DOI: 10.2305/NFQV1302
Research Article
Gajah 57 (2024) 13-19

Feeding Programme in Captive Working Elephants of Myanmar

Khyne U Mar

Freelance Researcher, Sheffield, UK
Author's e-mail: emaximus2014@gmail.com

Abstract. Nutrition is important for a variety of reasons. Animals need the proper nutrition for growth, maintenance, reproduction and for providing energy. For animals used for draught purposes, their nutritional requirements are higher than those of non-working animals. Extensively kept elephants seem to thrive well on the jungle forages, tree fodders, shrubs, herbs and other natural vegetation. However, the nutritional value of forages in natural habitat is closely associated with the preservation of forest, climatic variation and season of the year. This manuscript will focus on the feeding programmes practiced in extensively kept captive working Asian elephants of Myanmar.

Introduction

Myanmar is home to the second largest total population of Asian elephants (*Elephas maximus*) remaining worldwide (after India), with a captive population of approximately 5,500 – the largest in the world today – where half is state-owned and the other half is privately-owned. Most of the elephants in captivity are employed by the State-run timber enterprise, Myanma Timber Enterprise (MTE) as logging elephants. These elephants are characterised as semi-captive because they are released at nights for foraging in forests with their family groups unsupervised, where they can feed on a broad spectrum of naturally found forage and are traditionally not provisioned nor aided in mating or calving. The MTE elephants work 5–8 h/day and 5 days/week. They have 10–12 h of foraging time at nights during working months (mid-June to mid-February). Elephants are given access to round the clock foraging in the non-working periods (mid-February to mid-June) which coincides with summer where daytime temperatures can reach 45°C.

Feeding habits of Myanmar elephants

A study of free-ranging Asian elephants in southern India documented that 112 plant species were edible (Sukumar 1990). Based on interviews of mahouts and veterinarians working at the Phokyar Elephant Camp operated by MTE in the northern Bago Yoma mountain range, MTE elephants consumed 103 plant species (Campos-Arceiz *et al*. 2008). Another study conducted in an MTE elephant camp in Okkan Reserved Forest of Myanmar documented that 124 plant species were eaten by elephants and feeding activity was significantly different between male and female elephants. Males foraged a wider area and more frequently while females consumed a more diverse diet (Himmelsbach *et al*. 2006). In Myanmar, captive elephants are traditionally released in a nearby forest at night to forage. Studies have shown that the daily mobility of MTE elephants for foraging did not differ greatly from the reported travel distance of wild Asian elephants (Minn *et al*. 2022). Obesity- and sedentary-related foot pad and musculo-skeletal pathologies as seen in zoo elephants (Miller *et al*. 2016; Wendler *et al*. 2019) are not common in MTE elephants because their diet is natural, and they have an energy-demanding long-distance mobility for daily foraging activities at nights. During the night, elephants are released with front legs loosely hobbled to prevent them from going astray.

While free foraging provides a greater selection of food choices, females with suckling calves and elderly (50+ years old) elephants that are not as mobile as their younger counterparts may not reach the best quality forage and may experience inadequate energy intake. Myanmar ele-

© 2024 The Author – Open Access
Manuscript Editor: Christian Schiffmann

phant managers are fully aware that the practice of hobbling restricts movement but also makes it time and energy demanding for the animal to reach the good quality habitat. For these reasons, supplementary diet is arranged, especially in the summer when there is low quality forage around the forests.

Elephant feeding management

The standing order of MTE on the elephant feeding management and care are as follows:

1. There is no supplementary feeding or hand feeding to healthy elephants. However, MTE allows supplementary feeding of paddy (rice before threshing/polishing and with husk) or cooked rice mixed with corn or pulses to elephants with the following conditions:

- sick elephants
- pregnant females
- females with young calves (<1 year)
- elephants with occupational injuries and mobility problems
- elephants separated from other elephants
- newly captured elephants
- elephants under taming training
- elephants working in logging sites that are close to agriculture land or in difficult terrain

2. Elephants must be offered a balanced diet composed of a variety of food items provided in quantities that are sufficient for each elephant to maintain appropriate body condition. The body condition of working elephants is visually assessed by officials and veterinarians on weekly health checks. Elephants' fodders should consist of grasses, bamboo, creepers/vines and leaves from ficus trees, wild palm tree stems, young banana stems/leaves and various fruits/vegetables.

3. Tree barks and vines (climbers) are the elephants' favourite food especially in summers. Vines/climbers from a large deciduous climber tree *Tinospora cordifolis*, (sin done ma nwae in Myanmar), is the most preferred food choice by elephants. It is used for various diseases in the traditional ayurvedic medicine and is believed to boost the immune system of the animals. It also aids digestion in elephants.

