



Comparative serum biological constituents of captive Asian elephants (*Elephas maximus*)

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Biological components in blood play vital role in physiological phenomenon of different animals while variation of blood gonadal hormones in relation to normal healthy condition, reproductive cycle, pregnancy etc. information on biological constituents along with hormones in blood of adult Asian elephant (*Elephas maximus*) under family *Proboscidea* is appeared to be meager (Morrow 1986, McDonald 1980). Keeping this in view, the present investigation had been carried out to throw some light on different levels of biological constituents along with steroidal and non-steroidal hormones in serum of adult non-pregnant female and male Asian elephants.

A total of 16 adult captive healthy Asian elephants (*Elephas maximus*) of which 8 males of 9–23 years and non-pregnant 8 females of 10–25 years of Odalguri district of Asom were considered for the present investigations. Blood samples were collected from ear vein aseptically and serum was separated. Each sample was divided into 18 aliquots and stored in 18 number of plastic vials at -20°C for estimation of different biological constituents according to parameters of the present study. The respective serum aliquot was used for estimation of calcium, inorganic phosphorous, magnesium, sodium, potassium, total trace elements like iron, copper, zinc and other biological constituents like total protein, glucose, cholesterol, alkaline phosphatase, by using quality kits while the cobalt was estimated by using Atomic Absorption Spectrophotometer. Estimation of serum 17β -oestradiol, progesterone, cortisol, T_3 and T_4 were done by using quality radioimmunoassay kits. Then the values were statistically analyzed according to Snedecor and Cochran (1994) for comparison and interpretation of results.

The 't-test' revealed that the mean serum levels of calcium, inorganic phosphorous, magnesium, sodium, potassium, total

trace elements like iron, copper, zinc, cobalt; other biological constituents like total protein, glucose, cholesterol, alkaline phosphatase, 17β -oestradiol, progesterone, cortisol, T_3 and T_4 were not found to be varied significantly and all mean values were presented (Table 1) according to findings of elephants of the Orang forest area of Asom were as comparable to findings of other authors with the no significant variation between sexes in living captive managemental and environmental conditions of Thailand, while the much lower concentration of mean calcium in male and inorganic phosphorus and magnesium (Tutasuvan *et al.* 2008) and similar mean concentration of potassium in male reported by (Wijesekera *et al.* 2008) in captive Sri Lankan Asian elephants. It was appeared that only Ellen *et al.* (2011) reported first on blood cobalt level in elephants grazing in industrial area comparing to the captives where stated to be normal level. Comparatively, less concentration of alkaline phosphatase was found to be in serum of elephants indicating healthy body condition of all elephants irrespective of sexes with no cellular damage.

The result revealed hormones like 17β -oestradiol, progesterone, cortisol, T_3 and T_4 levels were not varied significantly between female and male adult Asian elephants. 17β -oestradiol found to be not traceable in all male and 3 female elephants when it was recorded to be 0.18 ± 0.02 pg/ml (range 0.15 – 0.35 pg/ml) in 5 females. The mean serum progesterone levels in female elephants were measured as 0.41 ± 0.11 pg/dl where as it was recorded to be not traceable in all males. However, John *et al.* (1994) reported that this serum progesterone concentration ranged from non detectable to 2,110 pg/ml in pregnant, 214.00 ± 5.20 pg/ml during oestrous cycle without mentioning stages of cycle of the same species of elephants. Brown *et al.* (1999) observed variation of progesterone and oestradiol remained within the range about 1.20–0.9 ng/ml and oestradiol 8.00–25 pg/ml respectively with no significant difference of LH surges during the period of ovulatory and anovulatory condition in same species too.

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Table 1. Mean concentration of biochemical constituents of blood Asian female elephant (*Elephas maximus*)

