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MANAGEMENT OF CAPTIVE YOUNG ELEPHANTS IN KERALA

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**Thesis submitted in partial fulfillment of the
requirement for the degree of**

Master of Veterinary Science

**Faculty of Veterinary and Animal Sciences
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2006



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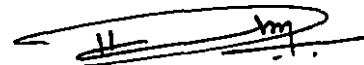
Dedicated to my beloved Parents, Guide, Dearest Friends & you

DECLARATION

I hereby declare that the thesis entitled “ **MANAGEMENT OF CAPTIVE YOUNG ELEPHANTS IN KERALA**” is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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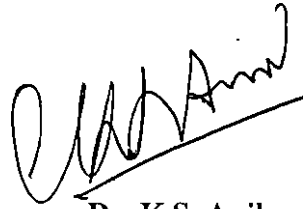
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Acty George

CERTIFICATE

Certified that the thesis, entitled “**MANAGEMENT OF CAPTIVE YOUNG ELEPHANTS IN KERALA**” is a record of research work done independently by Sri. **ACTY GEORGE**, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, associateship or fellowship to him.



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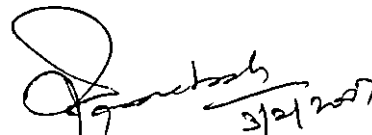
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Transit umbra, lux permanent

Shadow passes, light remains

(Latin Inscription found on sundials: the truth alone remain, while every thing else fade)

As I scribble down the final few words of the thesis, which ironically find its place in the beginning of this compilation, and as I deliver my humble offering on the altar of science, I am convinced of the fact that it is no personal feat. When ever I lost track, I luckily found people to guide me, some of them have names, while others just had faces. I am gratefully remembering all those people who had their hands with me in this endeavor.

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Introduction

1. INTRODUCTION

Elephants, which are amongst the most popular and decorative of animals, stand as a witness of prehistory, having been a part of the environment of our ancestors. They originated by the beginning of the Pleistocene period, can be considered contemporary with man (Aguirre, 1969). Among the wild animals elephants have a universal appeal and they are highly successful in winning the heart of millions in a great way. Last several decades were considered as dark era of animal kingdom where humans, the caretakers, faltered in many ways to cater the need of the beautiful creations of God, even terribly failed in up keeping the population. It was elephants, among the animals, who suffered the most.

Gone are days, hard and still going strong for African and Asian elephants. The effects of poaching, drought and habitat encroachment by humans have reduced the number of African elephant population to 6,50,000 from 1.3 million in the last decade and is expected to drop to 25,000 within 40 years. It can be compared with the plight of black rhino which declined from 70,000 to 3,000 over 16 years and many others (Koch, 1992).

On some continents we have no more than 10 years left to study the natural population of some species, so benign management no longer enough. The entire planet is going to require active management where the role of humans in the equation is central: most habitat fragmentation stems from human deeds and climatic shifts and human hunting adds to the problem (Roberts, 1988).

As habitat is fragmented, populations dwindle and conservation biologists are trying to ascertain the danger point: in essence, when does a population become too small to survive? What are the processes that determine why some species go extinct and others survive? To answer it we have to first understand the population dynamics of target species, including a census of how many there are and their age, sex, mortality rate, distribution, and the overall population trend. We also should have a basic knowledge of the demography of the particular species that is, their birth and death rate,

age at reproduction, and how these vary annually etc. Research should also be done on how species adapt to the resources that is available to them in their habitat (Roberts, 1988). It is where the importance of the study of scientific management comes.

Though captive breeding, care and management is still a debatable and controversial issue, sometimes answer the questions regarding the conservation and preservation of some species of animals. The need of the hour is better care of the animal's emotional, behavioural and psychological well being.

Elephants form an integral part of the cultural life of Kerala. In Kerala there are approximately 700 captive elephants as known from the records and among them only less than 20 elephants which belongs to the category of young elephant aged below 15 years. These captive elephants are owned by the Forest Department, Devaswoms (the temple administrations) and individuals, upon which this study carried out.

Elephant keeping is a highly risky job among all animal rearing, ignorance of scientific management practices, animal behaviour and their psychology taxes heavy loss and untold misery. In this context it is an absolute necessary that the elephant keepers and owners know their elephant and its management

This study was conducted with the following objectives to know the animals more and make recommendations for a good management practice.

1. To observe, record and assess the existing management, feeding and training practices of young elephants.
2. To assess the animal's body condition and health status with the available records.
3. To identify the problems and prospects of scientific management of young elephants in Kerala.
4. To suggest suitable recommendations in the management of captive young elephants in Kerala.

Review of Literature

2. REVIEW OF LITERATURE

EARLY LITERATURE ON ELEPHANTS

The Asian elephant, a symbol that once adorned flags and ancient temple grounds of royal kingdoms- is being forced out of its forest home by logging, agricultural clearance, and ill-planned development schemes. Elephants were the integral part of the cultural and social life of ancient society and there were numerous references about them in ancient texts like Gajasasthra of Palakapya, Bhasha Prabudha of Raja Serfoji, Mathangaleela of Neelakandan Nambisan, Gajaraksha Thantram and Hastyayurveda and other works in Sanskrit by Vyasapayana Nakula.

2.1 EVOLUTION OF ELEPHANTS

Osborn (1933) reported that proboscideans ranked next to man in biological interest and far surpasses man in confirmation of the principles of biomechanical evolution first set forth. Proboscideans possess no less than fourteen widely distinct type of biomechanical adaptation to an environmental range guided by a surpassing intelligence, and guarded by tusk-like weapons equal or superior to any of those invented by man up to the introduction of firearms.

Aguirre (1969) suggested that a few long living species of elephants were known to have existed in the Early Pleistocene, and in the faunal revolution of the Early Middle Pleistocene, these evolved into new species. These species extended from transitional forms to highly specialized forms which had become extinct but the two of the living forms remained were African and Asian elephants.

Asian elephant were seen in some of the Asian countries like Bangladesh, Bhutan, Brunei, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Sri Lanka, Thailand, Vietnam and an African country, Cambodia (IUCN 1996).

Choudhury and Anwaruddin (1999) explained that the puddle effect (rapid habitat loss and fragmentation) was the grave problem, which caused rapid evaporation

of elephants from earth's surface and made them non self sustaining. He warned the importance of human intervention.

Fragmentation of wildlife habitat was the major cause of conflict between humans and wildlife and it was the most serious threats to India's wildlife. (Easa and sankar, 1999).

2.2 TAMING OF ELEPHANTS

According to Carrington (1959) Asian elephant was probably first tamed about 4000 years ago by the people of the Indus valley civilization.

Archeological evidence and history of taming of elephants in India dates back to 3500 BC as evidenced in the engravings of Mohanjo Daro (Induchudan, 1989).

Lair (1997) reported that there were about 2500-4000 domesticated elephants reported in India of which more than 600 were in Kerala.

There were descriptions about elephant taming, management, diseases, treatment and musth behaviour in ancient literatures of Mathangaleela of Neelakandan Nambisan, Gajaraksha Thantram and Hastyayurveda (Ananthasubramaniam, 1979; Induchudan, 1989).

2.3 GROUPING OF ELEPHANTS IN CAPTIVITY

According to Johnson (1964) there was a close relationship of morphometry between body weight and height at shoulder (correlation coefficient 0.99) and body weight and total length (correlation coefficient 0.99) for males; it was almost the same in case of females but the correlation coefficients were 0.99 and 0.97 respectively and this reduced the risk of weighing of elephants in the field.

Ishwaran (1984) classified elephants into groups according to their age, as calf <6 months to 2 years; Juvenile 2-7; sub adult 7-16; and adult >16years.

Hile *et al.* (1997) classified the elephants into different age groups using Minitab program and calculated all possible linear regression for each group and concluded that body weight in Asian elephants could be predicted from body measurements and chest girth. They reported that chest girth was the best single predictive parameter and the addition of body length had improved the accuracy of prediction.

2.4 MANAGEMENT OF ELEPHANTS IN CAPTIVITY

According to Panicker (1985) management of captured elephants for captive purposes starts right from the very first day of their entry into the Kraal. The first objective was to establish a steady relationship between mahout and the animal. He reported that taming started with feeding, then traveling, regular bathing and gradually made them to obey different commands. Elephants were given specialized training by giving commands after the initial period of training to obey the simple tasks of sitting, walking and lifting the limbs, on commands.

Krishnamurthy (1989) suggested that there were differences in management practices adopted under different systems and regions for care of elephants in captivity. Most of these practices continued to evolve even though tradition-bound practices were difficult to change. He also reported that the quantum of ration for each individual elephant was determined according to age, size, capacity for work and several other factors.

Krishnamurthy (1989) described the ideal management of captive elephant; where he explained a gamut of subjects' viz., mahouts, routine practices, hygiene, bathing, foot care, and work load with special mention to health assessment and monitoring.

Chandrasekharan *et al.* (1992) reported that musth was noted even among very young captive Asian elephants in the age groups of 11 to 15 years.

According to Priest (1994) protected contact, a new method of current management practice, reduced animal related keeper injuries, it also established a safer training environment for new or inexperienced keeper, when operated under experienced supervision. For animals, it was found to be helpful to eliminate the physical or psychological trauma incidental to the physical discipline necessary to establish and maintain the social dominance, sometimes required to control the behaviour of elephant in free contact.

Krishnamurthy (1998) reviewed different systems of captive elephant management in India and mentioned that in most of the zoos, elephants were kept tethered in stables and only very few keep their animals in open enclosures with moats around. He noted that the temple elephants in Kerala were tethered under the shade of trees within the temple premises whereas the animals of Tamilnadu have well maintained stables, specially designed for elephants.

The elephants were given a few minutes of rest immediately after work before they were taken for a drink or shower, one day rest per week for working elephant was also suggested (Ponnappan, 1998)

There were no differences noticed, in percentage time spent lying down, eating, walking and standing, of unchained elephants; moreover, high levels of activity coupled with equivalent activity budgets and the lack of injury suggested that an unrestrained management policy was successful in these animals (Brockett *et al.*, 1999).

According to Friend and Parke (1999) penning and picketing significantly decreased the amount of time elephants spent in stereotypic weaving. The incidence of all stereotypic behaviours like weaving, head bobbing and trunk tossing were also notably decreased when the elephants were kept in pens. They described that the total amount of time spent to perform all stereotypic behaviours were negatively correlated with age. They also said that pens were preferred over picketing because the elephants showed reduced stereotypic behaviour and appeared to be calmer than those kept picketed, when out for work or performances.

Ponnappan (1999) reported that regular bathing and grooming of elephants were important to set up and upheld a good relationship between mahouts and elephants. He described that it helped to loose the old skin that developed on its body and ensured enhanced peripheral blood circulation led to the development of new skin layers.

Poole and Taylor (1999) mentioned that greatest success in keeping and breeding elephants were in the source countries in natural or semi- natural conditions. The breeding success in most western zoos is low and young are rarely reared.

There was significant reduction in stereotypic behavior and had a positive effect on the well being of elephant when subjected to penning over picketing. He reported that some trainers preferred penning over picketing because of reduced stereotypy, ease in keeping the elephants clean and their improved temperament (Ted and Melissa, 1999).

Schwammer *et al.* (2001) discussed about the merits of two handling methods: protected contact (hands off) or free contact (hands on). He reported that the latter approach represented the most promising method for managing cows when well-trained animal keepers were available.

Elephant calves that were orphaned or displaced in the wild or rejected by the lactating mother needed to be hand-raised in captivity by zoo keepers, rehabilitators or mahouts. Hand-raising of elephant calves in captivity was a most challenging task entailed tender love and care; patience and most importantly appropriate substitute for elephant milk (Sheldrick, 2002).

2.4.1 Restraining of elephants in captivity

The captive elephant's limbs were tied to restrict its movement by special chains provided with hooks called shackles. A 2 ½ inch thick and 1.25 m long flexible wooden stick known as cherukol, spear, one meter long stick with hook at one end called thotty, and a knife were observed to be the usual implements carried by mahouts (Panicker, 1985).

For tethering elephants, chains of varying thickness of $\frac{1}{2}$ inch, $\frac{5}{8}$ inch and $\frac{3}{4}$ inch were found to be in use, a neck collar made up of thick double rope had been put to the elephant for anchoring and giving foot commands by the mahouts while riding the elephant (Cheeran, 1998).

Mikota *et al.* (2003) explained the importance of the use of appropriate equipments while capturing and training. Equipments used for capturing and training were old, poorly maintained, and used improperly. Injuries inflicted by improper use of these equipments led to large wounds, abscesses and even mortality.

2.4.2 Role of mahouts in management of elephants

Deraniyagala (1955) described the importance of mahouts in captive rearing of elephants, a thorough knowledge of hunting, capturing, and taming of elephants were essential. He also described the importance of knowing the effects of pressure on no less than 90 nerve centers which one effectively employed to control the beast.

