Blood levels of cholesterol and triglycerides in wild and domesticated Asian elephants (*Elephas m. maximus*) in Sri Lanka

Indira Silva & Ashoka Dangolla
Department of Veterinary Clinical Studies
University of Peradeniya
Sri Lanka

Introduction

Cholesterol is important in the synthesis and maintenance of cell membranes and synthesis of steroidal hormones (Kaneko, 1989). Triglycerides are used to either generate energy or to be deposited as adipose tissue (Guyton, 1995). The common food items of elephants are likely to be deficient in lipids (Nair & Ananthasubramanium, 1979). Cholesterol and triglycerides may be synthesized in the body. The present work was carried out to study the cholesterol and triglyceride levels in wild and domesticated elephants *(Elephas maximus maximus)* in Sri Lanka. It also provides an opportunity to compare the findings with previous observations on serum cholesterol levels in elephants in India and Sri Lanka (Ratnasooriya *et al.*, 1995; Nirmalan & Nair, 1969). Such reports on blood constituents in elephants are not only of academic interest, but are extremely important for veterinarians for diagnosis of clinical conditions of both domesticated and wild elephants (Silva & Kuruwita, 1993a; Silva & Kuruwita, 1993b; Ratnasooriya *et al.*, 1990).

Materials and Methods

Blood samples of 15 wild elephants were collected while on lateral recumbency under general anaesthesia induced by using Immobilon (combination of Etorphine hydrochloride with Acepromazine), and from 18 domesticated elephants while on lateral recumbency without anaesthesia. Sampling was carried out during the period extending from July 1997 to December 2000. Blood samples were drawn from the ear veins, into heparinized glass tubes. All samples were collected between 0900 and 1500 hrs and were transported on ice to the laboratory. Samples from domesticated elephants were transported within a few hours, while those from wild elephants were transported within 24 hours of collection. Plasma was separated and kept frozen until analysis.

An enzymatic technique was adopted to measure the plasma cholesterol concentration using a commercial reagent kit (Randox Laboratories ltd., Ireland). In this method, cholesterol was oxidized by cholesterol oxidase to cholestene-3-one and H_2O_2. The chromophore quinoneimineis was formed from H_2O_2 and 4-aminoantipyrine in the presence of phenol and peroxidase. The GPO-PAP method was adopted to measure plasma triglyceride concentration using a commercial reagent kit (Randox Laboratories ltd., Ireland). In this method, triglycerides were hydrolyzed by lipases to glycerol and fatty acids. The chromophore quinoneimineis was formed from H_2O_2, 4-aminoantipyrine and 4-chlorophenol under the catalytic influence of peroxidase. The absorbance values were read at 500nm for both cholesterol and triglyceride, using a LKB Ultrospec Plus 4054 UV/visible spectrophotometer.

Results and Discussion

The arithmetic means and the standard errors of plasma cholesterol and triglyceride levels of the 15 wild and 18 domesticated elephants are summarized in Table 1. The domesticated females had lower cholesterol levels compared to domesticated males ($p<0.05$). It is believed that exercise could reduce serum cholesterol levels (Guyton, 1986). Generally, females are preferred to males for logging owing to their temperament. Therefore, these values for cholesterol levels are to be expected as the domesticated females sampled in our study were regularly worked and the samples were collected during working

Table 1. Arithmetic mean (standard error) of plasma levels of cholesterol and triglycerides in 15 wild and 18 domesticated Asian elephants (*Elephas m. maximus*) in Sri Lanka.

	Cholesterol (mg/dl)	Triglycerides (mg/dl)
Wild Elephants		
all animals (n=15)	30.2 (4.4)	19.5 (4.0)
males (n=8)	22.7 (4.3)[1]	14.0 (4.4)
females (n=7)	38.8 (7.3)	27.7 (6.3)
Domesticated Elephants		
all animals (n=18)	33.9 (2.2)	10.0 (2.6)
males (n=8)	40.4 (2.3)[21]	3.9 (2.1)[1]
females (n=10)	28.8 (2.7)[2]	14.5 (3.6)[1]
all males (n=16)	31.6 (3.2)	9.7 (2.8)[2]
all females (n=17)	32.9 (3.5)	20.2 (3.8)[2]

means with the same superscript are significantly different ($p<0.05$)

hours. However, the values for cholesterol for domesticated elephants reported by Ratnasooriya *et al.*(1995) are approximately 10 mg/dl higher than those presented here.