4. In the rainy and cold season, various grass species and bamboo shoots are the major food for elephants. In summer, young grass and fresh bamboo become scarce, so elephants mainly feed on barks, twigs, vines, fruits, creepers and bamboo clumps. By law, MTE elephants are given an official rest period starting from 15. February until the monsoon arrives (mid-June). During this period elephants are taken to summer rest camps where they can find wild banana, wild coconut (*Cocos* spp.), wild palm (*Livistona* spp.), jackfruit, mango etc. and bark, stems and leaves from trees like teak (*Tectona grandis*), and under-story trees like *Mitragyna diversifolia* (Bin ga), *Bombax malabarica* (Lat pan), *Albizia procera* (Thit Phyu), *Albizia Lucida* (Than that) etc. According to veterinary records of MTE elephants, the elephants are prone to constipation in summer months which is believed to be due to indigestible fibrous contents of forages. Tamarind and salt are the traditionally used herbal laxative to prevent constipation and to soften the hard stool. Elephants should be given access to water for drinking and for grooming 24/7.

5. The departmental instruction has stated that the staff should find new foraging areas during the summer rest period if the foraging grounds are scarce of good quality forage. However, old elephants (>50 years) and those with mobility problems should not be forced to move to a new location to avoid exhaustion. Old elephants with worn teeth should stay in the area where succulent food can be found. They need to consume 200–250 kg of forage and 125–150 litres of water every day. Mahouts of these old and sick elephants must stay in the same location. Elephants that are prone to constipate should be given cooked rice or thick porridge mixed with groundnut cake, jaggery or coconut powder. The same amount of extra food should be given to sick, pregnant females and females with suckling calves and those elephants with mobility problems. The extra food is given in evenings before they are released at nights for free foraging. All staffs are instructed to guide elephants to good quality foraging ground.

6. If the weather changes or if elephants are transported/moved to new campsites, the fodders they can access during night foraging may

be less than usual foraging. Mahouts must bring cut fodders to meet their requirements. Elephants should not work at the new locations until the animals know the new terrain and foraging grounds. It is advised to give a minimum of 2 months rest. Elephants must have good digestion and normal bowel movement before they start working.

Care of newborn elephants

Healthy calves can stand on their own and walk within hours after birth. On average, newborn calves stand about 1 m high and weigh around 70 kg at birth. When calves nurse, they are using their mouths, not their trunks. A healthy calf can find the mother's teat on its own.

Calves with a shoulder height less than 1 m (or weighing less than 70 kg) are not able to reach the mothers' teat and they need replacement neonatal milk starting from day 1 of age. It is utmost important to help these undersized calves to get colostrum immediately after birth. Colostrum is high in calories, but more importantly, contains immunoglobulins which aid in the prevention of disease in the first few weeks of life while the calf's own immune system is developing. Staff must collect as much colostrum as possible manually from the mother and feed it to the newborn by bottle. Colostrum should be given when the calf is less than 12 h old if possible. Normally mothers cease to produce colostrum after 24 h and it is painful to collect colostrum manually from mothers after 12 h. Mothers' plasma can be given orally as a replacement of colostrum. Whole blood from the mother elephant should be collected beginning at least eight weeks prior to the birth and plasma separated and stored.

The mother and calf should be monitored closely by staff especially during the first couple of weeks. Monitoring should continue for a number of weeks if the female is inexperienced, or if the female demonstrates aggression towards her own or other calves or staff. Elephant calves are solely dependent on receiving nourishment from their mother's milk for the first months. Camp managers need to choose the correct replacement formula for orphaned calves born to mothers that died during postnatal periods and those with low milk supply. A few MTE females do not have teats as the result of injury caused by improperly designed breastband or rubbing with ropes during taming at younger age. These females cannot nurse their young.

Limited data exist concerning the milk composition of captive Myanmar elephants and none to date from wild elephants. The only study of Myanmar elephant milk stated that milk samples from MTE female elephants showed 5.23% protein, 15.10% fat, 0.87% ash, and 0.18 μg/ml vitamin E (Dierenfeld *et al*. 2020). Total protein in milk was higher during the wet season compared to other seasons because the crude protein content of forage was also higher in the wet season. Protein composition was higher in milk of mothers with female calves compared to male calves. Milk from mothers nursing calves aged 1.5–3 years was high in fat, but milk solids and protein percentages increased when calves grew older. More studies need to be conducted to understand the variation associated with seasonality, geographic location, vegetation/diets to milk quality and quantity. Quantification of dietary adequacy, as well as nutritional status of both females and elephant calves, through assessment of diet ingredients and milk composition are still in its infancy.

Nutrition programme for calves (<5 years)

Calves born to mothers without teats, mothers with a low milk supply, or mothers that died during or soon after parturition should start bottle feeding as soon as possible after birth or the loss of the mother. During the first four months of age, newly born calves of MTE elephants are given human infant replacement formula. Milk replacement formulae from equid and exotic animals are not available in Myanmar.

Additional water or fresh fruits are provided to lactating mothers in hot temperatures. Dehydration can be serious, so it is important to make sure the lactating females are taking in extra fluid when it's hot. The water consumption of mothers and calves can be judged by the appearance of dullness or dryness of skin and decreased urine output.