August and Anderson (1987) recommended a Motivational-Structural rule hypothesis on mammal sounds, which states that sounds gave out by birds and mammals in aggressive or hostile circumstances (termed as aggressive sounds) were of low-frequency and noisy (wide-bandwidth), whereas sounds produced in fearful or appeasement contexts (termed as fear sounds) were of low-frequency and tonal. [it was always helpful for a good and experienced mahout to avoid elephants according to their change in sounds, so this is very important from the owners point of view they should take care while posting a mahout and should give enough time to acquaint with their animals and have a thorough knowledge of animal to avoid accidents.

Line (1987) found out that familiarity of keepers with their elephants enabled them to filter, cumulate and integrate behavioral responses to a variety of situations over a long period of time.

Adler (1996) reported that close contact with trainer provided social contact for social animals or those in small groups.

Lair (1997) distinguished and classified three strata of elephant keepers as mahout- owners (people who own and ride elephants), non-mahout owners (people who own but not ride elephants) and hired mahouts (people who only ride elephants) on economic perspective than social perspective.

Damodaran (2000) opined that the elephant mahouts should be thorough and quick in, harnessing and controlling animals, techniques acquire from the elder or first mahouts. They should be provided with extra guidance and training and work as a single mind and soul.

The mahout should spend long time with the elephant to understand the animal better and to establish a bond of confidence between them (Girinathan, 2000).

Schulte *et al.* (2000) described that elephant handlers often refer to one member of the 'herd' as being the dominant female.

2.4.3 Significance of scientific management

The lack of modern scientific information about elephants and their behavior led to the present day conflict between mahouts and elephants so also the accidents (Joy, 1990).

Forthman and Ogden (1992) reported that the role of environment variables and role of applied learning were important in the profession for promotion of species typical behavior and for solving some problems of conservation and captive propagation.

Poor management, care, and mahoutship were the most alarming problems faced by the domesticated elephants in Thailand, India and Sri Lanka. (Lair, 1997).

Giridas (1998) opined that the elephants face cruelty and breakdown behaviour due to the lack of awareness of scientific elephant management by mahouts and owners.

Elephant owner's ignorance of scientific know-how, about elephant management and welfare practices led to over exploitation of elephants, ensued ever ending strife and struggle for them. (Nibha, 1998).

Panicker (1998) reported that imparting scientific knowledge, traditional training methods and practices about modern scientific approaches in elephant management, rearing practices and welfare could lead to reduced cruelty and discomfort to elephants. He also suggested that periodical refresher courses and hands on training sessions is the need of the hour to improve their existing knowledge.

Ponnappan (1998) reported that most of the injuries to the elephants are caused due to lack of knowledge about their behaviour, management and unfettered use of restraining methods and devices by the mahouts.

Carlstead *et al.* (1999) reported that data collected in a standardized manner through the use of keeper surveys were provided reliable and valid assessments of the behavioral profile and dominance status of individual animals.

Cheeran and Trevor (2000) recommended that appropriate guidance and training should be given to elephant keepers and owners to foster modern management practices for ensuring compassionate handling of elephants and for correcting trivial mistakes.

In the wild, the Asian elephant is nearing extinction and the African elephant is endangered. In captivity, the breeding results are still far from sufficient to maintain the population. The cause is a lack of facilities able to house bulls. In addition, many elephant keepers and handlers have insufficient training and knowledge of these species (Schwammer *et al.*, 2001)

2.4.4 Housing of elephants

According to Clarke (1968) elephant exhibited at Topeka zoo, housed two female Asian elephants and measured 9.1 m by 6.1 m, the walls were made of reinforced concrete and cast steel. Tied rings were placed on the floor, on the back wall and on each side wall so that both elephants were chained by all four legs if necessary. An over sized water line supplied a high pressure water flow if necessary for bathing the elephants daily.

Captive animals were often housed in circumstances conducive to the display of abnormal behaviors (Sommer, 1974).

Hutchins *et al.* (1984) reported that naturalistic exhibits, both with physical complexities and replicating closely the wild habitat of the species with their natural social groupings had a beneficial effect on the exhibition of the species typical behaviour in captive animals.

Bist (1996) discussed the set standards and norms for elephant owners and recommended a minimum floor area of 5 × 2.5 m for a weaned calf of height below 1.5 m, and 7 × 3.5 m area for a sub-adult elephant of height ranging from 1.5-2.5 m, for a cow elephant with an unweaned calf or for an adult elephant above 2.25 m in height, and an area of 9 × 5 m were recommended. In case of covered sheds, it was mentioned that the height of the structure should not be less than 4.8 m and that corrugated iron sheets or asbestos sheets should not be used for the roofing of elephant stable.

Cheeran (1999) reported that the tethering site should have shade proximity to water, surface should not be hard and must be preferably muddy with provision for drainage and convenience to dispose dung, urine and fodder refuses.

Poole and Taylor (1999) mentioned that in a sample of 20 zoos which responded to a questionnaire survey, the elephants were provided with a barn like

house, the medium size of which was 250 m² in area with a surrounding concrete outdoor enclosure typically with a dry moat around it.

2.4.5 Feeding of elephants

Mccullagh (1969) suggested that the daily digestible protein requirement for a young growing elephant with a body weight of 1000 kg is 0.3 kg. This entailed a mean protein content of 6% of food they had taken.

The elephant breast milk is more related to human milk than any other mammals contain low protein, lactose and fat, and vitamin A and Carotene was negligible, so manipulation of formula, to achieve high fat content when artificial feeding was practiced, indeed appeared to be undesirable. The unique fatty acid (higher amount Capric acid) composition attributed to the elephant calf's intolerance to bovine milk a major concern (Peters *et al.*, 1972).

Laws *et al.* (1975) reported that elephant required food 1.5% (dry weight) of its body weight.

Laws *et al.* (1975) suggested that the rate of throughput depended upon the fiber content and amount of water consumed along with the diet.

Oliver (1978) reported that elephants were prone to sodium deficiency.

Schmidt (1978) reported that the Portland zoological gardens had maintained a breeding herd of elephants with a typical daily diet consisting of 45 kg of timothy hay, 1.5 kg oats, 23 kg carrots and 0.5kg rock salt given three times a week. About 180 gm of a commercial vitamin-mineral supplement was also fed daily to each elephant.

Ananthasubramaniam (1979) reported that a dry matter consumption of 1.18 percent of body weight was observed in adult Asian elephant and it was also necessary that they were supplied with huge bulk to keep their digestive tract function normally.

Palm leaf (*Caryota Urens*) with a leaf stem ratio of 1:1 was reported to contain 38.8 percent dry matter, 2.0 percent protein, 9.3 percent crude fibre, 22.9 percent nitrogen free extract and 3.5 percent total ash with 0.35 percent calcium and 0.23 percent phosphorus (Bhaskaran Nair and Ananthasubramaniam, 1982). They also opined that easy availability of palm leaves made this a popular bulk feed for captive elephants in Kerala.

Sharma and Krishnamurthy (1984) reported that in the wild, calves suckled other cows as well as their mother, even when the former are not in milk.

Schmidt (1986) reported that rice-based formulas containing cow's milk have been used to raise many baby elephants successfully and such a formula required addition of multivitamins and about 825 mg bone meal per 100 gm formula to give proper Calcium: Phosphorus ratio.

Schulze (1986) opined that quantitative and qualitative deficiency of diet resulted in illness like severe anaemia especially among young elephants. He also recommended as a thumb rule 100-150 litres of clean drinking water and 100 kg of good quality feed daily, with supplementary vitamins and minerals in captive rearing. He further proposed that tethering of elephants was essential to avoid faecal and urinary contamination of feeds.

Jachmann (1987) reported that elephants required a diet consisting of at least 50 per cent browse round the year. Lignin present appeared to be an important factor, determined selective feeding by elephants so also certain amount of crude fibre as a high protein/fibre ratio in young grasses caused a rapid through put and a low absolute rate of assimilation necessitated the intake of a certain amount of browse. More over magnesium, calcium and sodium were present two or four times lower in grasses than in browse, on a year round basis.

Karsten (1987a) suggested the importance of feeding large amounts of hay to elephants to meet the bulk requirement. Amount of hay for adult elephants is stated as 205-300 pounds per day.

Karsten (1987b) suggested that the elephant must be fed large quantity of hay roughly 250-300 pounds per day for adult elephants. The elephants fed on concentrates lacking the fibrous bulk were predisposed to conditions like torsion of intestine and telescoping, when rolled on ground. It is also noted that the bulk diet of animal keeps the position of organs and intestine intact.

Sukumar (1990) suggested that elephants were highly adaptable in their feed requirement and observed that they met up to 90 per cent of their requirement in some areas with grass, and in some other areas by browse, depended on the nutritive value of the vegetation. The study revealed that the wild elephants of South India fed on 112 plant species on which, 25 species made up to 85 per cent of the bulk of their food.

Sukumar (1990) reported that elephants prefer browse plants especially during dry season, as the protein level of grass falls below 2.5 per cent but browse plants had high crude protein levels even during the dry period. He also said that elephants maintained a certain level of browse in the diet for proper digestion of protein.

A draft presented with standards and norms for elephant owners had recommended a minimum of 100 kg of green fodder for an elephant of height below 1.50 m and 150 kg fodder for the 1.50 m to 1.80 m height category and 200 kg for the 1.80 to 2.25 m height category. The elephants above 2.25 m height should be given 250 kg of fodder. Additional concentrates had to be given to all the animals as prescribed by the veterinarian (Bist, 1996).

Das (1996) detailed the management of elephants in the camps of the forest department of Kerala. It was noted that the elephants were classified into different classes based on their height. All the classes were given 4 kg wheat, 2 kg horse gram, 200g salt and 100 g jaggery as rest diet and additional 6 kg ragi as working diet. In

addition, class I animals above 244 cm in height were given 20 bundles of 25 kg cut fodder. Class II animals above 213 cm were given 18 bundles, class III of height above 183 cm, 16 bundles and class IV above 150 cm, 14 bundles of cut fodder. The elephants above 60 years of age were given 3 kg wheat, 3 kg ragi, 200g salt and 100 g jaggery and 30 bundles of cut fodder.

Powder milk was mixed with luke-warm water and infants were fed at least 7 times a day at two hours interval. Feeding bottle was prepared with the help of a 750 ml of conical glass bottle fitted with a piece of rubber tube of a bicycle (Thakuria *et al.*, 1996).

Krishnamurthy (1998) reviewed the different systems of captive elephant management in India. He recorded that in some southern states elephants were allowed natural grazing at least 15 hours a day; over and above this they were provided with a grain ration in cooked form twice a day. The grain ration provided consists of some cereal grains and lentils. In northern and north-eastern states, the animals got a fixed quantity of raw grains consisted of rice or broken paddy and some lentils fed once a day. In addition, they are also fed with a variety of cut fodder.

Previously the free availability of palm leaves made this a popular diet for elephants in Kerala and most of the elephants strongly preferred fish-tail palm leaves (*Caryota Urens*) to coconut leaves, but the severe scarcity of *Caryota* leaves, adversely affected the diet of elephants. Most of the captive elephants were also given concentrate feed once a day in most of the captive establishments (Ponnappan, 1998).

Elephant's capacity to digest food is poor, approximately 40 per cent is digested and rest 60 per cent is passed out as dung. The standard practice is to supply fodder at the rate of five per cent of the body weight and such as a cow elephants needs 150- 175 kg of fodder as against 200-250 kg for a bull (Cheeran, 1999).

Easa and Sankar (1999) reported that the elephants did take a wide variety of food ingredients in the wild they. They enumerated about 97 species of plants and grass dominated in the diet of elephants of Wayanad region, Kerala state.

Poole and Taylor (1999) suggested that elephant diets should include a variety of species of food plants, ideally 25 or more, as in the wild accompanied with relevant supplements such as calcium. They also mentioned the importance of bulk in the diet; the most crucial thing in elephant feeding practice, which helps elephants from digestive tract problems. Elephants also needed plenty of sodium in the diet which can be provided by a salt lick.

Stoinski *et al.* (2000) suggested that feeding enrichment commonly practiced in many species but in elephants it is understudied. A significant increase in feeding was observed when the browse was provided and in contrast, drinking and inactivity decreased. They also reported that browse was an effective naturalistic method for increasing activity as well as species-typical behaviour exhibition.

Holdo *et al.* (2002) reported that elephants practiced mineral licks or geophagy to supplement the Na⁺ concentration found in plants especially during the dry season to compensate Na⁺ deficiency.

2.4.6 Diseases of elephants

The prevalence of helminth parasites in zoo animals of Kanpur Zoological Park was studied by Gaur *et al.* (1979) and observed strongyle infection in five out of the eight elephants examined.

Schmidt (1986) reported that diarrhea in elephant calves might be due to formula intolerance to the available artificial formulas or to pathogenic bacteria (viruses were also a probability, but none had been identified as the cause of diarrhea in an elephant calf).

To the date only a few viral infections had been reported in the wild and the captive elephants. Among these were infections with the viruses of rabies, foot- and-mouth disease, rinderpest and encephalomyocarditis (Schmidt, 1986).

Successful treatment of trichostongyle infection in six elephants with 'fenbendazole' was reported by Lakhar and Das (1988).

