source		
	Sugarcane	Berseem	Jowar
	7.15	11.53	8.33

Protein supply is dependent on season specific forage source

Intake and utilization of N is also influenced by age

Intake and utilization of N (mg/ Kg BW^{0.75}/ d) in Asian elephants			
	Calf	Sub-adult	Adult
Intake	2466 ^c ±92.1	2249 ^b ±33.5	1675 ^a ±77.5
Absorbed	1443 ^c ±48.9	1138 ^b ±15.5	812 ^a ±50.3
Balance	347.1 ^c ±33.4	227.5 ^b ±6.0	123.1 ^a ±18.9
MFN losses	714.5 ^c ±98.1	627.2 ^b ±19.8	417.8 ^a ±30.2
EUN losses	219.0 ^c ±0.0	189.2 ^{bA} ±0.9	153.0 ^{aA} ±0.0
Dermal losses	35.0±0.0	35.0±0.0	35.0±0.0
Total endogenous losses	969 ^c ±98.1	851.4 ^b ±20.1	605.8 ^a ±30.2
True digestibility (%)	82.0 ^c ±3.8	74.25 ^b ±1.4	75.8 ^a ±0.9
Minimum CP%*	9.7 ^a ±0.6	8.0 ^b ±0.2	6.0 ^c ±0.0
CP% (NAG, 1997)	12-14	12-14	8-10

Are captive Asian elephant diets adequate in CP content ????

	Guwahati	Chattbir	Hyderabad	Mysore
CP (%)	7.89±0.16	9.73±0.01	8.01±0.13	10.82±0.17

Ration adequacy with respect to crude protein supply

Species	Suggested CP%	CP % in the diet being fed
Cervids	12-16	13.0-18.5
Antelopes	8-10	14.5-18.8
Wild ass	8	12.2
Rhinoceros	8	9.3-9.7
Adult elephant	8	7.9-10.8
Growing elephants	12	11.0-11.4
Giant squirrel	15	15.2- 16.1
Monkeys	8	12.0- 21.6% (LTM)
Langurs	17	14.1- 21.5

Are we obsessed with feeding excessive protein to our zoo animals

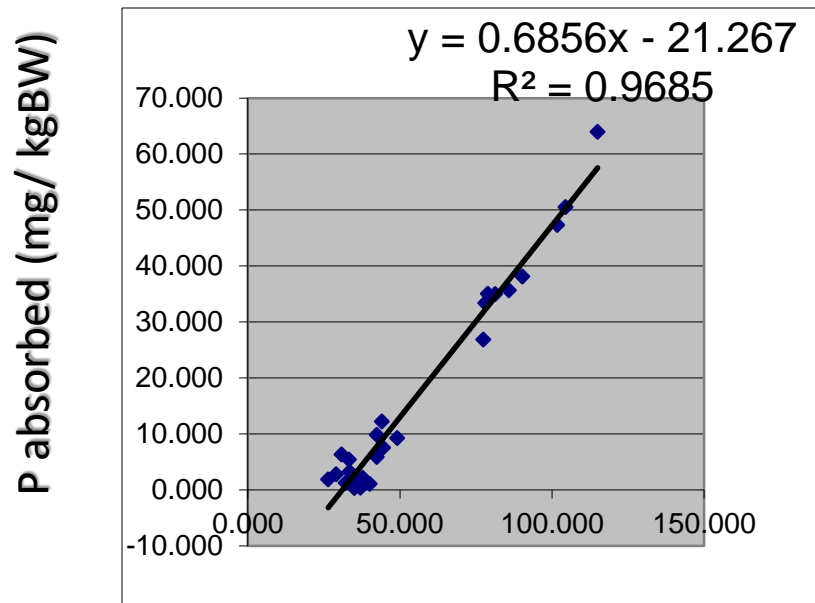
Das et al., 2013b

Species	Suggested CP%	CP% of the diet being fed
Slow loris	17	13
Tibetan wolf	28	57.4- 66.4
Bear	15	14.7-17,7
Red Panda	18	13.7 -16.5
Pelican	20-30	74.1-75.6
Psticines	10-15	12.6-14.7
Hornbill	11	7.2-32.2 ????????