It is interesting to note that differences were not observed between the males and females in the case of the wild elephants. The males however, tended to have substantially lower levels of cholesterol even though the difference was not statistically significant. The males in the wild were either in *musth* or approaching *musth* during the sampling period. During *musth*, the males travel longer distances and therefore may have been exposed to relatively more exercise than the females, thus lowering the blood cholesterol levels. It would be interesting to study the serum cholesterol levels together with plasma thyroxine and insulin hormone levels to exclude the possibilities of hypothyroidism and diabetes mellitus which are known to reduce plasma cholesterol levels, as suggested also by Ratnasooriya *et al.* (1995). However, gender differences in serum cholesterol levels have not been reported in Indian elephants (Nirmalan & Nair, 1969). The possible reasons for lower cholesterol levels in Sri Lankan elephants compared to their Indian counterparts as reported by Nirmalan & Nair (1969) may be attributed to subspecies differences and the possible existence of a cholesterol degrading factor in the blood of Sri Lankan elephants in addition to the method of sampling (Ratnasooriya *et al.*, 1995).

In general, female elephants tend to have significantly higher levels of triglycerides compared to males ($p<0.05$). This difference was statistically significant in the domesticated group while the evidence for statistical significance was scarce in the wild elephants. In ponies however, increased serum triglycerides have been observed upon starvation (Kaneko, 1989). This observation becomes relevant as both elephants and ponies are herbivores.

It is known that blood triglycerides levels in ruminants increase during lactation and are used by the mammary tissue to produce milk. Therefore, the potential of predicting milk producing capabilities in ruminants using plasma lipoprotein levels has been suggested (Kaneko, 1989). The present findings would be useful in selecting domesticated females with good mothering qualities for future breeding programmes. This could be important to

Sri Lanka as captive breeding has been strongly recommended, to meet the requirement of elephants for work, ceremonies and tourism (Santiapillai, 1997).

Acknowledgements

Technical expertise of K.R.J.K. Amararathna and M.R.C.K. Mallawa are greatly appreciated. This study was partially funded by grant No RG/2000/83/V of University of Peradeniya.

References

Guyton, A.C. 1986. *Textbook of Medical Physiology*. W.B. Saunders company, Harcourt Brace Jovanovich, Inc.

Kaneko, J.J. 1989. *Clinical biochemistry of domestic animals*. 4th Edition, Academic Press Inc., San Diego, California 92101, 106-135 pp.

Nirmalan, G. & Nair, S.G. 1969. Biochemical studies on the blood of Indian elephants (*Elephas maximus*). *Res. Vet. Sci.* 10, 176-180.

Nair, V.B. & Ananthasubramanium, C.R. (1979). Studies on the nutritional requirments of the elephant (*Elephas maximus*). 1. Evaluation of the nutritive value of the palm leaf (*Caryota urens*). *Indian vet. J.* 56, 667-671.

Ratnasooriya, W.D., Amarasinghe, A.B.C. & Kodikara, D.S. 1995, Total serum cholesterol levels of Sri Lankan elephants (*Elephas maximus maximus*)

Ratnasooriya, W.D., Fernando, S.B.U., Mantunga, A.M.V.R., Caldera, H.S., Liyanage, G.K. and Premakumara, G.A.S. 1990. Hematological values for adult asian elephants (*Elephas maximus maximus*) at the Pinnawala elephant orphanage, *Sri Lanka. med. Sci. Res.* 18, 899-902.

Santiapillai, C. 1997. The Asian elephant conservation: A global stratergy. *Gajah* 18: 21-39.

Silva, I.D. & Kuruwita, V.Y. 1993a. Hematology, plasma and serum biochemistry values in free ranging elephants in Sri lanka. *J. Zoo & Wildlife Med.* 24:434-439.

Silva, I.D. & Kuruwita, V.Y. 1993a. Hematology, plasma and serum biochemistry values in domesticated elephants (*Elephas maximus ceylonicus*) in Sri lanka. *J. Zoo & Wildlife Med.* 24(4):440-444.