Metzler *et al.* (1990) reported that Asian elephants possessed serum antibodies with specificity for three bovine herpes viruses and concluded that infection with a hitherto unidentified herpesviruses might be widespread among captive Asian elephants.

The incidence and causes of mortality in captive wild herbivores of Assam state zoo was studied by Chakraborty and Choudhary (1996) for a period of five years and observed a case of death due to colibacillosis in elephants.

Foot-and-mouth disease virus infection associated antibodies were found positive in 4.58 percent of elephant sera collected from 15 camps of the forest departments of Tamilnadu, Karnataka and Andaman and Nicobar Islands (Bhat and Manickam, 1997)

Modi *et al.* (1997) observed 100 percent parasitic infection throughout the year in elephants belonging to Sanjay Gandhi Biological Park, Patna and Jawaharlal Nehru Biological Park, Bokaro.

Sukumar *et al.* (1997) reported that the overall risk of death in captive elephant was low between 5 and 60 years. During the first few years of life, mortality rates were high with relatively higher female mortality than males which continued till 10 years of age, beyond that there was not much difference in mortality rate until 20 years of age. From 20 years onwards, the mortality rate of males was significantly higher than that of females.

Elephants were observed to be affected with contagious diseases such as anthrax, tuberculosis and pasturellosis and vaccination was suggested for protection. Root of tusks was reported to become oedematous by excessive use of tusks to carry load or by playful hitting. Selection of steep and rough route for logging operations was found to injure the foot of elephants (Krishnamurthy, 1998; Poomulli, 1998; Cheeran, 1998).

The effectiveness of 'fenbendazole' in the treatment of *Murshidia murshidia* in Indian elephants was reported by Roy and Mazumdar (1998) at Alipore Zoological Garden.

2.4.7 Legal Aspects in captive elephant management

The Asian elephant whether domesticated or wild came under the wildlife Protection Act, 1972, (as amended up to 1993) (Anon, 1997; Choudhury, 1993) and its possession and transaction were legally controlled.

Rehabilitation and reintroduction programmes were complex and required close monitoring and when an intelligent and social animal such as elephant has to be rehabilitated a collaboration of biological, social, political and legal issues were needed to be addressed (Box, 1991).

Cheeran *et al.* (2000) reported that the sections 40, 41, 42, 43, 44, 45, 46, 47, 48 and 49 of the wildlife protection act 1972 and prevention of cruelty act of 1960 prescribe many regulations for keeping the animals in captivity and using the provisions under section 64 of wildlife protection act 1972, the Kerala government laid out the rules regarding captive elephant management. Some of the relevant rules are as follows.

- All the mahouts in service and newly recruited shall undergo in-service/pre-service training by forest department and obtain license.
- A mahout shall not handle the elephant under intoxication.

- The chief wildlife warden/ authorized officer will issue the license based on his performance in the training.
- The first mahout of an elephant should have a previous experience of three years as second mahout and two years of experience as third mahout.
- The license should be renewed every two years.
- The mahout shall give at least one month notice to the owner in writing under proper acknowledgement before leaving an elephant failing to which, his license will be suspended to minimum of six months.

Similarly, the rules insist the proper housing, ownership, care of elephant, feeding practices, work load, timber handling, acts of cruelty to elephants, norms and standard of transportation, retirement of elephants, care of old elephants, record keeping, breeding policy, cutting tusks and remuneration to mahouts.

Convention on international trade in endangered species (cites) on wild flora and fauna came into effect on July 1975 in order to protect wild flora and fauna against over- exploitation through international trade. Elephant was listed in Appendix I of CITES which included the species threatened with extinction.

Draft proposals on captive elephant management by the forest department stipulated registration certificate from chief wild life warden, license for the mahout, maintenance of register, daily bathing and veterinary check up every six months as the legal requirements, According to the proposals elephants less than 1.5 m height should not be used for work, and those above 205 m height were allowed to carry 400 kg and haul 1000 kg weight of logs. Retirement age of working elephants was fixed as 65 years and provision was given for allowing them only for smaller works after retirement.

2.5 MAJOR CONCERNS IN HAND REARING

Young and juvenile elephants reported to have higher body temperature than adults; the oral temperatures were slightly higher (at least in young ones) than rectal

temperatures; the ear-angle temperatures were lower than deep-body temperatures, suggesting that the ear might well be an effective area of heat loss during stress; and that the body temperatures recorded were slightly higher than those recorded previously (Brattstorm *et al.*, 1963).

Krishnamurthy (1989) reported that the way how an elephant calf is hand-raised and treated by its keepers during its formative years not only determined its survival but also marked the temperament of the elephant as an adult.

Elephants owned by private owners tend to be more dangerous and vulnerable to exploitation than elephants owned by forest departments because the owners/ keepers are more responsible than the former (Joy, 1990).

The major cause of concern in captive rearing was the unavoidable imprinting of the elephant calves. There was no guarantee that once rehabilitated the hand-raised elephants will not come into conflict with humans (Sheldrick, 1995).

Female elephants in western zoos and circuses were relatively heavier than female working elephants in Asian camps (Kurt, 1995).

Kurt and Schmid (1996) observed that working elephants were approximately 92 per cent of the weight of similarly sized wild elephants (in terms of body weight/shoulder height) and that the circus elephants and zoo elephants, were approximately 30 per cent and 31 to 72 per cent respectively, more heavier than that of similarly sized wild elephants.

The welfare of Asian elephant is so important in every situation and the methods of capture, training, housing and husbandry affected their health, and physiological well-being. In particular tethering and confinement and some abnormal behaviours that they display in captivity were welfare concerns (Taylor and Poole, 1998).

Rees (2004) reported that the aetiology of stereotypic behaviour was the result of poor husbandry experienced in early life, such as chaining and inappropriate housing. Hunger and the physical thwarting for attempts to reach food and shelter

might had been the proximate cause of individual episodes of stereotypic behaviour, with temperature stood-in as a compounding factor. He also mentioned the importance of early grooming and good husbandry practices in captive rearing.

2.6 TRAINING

Hediger (1955) emphasized that captive animals needed social and physical stimulation.

Harlow *et al.* (1963) reported that captive management facilities realized the importance of appropriate social groupings which were instrumental and essential in successful captive propagation possibly because of the social facilitation of synchronous group displays.

Aik (1992) reported that a traditional elephant training method could be modified by the use of Xylazine as a sedative and muscle relaxant. The drug was found to be helpful in the training process especially to restrain the animals which, it made easy and safe. Xylazine was used to prevent repeated beatings to pacify the elephants. He concluded that it was important to play with elephant calves to win their acceptance of man and it took less punishment and time to be trained.

According to Forthman and Ogden (1992) animal training had become far more sophisticated since the early days of circus performances, where it was demonstrated and highlighted the species' natural history and behavior. These demonstrations enhanced both physical fitness and psychological health, when performed on schedule, taking in to account species requirement for rest, feeding time and seasonal reproductive aggressiveness. Such training is recommended especially for large, dangerous and reportedly 'intelligent animal' such as elephants. They also mentioned food or pats and application of ankus (elephant hook) as positive and negative reinforcers, respectively to condition responses in a set of vocal commands. Time outs given occasionally were used to eliminate misbehavior.

Routine husbandry practices to skin, feet and teeth, which needed constant attention in captivity, were made much easier and safer with trained animals (Adler, 1996).

Capturing and taming of elephants in Indonesia had begun in 1986 as an attempted solution to human-elephant conflict. The intent was to train "problem" elephants for use in agriculture, logging and tourism. There were no formal training program for the younger pawangs (elephant handlers) who participated in captures and have learned from their peers (Mikota *et al.*, 2003).

Nissani *et al.* (2003) revealed that elephants could be trained to perform a variety of tasks, which enabled them to meet the daily challenges of life in the wild and captivity by relying on built in behavioral predisposition, trial and error learning, excellent memory and extensive social networks.

2.7 BEHAVIOUR

Hediger (1968) observed that circus elephants were slept shortly after midnight and woke up after every 1-2 hours to urinate or defecate. He also estimated that Indian elephants spend an average of 2 hours and 19 minutes asleep.

Elephants had long lasting memories and discriminated things even after a long period (Markowitz *et al.*, 1975).

Markowitz *et al.* (1975) reported that environmental engineering and environmental enrichments were crucial and should be used to effect behavioral change, he also described the functional relationships between the behavior of captive animals and their physical and social environment.

Rapaport and Haught (1987) opined that allo-maternal or mother like behaviour was a very conspicuous feature of elephant social behaviour, towards young other than their own calves, they were protective of all calves with in the group and allowed nursing by calves other than their own offspring.

Sharma and Krishnamurthy (1984) reported that in the wild, calves associate themselves with just one cow other than the mother, though not always and at all ages and even suckle them. These associations caused a particularly dramatic situation when calves were weaned so it was essential to study their behavioral development and relationship with other elephants so that management of weaning and training were gradual, and less painful to the cow and the calf, particularly the latter.

Bloomsmith (1989) suggested that 'feeding enrichment' as a mode of environmental enrichment, wherein type of food or its manner of presentation is altered to increase time spent foraging and feeding.

According to Novak and Drewsen (1989) the primary goal of captive management was to promote species typical behaviour patterns and to discourage exhibition of behaviours that were apparent artifacts of captivity, such as pacing, regurgitation and reingestion and self mutilation.

Kiely-Worthington (1990) opined that almost all the elephants in circus showed stereotypic behaviour during day light hours.

Hall-Martin (1992) observed that newly captured juvenile elephants developed extreme signs of stress when confined within walls.

Garai (1994) reported that introduction of an adult female to a group of juveniles had a positive effect. It was also mentioned that display of play behavior is probably an indication that animal are at ease.

Garai (1994) reported that younger individuals (probably less than 2 years) repeatedly showed "suckling", or "attempt to suckle" behaviour, at the ear pinna of another group member or even the railings of the shed. (36.1 per cent of all his interactions with a partner were "suckling" and 44.3 per cent attempted "suckling").

Lawrence and Terlou (1993) reported that anticipatory stereotypic behavior was observed before feeding, watering, performance and unchaining. They were also reported that the animals were produced grunting noises and noisy calls when keepers approach their sheds.

Schmid (1995) reported that electric pens or paddocks reduced the incidence of stereotypic behavior and offered increased opportunities for elephants to satisfy their behavioral needs, even taking elephants for walking or bathing improved their attitude and showed a positive behavior with less stereotypic behavior.

Carlstead (1996) found that many wild animals were well adapted to the captive environment; however, successful acclimatization often depended on behavioral characteristics, such as temperament and social behavior.

Benedict and Lee (1936) observed that elephants, the largest mammal, had the greatest heat production in proportion to the surface area of any animal, but had the lowest body temperature of any of the large animals.

Dastig (2001) reported that the orphans had never lived in a natural social structure. Circuses and zoos usually kept only female elephants, which were then deprived of a social structure including an alpha cow, aunts, sisters and their young ones.

Hutchinson *et al.* (2003) mentioned that elephants were capable of running at the speed of 6 meter per second (22 km per hour) for short distance and needed just 10 m accelerate to reach the maximum speed.

Freeman *et al.* (2004) reported that the female elephants were always well behaved in captivity with humans regardless of how they relate to other elephants, except a few.

Bradshaw *et al.* (2005) reported that attachment - bonding process between mother and infant were too strong which got disrupted with maternal separation,

deprivation, mass deaths, social break down from poaching, culls and habitat loss. This will predispose violence in adulthood, depression, unpredictable behavior and hyper aggression.

Elephants were renowned for their close relationships but the disruptions to the attachment bonding process affecting socialization could be remedied to a particular extent by compulsory social structuring such as older generation introduction as a new conservation strategy that promote normal social pattern both in *insitu* and *exsitu* conservation (Bradshaw *et al.*, 2005).

Pool *et al.* (2005) suggested that elephants were capable of vocal learning as in the case of bats and dolphins. This was essential in a long lived relationship to maintain individual specific relationship and to involve fluid group membership

Koch (1992) opined that modern elephants had complex social lives. Related adult females (mothers, daughters, sisters and cousins) and their young offspring lived together in groups. Each group is led by an elder female as they, being a matriarchal society.

Young males formed bull herds once ejected from groups when they reach sexual maturity. Adult bulls generally live alone, but consort with female groups for breeding (Koch, 1992).

Accidents were common during their extensive migration in search of food and water. Once separated from the herd they were rarely admitted to the herd and most of them become orphans (Koch, 1992).

Materials and Methods

3. MATERIALS AND METHODS

3.1 SAMPLING DESIGN

This experiment was designed to study and record the prevalent management practices carried out for young elephants in Kerala. As a preliminary step a survey was conducted along central Kerala where the maximum numbers of young elephants were seen. The survey also included a detailed discussion with owners and mahouts of the animals on which the study was carried out. Eight Private owners and three forest department camps were identified, selected and listed for the purpose of sampling. Thus the sample of study consisted of 8 owners, 28 mahouts and 17 elephants.

