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A Note on the Nutritional Requirements of the Asian Elephant (Elephas maximus indicus)

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A NOTE ON THE NUTRITIONAL REQUIREMENTS OF THE ASIAN ELEPHANT (*Elephas maximus indicus*)

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Abstract: In this preliminary study, data were collected with regard to the high concentration of cobalt in palm leaf and of vitamin B_{12} in the blood plasma of the elephant. This suggests microbial synthesis and absorption of vitamin B_{12} in the elephant intestine.

Prompted by the consideration that, besides the work of Benedict (1936) in a single elephant called "Jap", no study on the nutrient requirements of this species for any specific physiological function has ever been reported in the literature, a systematic investigation in this regard was carried out in two adult and two young elephants (aged 39 years, weighing 3,605 kg and aged 10 years, weighing 1,337 kg, respectively) fed exclusively palm leaf (*Caryote urens*) *ad lib*. at first and subsequently at 75% level of the *ad lib*. intake. Nitrogen, calcium, phosphorus and energy balances were determined essentially as per the usual procedure followed in the case of other species of large animals, strict vigilance being maintained round the clock during the collection period of three days for quantitatively gathering without contamination, feed residues, feces and urine manually with the help of mahouts. Methods of chemical analysis adopted were those described in Association of Official Agricultural Chemists (A.O.A.C.) 1970. The ultimate object of the study was the formulation of feeding standards for maintenance and growth of the elephant. It was observed that the experimental subjects under this dietary regime maintained sound nutritional status, adjudged by the normal concentration of the better known blood constituents such as red cell, hemoglobin and plasma proteins (Nirmalan and Nair, 1971; Nirmalan *et al*., 1967; Simon, 1961). The requirements assessed in terms of dry matter, digestible crude protein (D.C.P.), total digestible nutrients (T.D.N.), digestible energy (D.E.), metabolizable energy (M.E.), and calcium were found to be 108g, 6g, 58g, 278 kcal, 237 kcal and 0.5g, respectively, per unit metabolic body size ($kg^{0.73}$) per day for the maintenance of adult elephant and 142g, 7g, 70g, 335 kcal, 279 kcal and 0.6g, respectively, per unit metabolic body size per day for the young elephant. Feeding standards for the maintenance and growth of the elephants were thus formulated for the first time on scientific basis and recommended for practical application. Results on phosphorus balance indicated that whenever palm leaf forms the sole source of feed to the elephant, there is a need for a phosphorus supplement. Palm leaf, even when fed at 75% of the *ad lib*. intake, was found to supply more than adequate cobalt for vitamin B_{12} synthesis, the concentration of which in the blood plasma, reported for the first time in literature in the case of the elephant, was found to be on an average 18.05 /ug/ 100 ml for the adult and 16.94 /ug/ 100 ml for the young. An interesting observation made during the course of the study, from the point of view of fundamental nutrition, was that the application of Maynard's figures for farm animals in general for the calculation of TDN from DE, conversion of DE into ME and for the derivation of kcal basal energy from endogenous urinary nitrogen (Maynard and Loosli, 1969) is valid in the case of the elephant as well.

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Editor's note: This note, by C.R. Ananthasubramaniam, was reviewed by two nutritionists K.C. Menon and O.T. Oftedal. Both agree that this is a pioneering study containing valuable data which will hopefully be published in full in the near future. In the opinion of Menon, the high concentration of cobalt in palm leaf and of vitamin B_{12} in the blood plasma of the elephant, suggestive of microbial synthesis and intestinal absorption of vitamin B_{12} in the elephant, is of particular interest. (The cobalt ion is located in the center of the vitamin B_{12} molecule). The latter reviewer comments that balance trials on large animals are difficult to conduct with sufficient accuracy to allow close determination of nutrient requirements, that experimental error may cause requirements to be underestimated, and that caution should be applied in using these preliminary data in devising diets for captive elephants. In response, the author points out that historically many feeding standards for domestic livestock have been determined by digestion trials and balance experiments, with consequent economic and biological benefits.