Barring growing elephants, some langurs and red panda, zoo animals are generally burdened with excessive proteins

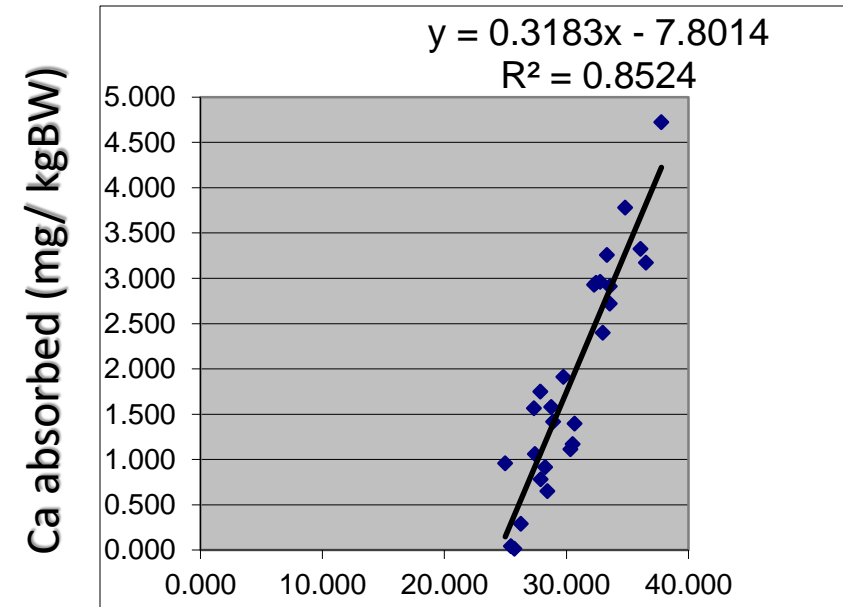
Understanding the mineral requirement of zoo animal

Correlation between intake (mg/ kg BW) and absorption (mg/kg BW) of Ca and P in Indian rhinoceros fed conventional zoo diets



Ca intake (mg/kg BW)

0.26%



P intake (mg/kgBW)

0.20%

Kumar, 2012

A comparison of the estimated mineral requirements

	Asian elephant		Indian rhinoceros	
	NAG (1997)*	Our estimate	NAG (1997)**	Our estimate
Ca (%DM)	0.30	0.23	0.55-0.63	0.26
P (%DM)	0.20	0.18	0.32-0.38	0.20
Fe (mg/ kg DM)	50	41	73-84	40
Cu (mg/ kg DM)	10	6.9	8-14	7.1
Zn(mg/ kg DM)	50	29.7	41-71	34.4

* Nutrition Advisory Group (NAG) recommendations for Elephants

** Nutrition Advisory Group (NAG) recommendations for white rhinoceros

Ration adequacy with respect to Cu and Zn supply

Species	Zn requirement (ppm)	Zn content of diet (ppm)	Zn requirement (ppm)	Zn requirement (ppm)
Cervids	40	32-42	10	7.8-9.9
Antelopes	40	23-32	10	8-9.7
Wild ass	50	28.9	10	9
Rhinoceros	41-71	27.4-35.5	8-14	6.6-10.6
Adult elephant	50	20.9-30.5	41-71	8.3-11.2

Deficiency of Zn and Cu was widespread among captive herbivores

Conclusions

- Basic data on feed consumption, diet digestibility and utilization of macro and micro nutrients in 53 selected species is generated. Major problems identified were excessive intake of calorie, protein and deficiency of Cu and Zn in many species.
- Nutritional adequacies of diet schedules followed by different zoos have been evaluated and specific measures for improvement have been suggested.
- For further improvement, role of nutrients in improving gut health, antioxidant, immunity , reproduction and welfare of captive animals should be explored.



Thanks for kind attention!