The major part of study was carried out in the forest department camps to avoid discrepancies due to the non-availability of recorded data and other variables required for this study, except the interview questionnaire.

3.2 DATA COLLECTION

3.2.1 Questionnaire preparation

A detailed questionnaire was prepared incorporating details regarding the knowledge, experience of the elephant owners and mahouts, and the general management details such as routine works, selection, housing, feeding, health care, training, behaviour, welfare and major constraints in elephant rearing. A preliminary survey was carried out to test the efficiency of the questionnaire and a model of the modified questionnaire is appended (Annexure -I)

3.2.2 Data collection

The data regarding the elephant owners, mahouts and their animals were collected from the owner's households and offices, mahout's rest room and the sites where the animal was tethered, by personal interviews during the period, March 2006 to

August 2006. Direct observation of elephant management at the owner's premises was also made and the data were entered in the questionnaire.

3.2.3 Observation

The following observations were made:

3.2.3.1 Routine followed in elephant facilities

Data on routine practices were collected by direct observation and the practices were recorded and verified. Schedule of routine activities of each elephant and its mahouts were collected from early morning viz., shed cleaning, bathing (frequency and duration), wetting, feeding, watering, resting, training, health assessment and reporting by mahouts to the authority in the Government camps. Data regarding the training of young elephants were collected through the detailed questionnaire prepared. The statements of the experienced mahouts in the field of young elephants were also collated and recorded.

3.2.3.2 Housing of young elephants

Housing details of the young elephants were recorded. The location of the shed or where the animals were tethered was observed and noted. The constructional details such as the type of floor, wall, roof and the hygiene of that place were recorded. The parameters such as the space availability for the animal to move around with respect to the size and age, lighting and comfort of animals' were also noted.

3.2.3.3 Feeding of young elephants

Feeding schedule practiced under different ownership was observed for the selected young elephants. The dry matter intake and nutrient availability of the feed fed was calculated using proximate analysis and compared with the available literature.

Type of food served including green fodder and concentrates during different periods of the year according to the age of the animal were noted and recorded.

3.2.3.4 Health assessment of young elephants

The general health of the young animals were observed and recorded. The growth parameters viz., weight, height at shoulders, fore foot circumference, length (from poll to base of the tail), tusk circumference, tail circumference (base of the tail), circumference of trunk (base of the trunk), neck girth and chest girth were recorded.

Assessment of the physical condition of an elephant, which had direct correlation to health, nutrition and habitat, done by a new method called body condition index/score, for Asian elephants (Wemmer *et al.*, 2006) (Appendix-I). The body condition score thus recorded was used to assess the management and nutritional status of the experimental animals.

The height, weight, length and other parameters were measured using a measuring tape. The weight of the elephant was estimated using a formula noted below for those animals whose weight was not recently recorded.



3.2.3.5 Disease and health management of young elephants

Data on disease and health management were collected from the register and the authority for the available period. Based on this, the incidence and occurrence of different diseases in young elephants were assessed.

3.2.3.6 Behaviour and Temperament of young elephants.

The young animals' temperament towards strangers, mahouts and other environmental variables were observed and recorded. Response of the animal towards the mahout's verbal commands (Appendix-II) and observed to identify the behavioural peculiarities of young elephants such as maintenance behaviour, comfort activities, and for stereotypic behaviour if any.

Table 1. Behavioural data collection chart

Sl. No	Behaviour	description
1	Feed / Drink (Maintenance behaviour)	Any ingestion of food and consumption of water. Often this will involve the individual gathering food or water with its trunk and lifting it into its mouth
2	Dusting / Mudding (Comfort behaviour)	Individual lifts quantities of sand, dust, mud or dirt and tosses onto own body with trunk. Includes water bathing, when individual douses own body with water
3	Head shake / Head weave, and Head toss (Stereotypic behaviour)	Vigorous shaking of head – ears flap against the body/head rocking from side to side repetitively
4	Trunk curl / Trunk twitch / trunk bounce (Stereotypic behaviour)	Curling of trunk tightly inwards/twitching the trunk back and forth/ dragging the distal portion of the trunk on the ground

3.2.3.7 Record keeping in elephant facilities

The records kept and maintained among the private owners for different purposes, recommended by the captive elephant rules 2003 of Kerala, were verified and documented.

3.3 ANALYSIS OF DATA

The information thus obtained was further analysed using statistical techniques such as average and percentage.



A



B



C



D



E



F

Plate 1. Routine. A- Shed Cleaning, B- Morning Walk, C- Bathing, D- Feed Preparation, E- Feeding, F- Routine Check up



A



B



C

Plate 2. Bathing. A- Group I, B- Group II, C- Group III



A



B



C

Plate 3. Wetting. A- Group I, B- Group II, C- Group III



A



B



C

Plate 4. Watering. A- Group I, B- Group II, C- Group III



A



B



C

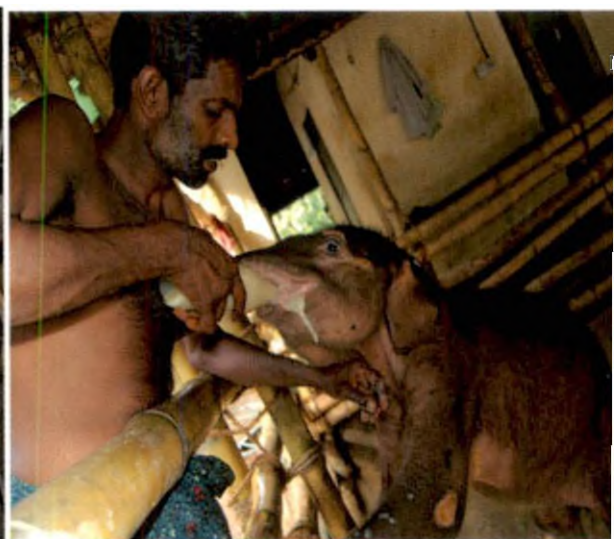


D

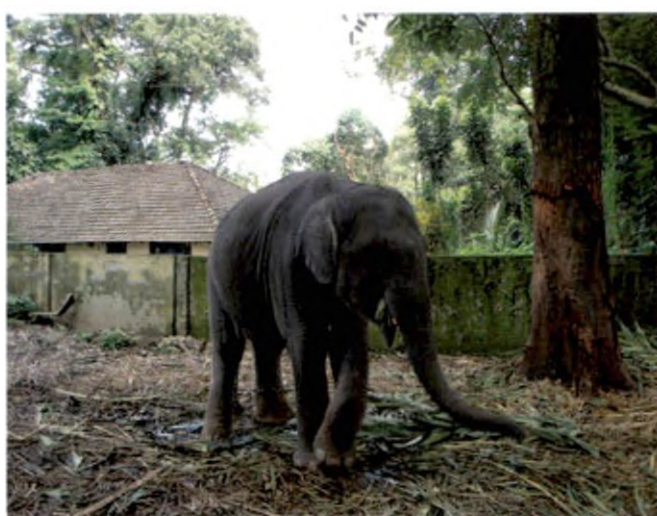


E

Plate 5. Training A- Leg Commands, B- Dog Sitting, C- Lie Down
D- Logging, E- Trunk up



A



B

Plate 6. Feeding. A- Milk Feeding, B- Palm Leaf



A



B



C

Plate 7. Housing. A- Penning, B- Open Picketting, C- Closed Picketting

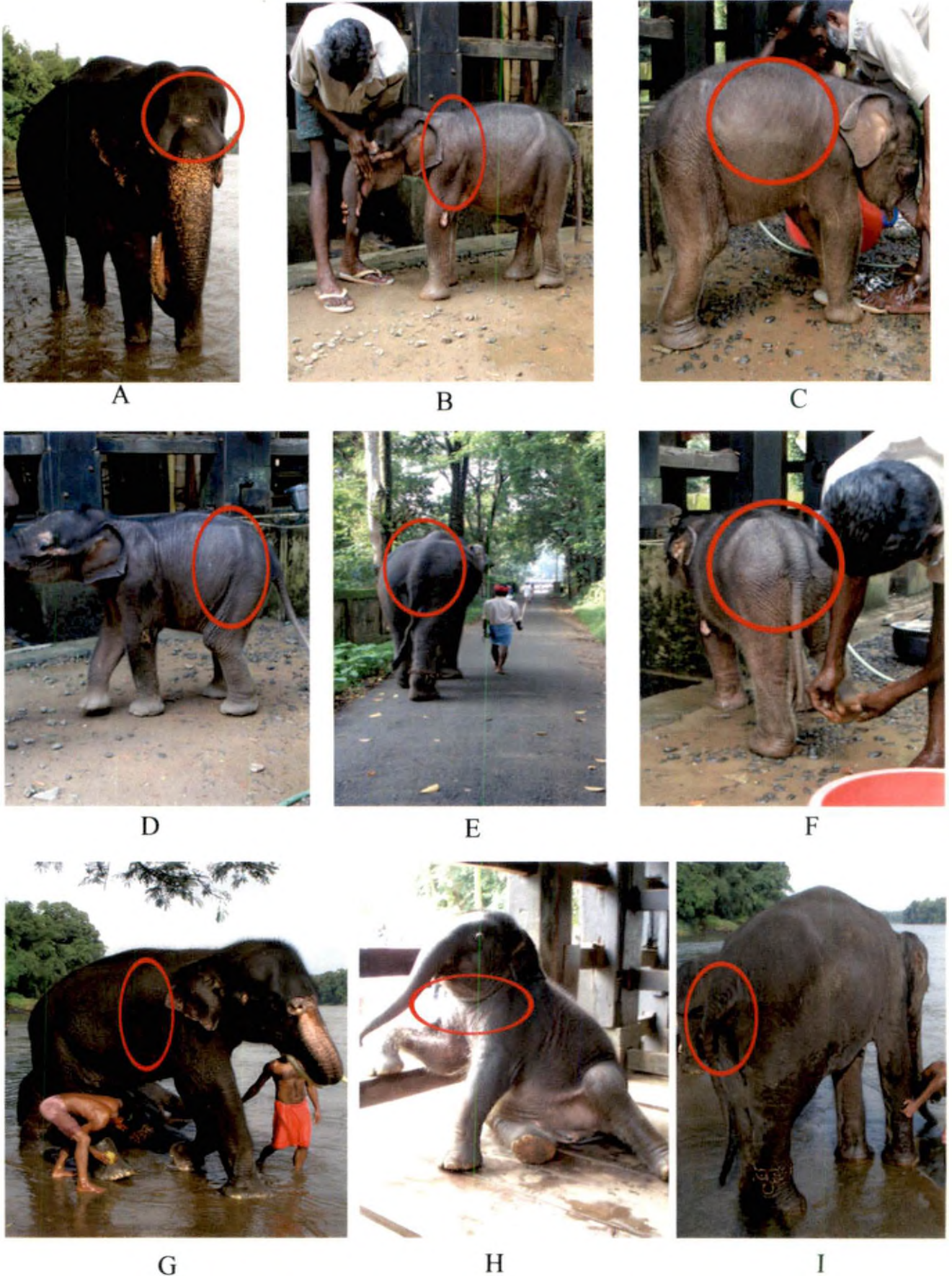


Plate 8. Body Condition Index A- Head, B- Scapula, C- Thoracic Vertebrae
 D- Flank Area, E- Lumbar Vertebrae, F- Pelvic Bone, G- Axillary Fat
 H- Brisket Fat, I- Tail fat



A



B



C



D



E



F

Plate 9. Behaviour. A- Suckling, B- Attention Seeking, C- Body Swaying
D- Head Weaving, E- Trunk Twitching, F- Chain Pulling

Results

4. RESULTS

The result of the study is discussed in this chapter under various headings.

4.1 PERSONAL PROFILE OF THE RESPONDENTS

4.1.1 Age of the elephant owners and mahouts.

The data in Table 2 revealed that 63 per cent of elephant owners belonged to the middle age group, while 37 per cent belonged to old and none in the young age group respectively. In the case of first mahouts, 69 per cent belonged to middle age group, while 31 per cent belonged to old age group. Among second mahouts, 58 per cent and 42 per cent belonged to middle and young age groups respectively.

4.1.2 Training attended by the elephant owners.

Table 3. Revealed that none of the owners received any training on elephant management but 38 per cent first mahouts and 34 per cent second mahouts received training. Those who did not attend training among first and second mahouts were 62 and 66 per cent respectively.

4.1.3 Experience of elephant owners and mahouts.

Data in Table 4 showed that a 50 per cent of owners were having medium experience in elephant keeping and 50 per cent were highly experienced. In case of first mahouts, majority of them (63%) were possessing high experience and 37 per cent possess medium experience. Most of the second mahouts (83%) were having medium level of experience 17 per cent of them were having only low experience.

4.1.4 Motivation of elephant owners and mahouts for elephant rearing.

Data in Table 5 showed that the majority of owners (75 %) and first mahouts (62 %) selected elephant rearing as a hereditary business and job.

4.1.5 Degree of injury to the mahouts

From Table 6 it is revealed that 75 per cent of first mahouts and 50 per cent of second mahouts got mild injury during elephant management and 25 per cent of first mahouts and 50 per cent of second mahouts got away with no injury. None of the mahouts were severely injured while managing young elephants.