Biological constituents	Age male elephants 9 – 23 years		Age of female elephants 10 – 25 years		t-test values*
	Mean	Range of values	Mean	Range of values	
Calcium (mg/dl)	9.05 ± 1.20	6.83 – 12.38	11.43 ± 0.77	7.31–14.30	0.085
Inorganic phosphorus (mg/dl)	3.64 ± 0.31	3.15 – 5.96	4.91 ± 0.47	3.45 – 5.25	0.146
Sodium (mmol)	82.10 ± 8.46	59.63–81.35	74.49 ± 5.88	57.45 – 98.67	0.899
Potassium (mmol)	2.92 ± 0.30	1.79 – 5.12	3.36 ± 0.52	1.38 – 5.51	0.571
Magnesium (mg/dl)	1.79 ± 0.25	0.98 – 3.02	2.18 ± 0.23	1.02 – 2.98	0.301
Total protein (g/dl)	8.41 ± 0.26	7.77 – 9.89	8.61 ± 0.28	7.71 – 9.89	0.550
Glucose (mg/dl)	44.59 ± 1.45	39.97–50.12	42.84 ± 1.58	39.61 – 51.10	0.230
Cholesterol (mg/dl)	19.18 ± 0.71	17.79 –22.20	18.50 ± 0.60	15.76 – 21.70	0.251
Alkaline phosphatase (IU/ml)	25.17 ± 1.29	24.30 –31.21	23.15 ± 0.95	20.11 – 27.23	0.275
Iron (mg/dl)	68.99 ± 5.69	60.78 –86.67	80.78 ± 6.13	44.44 – 95.56	0.147
Copper (mg/dl)	38.38 ± 3.63	27.91 – 60.47	53.09 ± 5.33	37.45–74.42	0.013
Zinc (mg/dl)	123.56 ± 2.78	116.26–138.87	123.49 ± 2.38	113.06–125.06	0.041
Cobalt (ppm)	0.31 ± 0.01	0.29 – 0.35	0.29 ± 0.01	0.25 – 0.31	0.041
17b-estradiol (pg/ml)	NT	NT	NT (3) 0.18 ± 0.02 (5)	-	-
Progesterone (ng/ml)	NT	NT	0.41 ± 0.11	0.23 – 0.55	-
Cortisol (nM/L)	346 ± 29.32	240 - 370	397.13± 28.18	390.00–520.00	0.002
T ₃ ng/dl	1.89 ± 0.08	1.60 – 2.30	2.15 ± 0.13	1.80 – 3.00	0.229
T ₄ ng/dl	6.20 ± 0.55	3.57 – 7.76	8.44 ± 0.44	7.30 – 9.89	0.053

* Not significant at 5% level; NT, not traceable; within parentheses indicated the number of observations.\

The mean serum concentration of cortisol levels of experimental elephants were found to be remained within higher range of variation with almost similar mean values in both sexes. Oliveira *et al.* (2008) also reported that the serum cortisol concentrations remained constant throughout gestation, progestin concentrations decreased significantly ($P < 0.05$) in the second half of pregnancy, declining to undetectable levels by 3 days before calving, while there were no significant differences between serum cortisol concentrations during the luteal and those of the non-luteal phase ($P > 0.05$). They also estimated the mean cortisol concentration as about twice that during pregnancy ($P > 0.05$) and during the estrous cycle with non-significant difference. No substantial changes in maternal cortisol were found during the course of pregnancy or the pre-partum period. Stress conditions like work load, diseases and any biological stress like any phases of oestrous cycle were absent, the mean serum concentration of cortisol might be considered to be normal indicating absence of any stress factor also. However, presence of comparatively higher cortisol level in serum of elephants of the study might be indication of normal requirement to make the animal stable under the prevailing environmental living condition.

As the elephants of this study were not kept under any stress, the present findings of T₃ and T₄ in serum of these animals of the investigation found to be very low in comparison to other ruminants where the reason behind these lower concentration might be required to control metabolic reaction and to maintain large body size stable in presence

of higher blood cortisol levels in comparison to other animals including ruminants like cattle and goats (Bonia 1992, Bonia 2008, Bonia *et al.* 2009). Otherwise, information pertaining to most of the biological constituents estimated in blood of elephant species Asian elephants (*Elephas maximus*) or even in African elephants (*Loxodonta Africana*) is appeared to be meager. Reason behind the lower levels of most of the elements in the study could not be well interpreted due to limiting related different biological and other environmental factors under which circumstances, habituation and adaptation of elephants occur where slight variation of any factor affecting body function with reproductive status might be causal factor resulting into variation of biological constituents concerned.

SUMMARY

Estimation and the 't-test' revealed that the mean serum levels of calcium, inorganic phosphorous, magnesium, sodium, potassium, total trace elements like iron, copper, zinc, cobalt; other biological constituents like total protein, glucose, cholesterol, alkaline phosphatase and hormones like 17β- oestradiol, progesterone, cortisol, T₃ and T₄ in serum were not varied significantly between adult males and non-pregnant females of Asian elephants of Asom. Progesterone in serum of male elephants of the present study was found to be not traceable in all males while in females the mean serum progesterone found to be 0.41 ± 0.11 ng/dl. Out of eight female elephants, 17β-oestradiol in serum was not traceable in 3 when it was measured as 0.18 ± 0.02pg/dl in serum of 5

female elephants indicated presence of cortisol level (240.00–520.00 nM/dl) in serum of elephants of the study might be indication of normal requirement to make the animal adaptable and stable under the prevailing condition of living. However, the mean values of all biological constituents in serum of this study might be considered to be normal physiological levels in adult captive Asian elephants of Asom with no stress of work or diseases.

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