4.2 DETAILS ABOUT THE ANIMALS

The young elephants were first divided into three groups according to their age. As the management practices were followed with slight difference they were classified accordingly for easy documentation and verification. Individual data were collected for each age group and recorded separately. The measurements taken were for height, chest girth, neck girth, length, right forefoot circumference and weight and with their respective values were presented in the Table 7.

4.3 GENERAL MANAGEMENT STEPS

4.3.1 Routine practices

From Table 8-9 the detailed description of the daily routine is revealed. It was seen that most of the young elephants were kept idle through out the day with less or no work, except to carry their own feed materials and early walk for bathing. Feeding and watering for Group I and Group II animals are done more frequently than others especially for the former. The animals take rest mostly during the night time. The animals in Group I the youngest of the lot, takes rest even during day time for short periods.

4.3.2 Frequency and duration of bath

Table 10 reveals that the young elephants in the Group I and Group II were given 7 baths a week on an average, and the elephants belonging to the third group were given on an average 5 baths in a week. It can also be seen that the average time taken for the first and second group is comparatively less than the last group and the values were 1 hr, 1.5 hrs, 2.6 hrs respectively. The time taken for bath for group I animals is considerably less and was decided according to the age. Young animals especially milk fed ones needed only wetting as they are with soft skinned and needed only gentle grooming.

4.3.3 Frequency of wetting

From Table 11 it is evident that the average frequency of wetting was more in summer than in winter and the average frequency of wetting was higher in the third group when compared to second group and first group.

4.3.4 Frequency of watering

It was observed that the frequency of watering varied with season, the highest is in summer season than the winter season, and Group I animals were given boiled, cooled water more frequently at about one hour interval in small quantity. Compared to Group III animals' the group II animals were given water more frequently and animals were taken to the ground water tanks for watering but the animals in Group III were taken to nearby streams both for wetting and watering. The study revealed that the frequency of watering varied from two to four times in hot summer months and twice in rainy season for Group II and Group III animals.

4.3.5 Training of young animals

Table 12 revealed that Group I animals are rarely trained for commands and performances as compared to Group II and Group III animals, except for the basic training for feeding. It also revealed that the Group II animals were mainly trained for common commands and sometimes for performance commands. Age at which the actual training started was from six years onwards. Training of young elephants started from the first day of entry into any elephant facility for feeding and regular check ups. Mahouts opined that full course of training for commands takes only 6 months to one year so very young animals were not subjected to training of all commands at the age of three to four years. All the animals above six years of age were trained for common verbal and leg commands, and training for light works was also started at this age for carrying food initially, then small logs and carrying people later as observed.

4.3.6 Feeding of young elephants

The daily feed intake of the animals were recorded and compared with the prescribed rations for young elephants. The quantity and quality assessment of the feed materials were also taken up. It was observed that the elephants were fed incessantly with palm leaves. Proximate analysis of the palm leaves (*Caryota urens*) were carried out and digestibility coefficients taken from works of Ananthasubramaniam (1979). Based on this the detailed nutrient availability for the animals were calculated as furnished in Table 13 & 14.

In addition to palm leaves some of the young elephants were fed with easily digestible feed items like rice, wheat, ragi, jaggery, mineral mixture and salt. Proximate analysis of the individual feed items were carried out and their digestibility coefficients taken from works of Vasanthakumar *et al.* (1999). Based on this nutrient availability were calculated as given in Table 15.

The nutrient availability for the young elephants on daily basis was calculated from palm leaves and concentrates. It was compared with the nutrient requirement calculated on the metabolic body weight as mentioned in Table 16.

Young elephants of group I was fed mainly on cow milk and the quantity fed daily was recorded. No scientific studies have been conducted on digestibility coefficients in this group till date and this field has immense scope and potential.

4.3.7 Health assessment of young elephants.

Among the animals taken for our study it was observed that only one animal had body condition score indicative of emaciated condition. This calf was admitted to the elephant facility as an orphan calf in a life threatening state. Two other animals, one of group II and the other of group III also had scores near the upper limit of average body condition score as seen Table 17 and 18. The study also revealed that for effective young elephant management, it is imperative that not only the environment but also the availability and infrastructure must be very conducive.

Body condition index score do have a direct relationship with general health, nutrition and management of the facility, as this is a unique method of its kind standardized in Asian elephants.

The study also revealed that the major ailments observed in elephants were diarrhea especially in milk fed orphan calves. Most of the elephant facilities in Kerala were practicing regular deworming and other health precautions but, no animals were vaccinated against any diseases prevalent in that area. Impaction is a common disease and deadly one in adult elephants, but this is not commonly reported in different young age groups, especially below 15 years of age.

4.3.8 Details of the housing systems

The housing systems adopted for the young elephants under study were documented and photographed. Details from Table 19 revealed that almost all the elephants were tethered / picketed under trees mostly on elevated bedding which was provided to avoid foot lesions. The animals in group I, which were very young, were housed in kraal / permanent house. Most of the animals in group II and group III were housed under tree shades. Very interestingly, a tin sheet roofed house was also observed for an animal in group III.

4.3.9 Details of behaviour and temperament of animals

Table 20 revealed that most of the animals in group II and group III showed the *classified behaviour in different categories taken under study*. The animals that showed stereotypic behaviour were picketed/tethered ones especially of group II.

4.3.10 Record keeping

It is revealed from the Table 21 that only organized elephant care facilities do keep records and most of the private owners were not keeping even the essential records.

Table 2. Distribution of the elephant owners and mahouts according to their age

SL No:	Age group	Owners	First Mahout	Second Mahout
1	Young (<30 Years)	0 (0)	0(0)	5 (42)
2	Middle (30-50)Years	5 (63)	11 (69)	7 (58)
3	Old (>50) Years	3 (37)	5 (31)	0 (0)
4	Total	8 (100)	16 (100)	12 (100)

Figures in parenthesis indicate percentage adjust to the nearest whole value.

Table 3. Training attended by elephant owners and mahouts.

Sl. no.	Owners	First mahouts	Second mahouts
Training attended	0(0)	6(38)	4(34)
Training not attended	8(100)	10(62)	8(66)
Total	8(100)	16(100)	12(100)

Figures in parenthesis indicate percentage adjusted to nearest whole value.

Table 4. Distribution of elephant owners and mahouts according to their experience in elephant management.

Sl. No.	Experience	Owners	First mahouts	Second mahouts
1	Low (\leq 5 years)	0(0)	0(0)	2(17)
2	Medium (6-25 years)	4(50)	6(37)	10(83)
3	High ($>$ 25 years)	4(50)	10(63)	0(0)
4	Total	8(100)	16(100)	12(100)

Figures in parenthesis indicate percentage adjusted to nearest whole value

Table 5. Distribution of elephant owners and mahouts according to their motivation for elephant rearing or mahoutship.

Reason	Owner	First mahout	Second mahout
Hereditary	6(75)	10(62)	10(83)
Own interest	2(25)	6(38)	2(17)

Figures in parenthesis indicate percentages adjusted to the nearest whole values.

Table 6. Distribution of elephant mahouts according to the degree of injury inflicted upon them.

Sl. No .	Degree of injury	First mahout	Second mahout
1	No injury	4(25)	8(50)
2	Mild	12(75)	8(50)
3	Severe	0(0)	0(0)

Figures in parenthesis indicate percentages.

Table 7. Age classification and body measurements of young elephants surveyed.

	Animal & Sex	Age	Height (cm)	Chest girth (cm)	Neck girth(cm)	Fore foot Circumference (cm)	Length (cm)	Weight (kg)
Group I 0-2 yrs	Newcalf (fm)	6 months	78	99	75	38	87	75
	Parvathy (fm)	1 yr 4 m	114	167	100	69	149	440
Group II 2-6 yrs	Eco (m)	3 yrs 5 m	150	217	142	61	168	720
	Asha (fm)	3 yrs 8 m	130	179	113	89	210	520
	Kalpna (fm)	4 yrs	141	205	121	73	186	740
	Eva (fm)	4 yrs 2 m	157	237	133	87	211	1010
	Minna (fm)	4 yrs 6 m	161	226	146	81	203	920
	Ammu (fm)	5 yrs 2 m	173	236	144	84	216	980
Group III 6-15 yrs	Lakshminarayanan* (m)	8 yrs	201	285	187	103	234	1550
	Surendran (m)	8 yrs 3 m	195	246	150	95	230	1085
	Adithyan * (m)	9 yrs	215	328	218	121	287	2300
	Neelakandan (m)	10 yrs 8 m	237	316	212	119	284	2250
	Parthan* (m)	11 yrs	242	362	240	122	306	2940
	Meena (fm)	14 yrs 9 m	221	291	186	107	276	1720
	Gopu* (m)	9 yrs 6 m	225	346	221	110	292	1850
	Rajeev* (m)	11 yrs	252	351	240	123	302	2490
	manikandan* (m)	8 yrs 9m	210	310	202	104	245	1650

(*) Private owned elephants

Table 8. Daily routine of captive elephant facilities of government camps

Time	Routine	Group I	Group II	Group III (A)
05.00-06.00	Early morning reporting	Yes	Yes	Yes
06.00-07.00	Shed cleaning & bedding	Washing of floor	Yes	Yes
07.00-07.30	Preliminary observation of the animal	Yes	Yes	Yes
07.30-08.00	Morning walk	Not practiced	Small distance walking	Yes
08.00-10.00	Bathing	30 minutes bathing	1 hour bathing	Yes
10.00-10.30	Concentrate feeding	Milk feeding	Yes	Occasionally practiced only when work
10.30-11.30	Training/feeding	Not practiced	Mild training	All kinds of training starts
11.30-12.00	Watering	Yes	Yes	Yes
12.00-13.00	Routine health check-up	Yes	Yes	Yes
13.00-15.00	Feeding (green fodder)	Milk feeding	Yes	Yes
15.00-16.00	Watering & wetting	Yes	Yes	Yes
16.00-17.00	Health reporting	Yes	Yes	Yes
17.00-19.00	Feeding (green fodder)	Milk feeding	Yes	Yes
19.00-05.00	Rest	Yes	Yes	Yes
19.00-05.00	Frequent close observation and feeding especially of young animals of Group I & Group II	Yes	Yes	Yes

Table 9. Daily routine of captive elephant facilities under private ownership

Routine	Group III (B)
Early morning reporting	Yes
Shed cleaning & bedding	Yes
Preliminary observation of the animal	Yes
Morning walk	Yes
Bathing	Yes
Concentrate feeding	Occasionally practiced only when work
Training/feeding	All kinds of training starts
Watering	Yes
Routine health check-up	Yes
Feeding (green fodder)	Yes
Watering & wetting	Yes
Health reporting	Yes
Feeding (green fodder)	Yes
Rest	Yes
Frequent close observation and feeding especially of young animals of Group I & Group II	Yes

Table 10. Average frequency and duration of each bath

	Group I	Group II	Group III
Number of baths/ week	7	7	5
Duration of a bath in hrs.	1	1.5	2.6

Table 11. Average number of wetting done per day in each group in summer and winter

	Group I	Group II	Group III
Summer	1	2	3.33
Winter	1	1	1.66

Table 12. Training of elephants and type of commands for which animals are trained

Sl. No	Type of commands	Group I	Group II	Group III	
				A*	B**
Common commands					
1	Face away to accept feed	Done	Done	Done	Done
2	Moving backward	---	Done	Done	Done
3	Moving forward	---	Done	Done	Done
4	Moving left	---	Done	Done	Done
5	Moving right	---	Done	Done	Done
6	Stand still with all four limbs on the ground	---	Done	Done	Done
7	Moving fore limbs	---	Done	Done	Done
8	Moving hind limbs	---	Done	Done	Done
9	Animal to sit	---	Done	Done	Done
10	Animal to lie down	---	Done	Done	Done
Commands for bathing					
1	Lie down	---	Done	Done	Done
2	Lie down leg stretched	---	---	Done	Done
3	Dog sitting	---	---	Done	Done
4	Hind limbs folded	---	---	Done	Done
5	Stand up – step one	---	---	Done	Done
6	Stand up – step two	---	---	Done	Done
Commands for working and festivals		---	---	Done	Done
Commands for performance purposes		---	Done	Done	---

(A*) Government elephants

(B**) Private elephants

Appendix II – Definitions of the above commands

Table 13. Dietary composition and feeding schedule followed in elephant facilities

Sl. No	Items	Group I		Group II	Group III	
					A *	B**
		1 months to 12 months	12 months to 2 yrs	2 yrs to 6 yrs	6 yrs to 15yrs	6 yrs to 15yrs
1	Milk	10 ltrs	5 ltrs			
	Concentrate ration					
1	Ragi	2 kg	4 kg	4 kg	6 kg	
2	Horse gram			2 kg	3 kg	3 kg
3	Wheat / Rice	1 kg	1 kg	2 kg	3 kg	3 kg
4	Common salt	10 gm	20 gm	50 gm	100 gm	100 gm
5	Mineral mixture	20 gm	25 gm	75 gm	100 gm	100 gm
6	Jaggery	500 gm	250 gm	100 gm	50 gm	50 gm
	Green fodder					
1	Green grass	5kg	10 kg	Occasionally	Rarely	50 kg
2	Palm leaves / coconut leaves		Occasionally	100 kg	200-250 kg	200 -250 kg

(A*) Government elephants

(B**) Private elephants

Table 14. Nutrients available from Palm leaves (*Caryota urens*)

	Animals	Age	Body. Wt (kg)	Metabolic body wt.(B.wt ^{0.73}), (kg)	Feed item (kg)	DM availability (%)**	DCP availability (%)**	TDN availability (%)**
Group I 0-2 yrs	New calf	6 m	75	23.38	5 grass	1.1	0.175	2.4
	Parvathy	1.4 yrs	440	85.06	10 grass	2.2	0.35	4.8
Group II 2-6 yrs	Eco	3.5 yrs	720	121.86	100 p. leaf	38	2.11	21.2
	Asha	3.8 yrs	520	96.09	100	38	2.11	21.2
	Kalpana	4 yrs	740	124.32	100	38	2.11	21.2
	Eva	4.2 yrs	1010	156.01	100	38	2.11	21.2
	Minna	4.6 yrs	920	145.74	100	38	2.11	21.2
	Ammu	5.2 yrs	980	152.61	100	38	2.11	21.2
Group III 6-15 yrs	Lakshminarayanan*	8 yrs	1550	213.28	200	76	4.22	42.4
	Surendran	8.3 yrs	1085	164.39	150	57	3.165	31.8
	Adithyan*	9 yrs	2300	284.49	250	95	2.275	53
	Neelakandan	10.8 yrs	2250	279.96	250	95	5.275	53
	Parthan*	11 yrs	2940	340.32	250	95	5.275	53
	Meena	14.9 yrs	1720	230.11	200	76	4.22	42.4
	Gopu	9.6 yrs	1850	242.68	200	76	4.22	42.4
	Rajeev	11 yrs	2490	301.46	250	95	5.275	53
Manikandan	8.9 yrs	1650	223.24	200	76	4.22	42.4	

(*) Private elephants

(**) calculated value based on fresh basis by Ananthasubramaniam (1979)

Table 15. Nutrients available from the concentrate feed fed to young elephants

	Animals	Metabolic body wt.(B. wt ^{0.73})	Wheat (kg)	Ragi (kg)	Horse gram (kg)	Wheat DCP available (%)	Wheat TDN available (%)	Ragi DCP available (%)	Ragi TDN available (%)	Horse gram DCP available (%)	Horse gram TDN available (%)	Total DCP (%)	Total TDN (%)
Group I 0-2 yrs	New calf	23.38	1	2	0	0.06	0.86	0.06	1.32	0.0	0.0	0.1	2.19
	Parvathy	85.06	1	2	0	0.06	0.86	0.06	1.32	0.0	0.0	0.1	2.19
Group II 2-6 yrs	Eco	121.86	2	4	2	0.12	1.73	0.13	2.64	0.4	1.25	0.6	5.62
	Asha	96.09	2	4	2	0.12	1.73	0.13	2.64	0.4	1.25	0.6	5.62
	Kalpana	124.32	2	4	2	0.12	1.73	0.13	2.64	0.4	1.25	0.6	5.62
	Eva	156.01	2	4	2	0.12	1.73	0.13	2.64	0.4	1.25	0.6	5.62
	Minna	145.74	2	4	2	0.12	1.73	0.13	2.64	0.4	1.25	0.6	5.62
	Ammu	152.61	2	4	2	0.12	1.73	0.13	2.64	0.4	1.25	0.6	5.62
Group III 6-15 yrs	Lakshminarayanan*	213.28	3	0	3	0.17	2.59	0.0	0.0	0.5	1.87	0.7	4.46
	Surendran	164.39	3	0	3	0.17	2.59	0.0	0.0	0.5	1.87	0.7	4.46
	Adithyan*	284.49	3	0	3	0.17	2.59	0.0	0.0	0.5	1.87	0.7	4.46
	Neelakandan	279.96	3	0	3	0.17	2.59	0.0	0.0	0.5	1.87	0.7	4.46
	Parthan*	340.32	3	0	3	0.17	2.59	0.0	0.0	0.5	1.87	0.7	4.46
	Meena	230.11	3	0	3	0.17	2.59	0.0	0.0	0.5	1.87	0.7	4.46
	Gopu*	242.68	3	0	3	0.17	2.59	0.0	0.0	0.5	1.87	0.7	4.46
	Rajeev*	301.46	3	0	3	0.17	2.59	0.0	0.0	0.5	1.87	0.7	4.46
Manikandan*	223.24	3	0	3	0.17	2.59	0.0	0.0	0.5	1.87	0.7	4.46	

(*) Private elephants

(**) Calculation based on digestibility trial conducted on horses on fresh basis Vasanthakumar *et al.*, (1999)

Table 16. Total nutrient requirement and availability of young elephants

	Animals	Body. Wt (kg)	Total DCP required (%)	Total TDN required (%)	Total DCP available (%)	Total TDN available (%)
Group I 0-2 yrs	New calf	75	0.16	1.64	0.3	4.59
	Parvathy	440	0.60	5.95	0.5	6.99
Group II 2-6 yrs	Eco	720	0.85	8.53	2.7	26.82
	Asha	520	0.67	6.73	2.7	26.82
	Kalpana	740	0.87	8.7	2.7	26.82
	Eva	1010	1.09	10.92	2.7	26.82
	Minna	920	1.02	10.20	2.7	26.82
	Ammu	980	1.07	10.68	2.7	26.82
Group III 6-15 yrs	Lakshminarayanan*	1550	1.49	14.93	4.9	46.86
	Surendran	1085	1.15	11.51	3.9	36.26
	Adithyan*	2300	1.99	19.91	6.0	57.46
	Neelakandan	2250	1.96	19.60	6.0	57.46
	Parthan*	2940	2.38	23.82	6.0	57.46
	Meena	1720	1.61	16.11	4.9	46.86
	Gopu*	1850	1.70	16.99	4.9	46.86
	Rajeev*	2490	2.11	21.10	6.0	57.46
Manikandan*	1650	1.56	15.63	4.9	46.86	

(*) Private elephants

Table 17. Body condition index of young elephants with total points scored

	Animals	Head	Scapula	Thoracic vertebrae	Flank area	Lumbar vertebrae	Pelvic bone	Axillary fat	Brisket fat	Tail fat	Total points
Group I 0-2 yrs	New calf	1	0	1	0	0	1	0	1	0	4
	Parvathy	2	2	2	1	2	2	2	1	1	15
Group II 2-6 yrs	Eco	2	2	2	1	2	2	1	1	0	13
	Asha	2	2	2	1	2	1	1	1	0	12
	Kalpana	2	1	1	1	1	1	1	1	1	10
	Eva	2	2	2	1	2	2	2	1	1	15
	Minna	2	2	2	1	2	2	1	1	1	14
	Ammu	2	2	2	1	2	2	1	1	1	14
Group III 6-15 yrs	Lakshmi narayanan*	2	2	1	1	1	2	1	1	1	12
	Surendran	2	2	1	1	1	1	1	1	0	10
	Adithyan*	2	2	2	1	2	2	1	1	1	14
	Neelakandan	2	2	2	1	2	1	1	1	1	13
	Parthan*	2	2	2	1	2	2	2	1	1	15
	Meena	2	2	2	1	1	2	2	1	1	14
	Gopu*	2	2	1	1	1	2	2	1	1	13
	Rajeev*	2	2	2	1	1	2	2	1	1	14
Manikandan*	2	2	1	1	1	2	2	1	1	13	

(*) Private elephants

(**) Appendix I – Asian elephant body index card included

- 0-5 points = emaciated condition
- 6-10 points = average condition
- 11 + points = fat or very good condition

Table 18. Prevalence of diseases encountered among young captive elephants

Sl. No.	Diseases	Government camps	Private ownerships
Parasitic diseases			
1.	Gastro- intestinal helminthiasis	Reported	Reported
2.	Louse infestation	---	---
Bacterial diseases			
1.	Tuberculosis	---	---
2.	Anthrax	---	---
3.	Tetanus	---	---
Viral diseases			
1.	Elephant pox	---	---
2.	Foot-and-mouth disease	---	---
Non-specific diseases			
1.	Impaction of colon	Reported	Reported
2.	Foot rot	---	Reported
3.	Corneal opacity	---	Reported
4.	Decay of pulp	---	---
5	Wounds	---	Noted
6	Skin condition	Normal	Normal

Table 19. Housing of young elephants

	Animals	Restraining	Floor type	Roof type
Group I 0-2 years	New calf	Temporary Kraal	Mud floor	Asbestos/Permanent roofing
	Parvathy	Kraal	Wooden floor	Asbestos/ Permanent roofing
Group II 2-6 years	Eco	Open picketting	Bedding / mud	Tree shades
	Asha	Open picketting	Bedding / mud	Tree shades
	Kalpana	Open picketting	Bedding / mud	Tree shades
	Eva	Open picketting	Bedding / mud	Tree shades
	Minna	Open picketting	Bedding / mud	Tree shades
	Ammu	Open picketting	Bedding / mud	Tree shades
Group III 6- 15 years	Lakshminarayanan*	Open picketting	Mud floor	Tin sheet roofing
	Surendran	Open picketting	Bedding / mud	Tree shades
	Adithyan*	Open picketting	Mud floor	Tree shades
	Neelakandan	Closed picketting	Mud floor	Tree shades
	Parthan*	Open picketting	Mud floor	Tree shades
	Meena	Open picketting	Bedding / mud	Tree shades
	Gopu*	Open picketting	Mud floor	Tree shades
	Rajeev*	Open picketting	Mud floor	Tree shades
	Manikandan*	Open picketting	Mud floor	Tree shades

(*) Private elephants

Table 20. Observations on young elephants for their behaviour

		Maintenance behaviour	Comfort behaviour	Stereotypic behaviour
Group I 0-2 years	New calf	---	---	---
	Parvathy	---	---	---
Group II 2-6 years	Eco	Noted	---	Noted
	Asha	Noted	---	Noted
	Kalpana	Noted	---	---
	Eva	Noted	---	Noted
	Minna	---	---	---
	Ammu	---	---	---
Group III 6-15 years	Lakshminarayanan*	Noted	Noted	Noted
	Surendran	Noted	Noted	Noted
	Adithyan*	Noted	Noted	Noted
	Neelakandan	---	---	---
	Parthan*	Noted	Noted	---
	Meena	Noted	---	---
	Gopu*	Noted	---	---
	Rajeev*	Noted	---	---
Manikandan*	Noted	Noted	Noted	

(*) Private elephants

Table 21. Details of record keeping in Government and Private ownership

Sl. No.	Records to be kept	Government ownership	Private ownership
1	Vaccination record	Yes	---
2	Disease and treatment record	Yes	---
3	Movement register	Yes	Yes
4	Feeding register	Yes	---
5	Work register	Yes	---

Discussion

5. DISCUSSION

5.1 PERSONAL PROFILE OF THE RESPONDENTS

Profile of mahouts gave a picture of their knowledge and experience about elephant management. From this study it is revealed that most of the elephant owners and mahouts were between 30 to 50 years of age. Majority of them selected elephant rearing as a traditional business and job though this is considered as a very risky affair. Most of the mahouts have sustained mild injuries during this period and some of them even though met with major accidents got away with only mild injuries.

The study further revealed that only a small percentage of mahouts have attended any scientific seminar or training programme on modern elephant management. The mahouts found to be short of knowledge about scientific elephant management, especially in young or orphan elephant rearing, so steps should be taken to fill the lacunae. It is in accordance with Joy (1990), he stressed the importance of scientific knowledge on elephant management both to mahouts and elephant owners; Cheeran and Trevor (2000) and Panicker (1998).

It was found that age was positively and significantly correlated with their knowledge on general management and disease management so also their experience. This indicated the importance of age and experience in elephant keeping. Perhaps the mahouts should have an even better knowledge than owners, being full time attendants of elephants and directly responsible to the daily chores but the necessity for improved knowledge on scientific management practices to the mahouts was observed to be essential and this is in agreement with Ponnappan (1998), Nibha (1998). According to Deraniyagala (1955) mahouts should have thorough knowledge in elephant capturing, taming, training and controlling.

As young or orphan elephant management entails patience, special care and attention, only a few mahouts were found to be suitable and selected for this job, as they should spend their whole time with the young ones. Mahouts were considered by

elephants as a member of their herd as a dominant matriarch, they should act as foster mother for the young or orphan elephants, providing knowledge and should guide them (Line, 1987).

The study revealed that, it is imperative that mahouts should be given enough time to acquaint with the elephants to come in terms with the elephants and understand the animal with all their behavioural peculiarities (August and Anderson, 1987). They could build a good relationship with elephants through regular bathing and proper grooming (Ponnappan, 1998), as it was very helpful for the elephants also and it ensured enhanced peripheral blood circulation and facilitated in losing their old skin to make the animal feel fresh.

5.2 DETAILS ABOUT THE ANIMALS.

The young elephants were divided into three groups according to their age and differences in their management practices to 0 to 2 years as calf, 2 to 6 years as juveniles and 6 to 15 years as sub adults, a similar classification was done by Ishwaran (1984). The age of animals under this study ranged between 6 months to 14 years and 9 months. The range of height of the elephants was from 78 to 242 cms. The average height of elephants of different groups varied from 96 cms in the group I animals that are calves, 152 cms and 218.5 cms respectively in juveniles (group II) and sub adults (group III) respectively. The variation in the average height of animals among the groups was non-significant. The data also revealed that the majority of the surveyed elephants were in the group III category. The females which are of same age as males in a group were found to be smaller than males.

It was observed that a large percentage of the surveyed elephants were of sub adult category (animals aged between 6 to 15 years of age). The data revealed that most of the private owners preferred elephants above 6 years of age. The animal selection by the private owners is mainly based on the utility of the animal than fancy purpose preferably, those animals which are trained or those in their apt age for training given due importance. A plausible explanation for private owners rearing mostly above 6

years may be due to the fact that the growth rate, health and attitude of an elephant could be more positively predicted at this age and this is found to be in agreement with Nissani *et al.*, 2003.

5.3 GENERAL MANAGEMENT STEPS.

5.3.1 Routine practices of elephant facilities

The routine practices followed in both private and Government camps were marked by several differences. The routine followed in Government farms was mostly time bound, but in private ownership scheduled work was not practiced. In Government camps mahouts were residents of the camps and their presence was mandatory, but in private camps the muster was not compulsory. Moreover, the animals were always stayed within the camps in Government facilities but the animals under private ownership were always on constant move with their mahouts and most of time outside the owners' premises. It is also noted that the elephants under private ownership was always not found with their mahouts, but in Government camps mahouts always stays with their animals.

5.3.2 Frequency and duration of bath

In Government camps, the average frequency of elephant bathing was higher than that of private ownership and found out to be on an average 7 baths/week and 4 baths/week respectively. The difference was mainly due to the access to water sources as most of the government elephant camps were situated near to the rivers or natural water sources. The time take for each bath is more in private camps compared to animals of Government camps. The average time taken for bath increases with age group of the animals and the values were 1 hour, 1.5 hours and 2.6 hours respectively. Mahouts spend more time with their elephants, bathing and grooming is found to be helpful in establishing a good understanding and relationship between them this finding is in congruence with Ponnappan (1999). This practice builds up the mahouts' confidence in their animal so also vice versa. While bathing the elephants were

scrubbed with coconut husk and occasionally they use stones. The importance of bathing in elephant management is in agreement with the observation of the study mentioned by Krishnamurthy (1989); Panicker (1985); Cheeran (1998).

The animals in group I or infants (0 to 2 years of age) were mostly subjected to wetting with hand scrubbing as their skin was thin and there was every chance of injury during thorough scrubbing.

5.3.3 Frequency of wetting

The average frequency of wetting in all age groups was more in the summer than in the winter. The frequency of wetting in summer is significantly higher than the frequency of wetting in winter in all age groups. It is also noted that the private elephants were allowed on an average 4 times wetting a day and varied based on the type of work and activity of the elephants during summer. Wetting is very important for elephants to cool off their body as they have higher body temperature with low heat dissipation; which increases stress in elephants, this management practice is found to be in agreement with the findings of (Brattstorm *et al.*, 1963).

5.3.4 Frequency of watering

The frequency of watering varied with season as normally expected and was highest in summer when elephants drank more water, and the least in winter. In all groups it varied between 2 to 4 times in hot summer months and 1 to 2 times in rainy season. It was observed that the elephants drank more water during summer than during rainy season.

The study revealed that animals put for work or training were given water more frequently as drinking is a technique to cool off their body and reduces the heat stress. Elephants were given a short period of rest after strenuous work to naturally cool off their body, then only allowed to watering or wetting. The elephants in Government

camps were taken to near by river to drink water whereas the animals under private ownership drank water from erected tanks or ponds.

5.3.5 Training of young elephants

Ninety per cent of group III young elephants were trained for various commands but elephants in group II were trained only for common commands this was because the minimum age fixed for training is 6 years. The animals in group I is rarely trained for any commands but they were trained to accept feed and to accompany the mahouts for wetting and bathing.

Group III animals which are above 6 years of age were trained to carry food items, small logs, commands for bathing and for other purposes such as to attend temple processions and carry people on top. It is revealed that training young elephants are easier than elephants of more than 6 years of age. Training from a very young age makes the process a gradual painless affair and reduces the suffering of animals inflicted during the training period. It is essential that the mahouts establish command over the animal to control the animal and establish a herd order as the dominant matriarch and it is usually accomplished with beatings and rewards (Forthman and Ogden, 1992).

It is revealed that complete breaking of elephants takes on an average 6 months. Elephants could be trained to perform a variety of tasks which enabled them to meet the challenges of captive life. Most of the training is based on trial and error learning and took longer time and more sophisticated training is necessary in case of elephants that are huge, dangerous and intelligent. Time outs given occasionally were used to eliminate misbehaviour. This is in agreement with (Nissani *et al.*, 2003).

Elephants were well adapted to the captive environment but successful acclimatization and proper training based on their behavioural peculiarities and temperament is essential (Carlstead, 1996). Traditional method of training is very painful with repeated beatings and punishments, this method could be modified by the

use of xylazine to pacify or restrain the much struggling elephants (Aik, 1992) but this was not observed to be practiced in any of the elephant camps under study.

The trainings observed in this study also supported the facts that it is essential the elephants are trained for routine husbandry practices and routine check up for skin, feet and teeth which needed constant attention as reported by Adler (1996).

5.3.6 Feeding of young elephants

The animals in group I were fed only with milk initially but gradually it replaced with grass. Approximately 5 to 10 kg green grass was provided to young elephants intermittently for a day over and above their daily milk and concentrate ration. 10 liters of milk provided initially, later on as age advances the quantity of milk reduced to 5 liters with a steady increment in green fodder. Milk feeding usually continued until 2 years of age. Lack of authentic literature regarding milk feeding of young elephants entails a further detailed research on the feed requirements of infant elephants.

Animals in group II and group III were mainly fed on palm leaves. The standard practice is to supply fodder at the rate of 5 per cent of the body weight as observed by Cheeran (1999). The animals of group II and group III were fed with one or two palm leaves at a time and provided fresh palm leaves when the already offered was eaten. Group II and group III elephants consumed roughages approximately 100-150 kg and 200-250 kg respectively. In Government facilities, the wastage is found to be negligible as they feed elephants one palm leaf after another when they have completely eaten the previous one. The mahouts visit the place of tethering frequently at half an hour interval. In the case of private elephants, the wastage of feed is more because they were fed three or four palm leaves at a time. Both in Government facilities and private ownership animals were fed few additional palm leaves to sustain the night. This study has not dealt with digestion trials of young elephants, the wastage and feed fed to animal and the nutrient requirement was calculated based on the works of Ananthasubramaniam (1979).

All the animals were fed concentrate feed based on wheat / rice, ragi and horse gram in addition to the green fodder mentioned above. Based on this study it was concluded that most of the elephants were fed well above their nutritional requirement suggested by Ananthasubramaniam (1979). This may be one good reason for early occurrence of musth in some of male elephants of both the Government camps and private ownership which is supported by Rasmussen *et al.* (1984) who reported an earlier starting, more intense and larger musth period in captive Asian bulls than in the wild, owing to the better health care, nutrition and less activity.

5.3.7 Housing of young elephants

The majority of elephants of Kerala lack proper housing facilities. This is evident from the fact that most of them were tethered under tree shades and on mud floor (Cheeran, 1999). It can be seen that 17.6 per cent of the surveyed elephants enjoyed the comfort of a permanent roof and that these elephants belonged to Government elephant facilities. All the private elephants and a few Government elephants were provided only temporary roof under shades of a tree with mud floor. The study revealed that most of the mahouts were very particular about the cleanliness of the housing premises and they provided bedding with litter materials prepared from wasted palm leaf and fronds. The bedding is found to be a protection for animals, particularly for foot problems. It was also used by the animals as a comfort material for sleeping at night.

Animals under private ownership were provided with mud floor and the hygiene and cleanliness is not at par with that of Government camps. This could predisposed to foot problems which were commonly reported in private elephants. The study revealed that most of the animals in group II and group III were picketed, and showed stereotypic behaviour which may be due to the lack of space to move around and to show their species typical behaviour (Schmid, 1995).

Naturalistic surrounding or providing place to move around could greatly improve the attitude of elephants and there by reduce any behavioural anomalies. The animals in group II and group III were kept idle and tethered for majority of times,

almost 80 percent of days in a year. This is in accordance with Markowitz *et al.* (1975), who reported that boredom predisposes to behaviour anomalies. However, further studies are required to ascertain whether permanent shelters are needed to house domesticated elephants at least during rainy season in Kerala.

5.3.8 Health assessment of young elephants

Health assessment of young elephants was done by body condition index and it was found that majority of the animals kept in both Government and private elephant facilities were in very good condition except three young elephants. Most of the animals in group I, II and III scored more than 11 points Table.1.

Body condition score has direct correlation to the health of the animal, plane of nutrition and management facilities provided by the elephant camps. The method used visual assessment to score six different regions of the body and it validates the physiologic measure of body fat which is directly related to the plane of nutrition and management. The Biometric measures used were also indicative of good health and plane of nutrition.

Young elephants both in Government and private facilities were periodically dewormed and did not suffer from grave parasitic problems. Even then parasitic conditions were reported in elephants in captivity (Laws *et al.*, 1975). It is found out from the study that none of the young elephants were vaccinated against any diseases prevalent in that locality, but precautions should be taken against anthrax and tuberculosis reported recently in captive elephant population in Kerala. Some animals do suffer occasionally from gastro intestinal disorders which are more related to food related problems than parasitic diseases. The incidences of impaction, a grave condition common in adult elephants was found to be reported in two of private owned young elephants and not in Government camps this might be because of the type of feeding. In government camps there is provision for the animals to be sent for grazing in the forest where as private elephants mainly depend on palm leaves alone. Regular health monitoring and reporting in Government camps was found to be very useful, but with private camps these practices were not followed.

Table 22. Body condition score and evaluation

	Animals	Total points	Remarks
Group I 0-2 years	New calf	4	Emaciated
	Parvathy	15	Good
Group II 2-6 years	Eco	13	Good
	Asha	12	Good
	Kalpana	10	Average
	Eva	15	Good
	Minna	14	Good
	Ammu	14	Good
Group III 6-15 years	Lakshminarayanan*	12	Good
	Surendran	10	Average
	Adithyan*	14	Good
	Neelakandan	13	Good
	Parthan*	15	Good
	Meena	14	Good
	Gopu*	13	Good
	Rajeev*	14	Good
	Manikandan*	13	Good

(*) Private elephants

5.3.9 Behaviour and temperament of animals

A strong relation between management and behaviour was observed during the present study. Most of the picketed/tethered elephants showed stereotypic behaviour and comfort behaviour. The animals which were kept loose at night and the animals kept in side pens or kraal did not shown any such behavioural anomalies this is agreement with studies done by (Schmid, 1995) who observed that elephants kept in electric pens showed reduced incidence of stereotypic behaviour; this offers elephants an increased opportunity to satisfy their behavioural needs as elephants are mostly nomadic in the wild and travels up to 20 to 40 kilometers a day in search of food.

Weaving was found to be a necessary replacement for walking to help pump blood out of the feet of the animal.

Animals aged above 10 years of age did not show any behavioural anomalies and appeared alert to the environment. It was also revealed from this study that animals which are engaged in works or specialised training were showed less or no behavioural anomalies.

5.3.10 Record keeping in elephant facilities

From the study it was revealed that record keeping was practiced only in the Government facilities and no private owners were found to be keeping any records except movement register. So, Kerala captive elephant rule should be strictly enforced to make record keeping a practice for strict verification and ratification.

Summary

SUMMARY

The objectives of the present study were to observe, record and assess the existing management, feeding and training practices along with the health status of young elephants with a view to identify the problems and prospects of the scientific management and to suggest suitable recommendations in the management of captive young elephants of Kerala. The experiment was designed to study and record the prevalent management practices carried out for young elephants in Kerala.

Data was collected using a detailed questionnaire incorporating the details regarding the knowledge, experience of the elephant owners and mahouts, general management details and major constraints in elephant rearing. The data were collected from the owners and mahouts at their house holds, offices, restrooms and the site where animal was tethered by personal interviews during March to August 2006. The observations made were on routine, housing, feeding, diseases and health management, behaviour and temperament and record keeping.

From the results of the study, it was evident that 63 per cent of elephant owners belong to middle age group, 37 per cent old age and none on young age. 69 per cent of the first mahouts and 58 per cent of second mahouts belonged to middle age group where as 31 per cent and 42 per cent of first and second mahouts belonged to old age group respectively. 38 per cent of the first mahouts and 34 percent of second mahouts alone received training regarding elephant management. One half of the owners were richly experienced in elephant management. 63 per cent of first mahouts and 82 per cent of second mahouts were having high experiences in elephant keeping. Majority of the owners (62%) and mahouts (83%) selected elephant rearing as hereditary business and job. Only 25% of first mahouts and 50% of second mahouts survived with out any injury where as none of the mahouts were severely injured.

The young animals were divided in to three groups based on their age as 0 to 2yrs (group I), 2 to 6yrs (group II) and 6 to 15yrs (group III). Feeding and watering for group I and II animals were done more frequently than third group. Most of the young

elephants were kept idle through out the day with less or no work. On an average group first and group second animals were bathed every day and those of third 5.5 times a week, so also the average time taken for each bath of group first and second is less when compared to third. Young milk fed animals needed only wetting of their skin.

Frequency of wetting was more in summer and the average frequency of wetting was higher in first and third group. Frequency of watering also was highest in summer season with the second group animals were given water more frequently from ground water tanks. Group three animals were taken to nearby streams for watering and wetting.

The age at which major training starts is at 6yrs of age. Full course of training for commands takes 6months to 1year. All the animals above 6 years of age were trained for common verbal leg commands for light works.

Proximate analysis of the common feed given (Palm leaves) was done so also of concentrate feed. Young elephants were fed with rice, wheat, ragi, milk, mineral mixtures and salt and milk was specially fed to group I animals. The results indicated that the young elephants were fed above their daily requirement.

Most of the elephants were tethered or picketed under trees on elevated bedding to avoid foot problems. Boredom was found to be as major factor for behavioural anomalies. The major ailments in elephants of Kerala were diarrhoea, especially in milk fed orphan calves followed by impaction in adults. Most elephant facilities were practicing regular deworming and health precautions. None of the animals were vaccinated against any diseases. Group II and group III animals showed behaviour as in the study. Those showing behavioural anomalies were mainly of group II which were picketed or tethered. The organized elephant care facilities alone kept records.

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ANNEXURE I

SURVEY OF CAPTIVE YOUNG ELEPHANTS IN KERALA

Place :
District :
Taluk :
Village/institution :

Ownership details

If Govt : In forests / In zoo / Others:
If Pvt : Temple elephant / Other pvt. Management
Owners name :
House No :
Name of Street :
Elephant name :
Ownership certificate : yes/ no/ applied for

Elephant facts

Age :
Sex :
If male : Tusker/ Makhna
Height :
Weight :

Source : wild caught / Captive born / Purchased / Others

Origin :
Assam / Arunachal Pradesh / Kerala / TN / Andaman / Bihar / U.P / Others

Purpose of keeping the elephant (nature of work): As Kumki / for patrolling / for carrying tourists / Temple / for begging / Attend functions / for exhibit / Unemployed / Timber hauling / others

Husbandry / Management

Nutrition

Does the animal have opportunity to graze Y / N?

If yes, where : Forest / Field / Waste land /

If no, where does fodder come from : Purchased / from forest / Fields / Others

Who brings fodder? Elephant itself / Supplier / Farm tractor / Bullock cart / Workers / Others

What does the green fodder comprise off?

1. Browse (dicots) : Ficus leaves / Palm / Others

2. Graze : Napier grass / Green grass / Hay / Others

Do you feed concentrates Y / N.? If yes then what: Horse gram / Ragi / Rice / Wheat

How many times a day is the animal fed with concentrate? Once / Twice/ Thrice

Any other special diet? Y / N. If yes, what is the special diet?

Additives if any Y / N. If yes then specify what is given:
 Given during any special period? : Every now and then / During pregnancy / During work /
 Others.....

Water for drinking

Is a perennial source of water available? Y / N. If yes then what? Pond / Lake / River / Stream /
 Well / Tap / Others
 How many times a day does the elephant have the chance to drink: Once / Twice / Thrice

Water for bathing

Is a perennial source of water available Y / N.
 If yes then what: Pond / Lake / River / Stream / Well / Tap / Others
 Number of baths a day:
 In summer : Once / Twice / Thrice
 In winter : Once / Twice / Alternate days
 Duration of bath..... Hrs. per bath.
 Is the animal groomed while bathing? Y / N
 If yes, then with what?: Brick / Light stone / Coconut husk / dry grass / Others.....

Housing

Does the animal have a shelter : Y / N?
 If yes then at what time : Only day / Only night / Both
 Area of the shelter : -----*----- feet
 Ceiling height of the shelter : ----- feet.
 Flooring : Sand / Soil / Cement / Others
 Building material : Brick and Cement / Wood / Thatch / Steel
 Roof : Tin / Cement or Concrete / Thatch / Asbestos /Others

Restraint: Methods and Devices

Tethering material : Chains / Ropes / Both
 Type of hobbles: With spikes / with out spikes / both
 No. of working hrs. /day: In season: Off season:.....
 Timing of work : From To

Socialization

How is the animal tethered : Alone / Groups of / > 1
 If in groups, no. of animals : Two / Three / Four / more
 Distance between each animal when tied: Can touch & feel / only see / Far away
 If alone, how often does it interact with other elephants? Every day / alternate days / once a week /
 once a month / once a year / never

Temperament

What is the animal's nature like? Calm / Friendly / Unpredictable / Nervous / Aggressive / Scared

Responds to command : Obedient / Disobedient
 Has the animal killed or injured anyone? Yes / No
 If yes, was it during or outside musth?
 Does the animal exhibit any stereotypic behaviour? Yes / No
 If yes, then what : Head bobbing / weaving / trunk swinging / others

Musth

Has the animal ever come into musth? Yes/No

Health Evaluation:

Mucous membrane : Pink / Pale
 Body Condition : Obese / Good Fair / Poor
 Foot : Toe nail cracks: Present / Absent
 If present : Horizontal / Vertical
 Over grown toe nails : Present / Absent
 Vision : Normal / Affected
 If blind : Unilateral / Bilateral
 Corneal opacity : Present / Absent
 If cataract present : Unilateral / Bilateral

Wounds : Present / absent
 If present type : Lacerated / Abscess
 How old : Recent / Old / Healing
 Location :

Swelling : Present / Absent
 If present type : Inflammation / Tumor / Oedema
 Location : Neck / Belly / Brisket / Other

Skin Condition: Normal / Abnormal

Describe if any

Abnormalities.....

Veterinary care

Do you consult veterinarians for treatment? Yes / No
 If 'Yes' how many times a year do you call: Always available / Once a week / Once a month / On demand
 Has the animal been treated for any minor/major health problem? Yes / No
 If yes, then for what disease/condition:
 Has the animal ever been vaccinated? Yes / No
 If yes, with what
 Is the animal dewormed? Yes / No
 What is the frequency of deworming: once in 3 months / once in 6 months / once in a year / rarely
 If yes, with what:

Information on Mahout

Any asst. mahout? Yes / No

Age of the first mahout

First mahout: Overall experience with elephants:..... Years

First mahout: How long with this elephant? If in moths:

If in years:

How many mahouts have handled this elephant so far? in Years

Mahout-elephant relationship

How many hrs. does the mahout spend with elephant in a day: 24 / 16 / 10 / 6 / <6

Is the elephant beaten? Yes / No

If yes, what provokes beating: misbehavior / disobedience / other

What is the elephant's response to the beating: Scared / Reacts / Obeys / Others

Do you love being with your elephant? Yes / No

If no, then why?

Given the chance would you do another job? Yes / No

If yes, why? :

.....

Signature: -----

Date: -----

APPENDIX I

ASIAN ELEPHANT BODY CONDITION INDEX

Sl. No:	BODY PART	GRADING FACTORS	SCORE
1	Head: Temporal Depression.	Full and convex when viewed from behind, frontal ridge vaguely outlined at best.	2
		Slight to moderately concave, frontal ridge defined.	1
		Deeply concave, frontal ridge forms a crater like rim around the temporal depression.	0
		Total Score:	3
2	Scapula	Spinous process not visible, or slightly visible when the legs are in certain positions.	2
		Spinous process visible as a vertical ridge with a concavity between the ridge and the posterior edge of the scapula.	1
		Spinous process pronounced and the blade line with armorial process pronounced as a knot.	0
		Total Score:	3
3	Thoracic Region	Ribs not visible, barrel smooth.	2
		Some ribs visible, but the extent and demarcation not pronounced.	1
		Many ribs strongly demarcated with pronounced intercostals depressions.	0
		Total Score	3
4	Flank Area	No depression visible, flank bulges outward in front of the pelvis.	1
		Depression visible as a sunken area immediately in front of the pelvis.	0
		Total Score:	1
5	Lumbar Vertebrae	Not visible, lower back smooth and rounded.	2
		Visible as ridges; skin slopes away from the top of the ridge; height of the vertebrae not exceed width.	0
		Total Score:	3
6	Pelvic bone and Rump	Not visible (or slightly visible); rump region between ilium and caudal vertebrae filled with tissue and not forming a depressed zone.	2
		Visible but not pronounced; the rump is slightly depressed and the zone between ilium and caudal vertebrae.	1
		Visible as a jutting bone; rump is a pronounced sunken zone between the ilium and the caudal vertebrae.	0
		Total Score:	3

7	Axillary Fat	Skin contains a thick hand full of fat, can be easily seized.	2
		Skin contains some fat.	1
		Skin thin, little tissue palpable underneath.	0
		Total Score:	3
8	Brisket Fat	Sternum well padded with muscle and fat, bone neither visible nor palpable.	2
		Sternum not visible but palpable.	1
		Sternum both visible and palpable.	0
		Total Score:	3
9	Tail	Fat and muscular, not bony feeling.	1
		Thin and bony feels stringy and individual joints palpable.	0
		Total Score:	1

Total number of points: 23

Body Condition Score:

0-5 – Emaciated

6-10 – Average

11+ -- Fat or very good condition

APPENDIX II

Commands used for training young elephants (2 -6 yrs of age group)

- 1) Face away to accept feed
- 2) Moving backward
- 3) Moving forward
- 4) Turn left
- 5) Turn right
- 6) Animal to sit down
- 7) Animal to lay down
- 8) Moving fore limb
- 9) Moving hind limb
- 10) Stand still with all fore limbs on the ground

Commands used for training young elephants (6 – 15 yrs of age)

- 1) Face away to accept feed
- 2) Moving backward
- 3) Moving forward
- 4) Turn left
- 5) Turn right
- 6) Animal to sit down
- 7) Animal to lay down
- 8) Moving fore limb
- 9) Moving hind limb
- 10) Stand still with all fore limbs on the ground
- 11) Move left front foot
- 12) Move right front foot
- 13) Move left rear foot
- 14) Move right rear foot
- 15) Keep both fore limbs in line
- 16) Keep both hind limbs in line
- 17) Move trunk up
- 18) Move trunk down
- 19) Trunk up and mouth wide open
- 20) Remain stationary on command
- 21) Come towards the trainer on command
- 22) Retrieve objects (commands to carry to palm leaves)
- 23) Leg commands mainly for logging works and festival processions
- 24) Bath commands
 - a) Lay down on right side
 - b) Lay down on left side
 - c) Dog sitting posture

- d) Standing on fore limbs and hind limbs knee
 - e) Stand left forelimbs forward and left hind legs backward and right fore limbs backward and right hind limb forward
 - f) Stand left fore limb backward and left hind limb forward and right forelimb forward and right hind limb backward
 - g) Take water in trunk and splash it on body
 - a) From above
 - b) From below
 - c) From right side
 - d) From left side
- 25) Move side ways to right side
- 26) Move side ways to left side
- 27) Commands for performances

MANAGEMENT OF CAPTIVE YOUNG ELEPHANTS IN KERALA

ACTY GEORGE

**Abstract of the thesis submitted in partial fulfillment of the
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ABSTRACT

The present study was undertaken to suggest suitable recommendations in the management of captive young elephants of Kerala after assessing the existing management, feeding and training practices through survey method. The credibility of information collected was cross checked with physical verification.

Data was collected from the owners' house holds and offices and sites where animal was tethered by personal interviews during March to August 2006. The observations made were on routine, housing feeding, diseases and health management, behaviour and temperament and record keeping.

From the study, it was evident that majority of the elephant owners, first and second mahouts belonged to middle age groups. Even though none of the owners received training, half of the owners were richly experienced in elephant management. Majority of the owners and mahouts selected elephant rearing as hereditary business or job. Injury was a major constraint in case of mahouts.

The young animals were divided in to three groups based on their age as 0- 2yrs (Group I), 2-6yrs (Group II) and 6-15yrs (Group III). Group II and III received more watering, wetting and bathing. Frequency of wetting and watering was highest in summer season. Actual training starts at 6 years of age and train the elephants for various purposes. It was evident that young elephants are fed above the nutritional requirements and kept idle for most of the time in the year. Boredom was found to be a factor for behavioural anomalies. Major ailments in young ones was diarrhoea were as impaction in adults. There was record keeping only in organized elephant care facilities.

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