Simple test for dehydration used in calves:

- Gently pinch the skin on shoulder blade or loin or brisket of calf with two fingers so that it makes a “tent” shape.
- Let the skin go.
- Calf is normal if the skin springs back to its normal position in 1–3 seconds.
- If the skin is slow to return to normal, the calf might be dehydrated.

Replacement milk formula for newborns

A common brand of neonatal replacement milk formula in Myanmar is Dumex Dupro by Dumex which is a human infants' and children's nutrition company. Its products are growing-up milk and follow-on milk. Dumex product is one of the Danone Group, company of Danone Dumex, headquartered in France (https://www.dumex.com.sg/products). Dumex Dupro Step 1 formula is used for calves under 6 months old and Dumex Dupro Step 2 formula is used for calves over 6 months.

This is a human infant replacement formula and is widely used in elephant calves. The formula is diluted strictly following the manufacturer’s instructions. MTE departmental instructions suggest giving replacement formula every 2–3 h until 4–6 months of age. Starting from a month old, newborn calves drink about 7–10 litres of replacement milk formula a day depending on weather (higher consumption in hot months) and growth rate (higher consumption in males with higher growth rate than females). Plastic nursing bottles and nipples are used for bottle feeding in calves (Fig. 1). It is important to clean the bottle thoroughly after use. Mahouts should be instructed to use boiled water to prepare the milk.

When the calf is old enough to use its trunk to manoeuvre skilfully, staff introduces soft and easily digestible fruits (banana, jackfruit, pineapple) to supplement the nutritional needs of calves, if mothers cannot produce enough milk. This practice is believed to help develop the browsing behaviour of calves and to train the calf’s digestive system to get used to non-dietary products. Rice water is also used instead of boiled water to prepare replacement milk when the calf starts eating soft shelled fruits. Rice water is the starchy water obtained by draining boiled rice. To make rice water, rice is cooked in a pot of boiling water according to the cooking instructions on the package or the same way Myanmar people traditionally cook the rice. When boiled, the starch from the rice is released into the water, creating the milky thick starchy rice water. Essential vitamins like vitamin B6, thiamine, niacin and riboflavin are abundantly present in rice water. Experienced mahouts in Myanmar also believe that diluting milk powder with rice water instead of boiled water can make the calf feel having a full stomach and provide much needed energy to the elephant calf. The downside of rice water is that it can be spoiled by fermentation within 24 h. Because it's a completely natural product, rice water doesn't have a long shelf life. When the replacement milk prepared with rice water has been used, the remaining portion should be refrigerated or kept in a cold place, and it should be used within 24 h. Because of the thick starchy nature of rice water-mixed milk formula, Myanmar mahouts trained the calves to suckle the milk formula via flexible wide-bored plastic tube (Fig. 2).



Figure 1. Feeding bottles.

Once the calves show no signs of digestion-related problems (tympany etc.) to the rice water-mixed milk formula, a soft ball of well-cooked rice (Fig. 3) is the start to introduce the calf (normally about 8 months old) to solid food. Such a rice ball is given a couple of times a day in between the bottle feedings. Weaning from milk gradually follows this process. To ease the expense of milk formula, bottle feeding is normally stopped when the calf is about one year old. Calves should not be completely weaned until they are over two years of age and must show that they can digest the foodstuff they have chosen, know the terrain, and can forage on their own. The calf should be nutritionally independent from its mother. The calf should find its nutritional needs from solid food



Figure 2. Calf trained to suckle the milk formula via tube.

(cooked rice is preferable), fruits, and grasses, with nursing only occasionally and primarily for comfort.

Parasite-associated mortality is regarded as one of the most common causes among young MTE elephants aged under 5 years (Mar *et al*. 2012; Lynsdale *et al*. 2017). Inadequate nutrition intake during the summer period (where the habitat had less nutritious forage) might play a role in the parasite-related mortality patterns observed (Mar *et al*. 2012). Departmental standing orders prescribe that Myanmar vets should deworm elephants before the summer in order to prevent mortality due to malnutrition-mediated parasitic infestation.

Nutrition programme for lactating mothers and adults (17–55 years)

Elephants are given supplements if the habitat does not bear fresh lustrous forage especially during the summer (February to June). The rate of grazing decreases as the grasses mature, become less palatable and dry up. The rate of browsing also decreases in the hot season when



Figure 3. Calf (age 8+ months) is trained to take cooked rice balls.

trees are losing their leaves. Therefore, the elephants have to spend more time searching for leaves on the trees than in the other two seasons and would thus have a lower rate of feeding. The lower quality and quantity of food eaten in the hot season may be reflected by a loss of body condition, which is an indication of malnutrition.

Lactating mothers and females that have given birth to more than two calves are given additional food even if they are in a good foraging ground. A suggested supplementary diet for an individual is cooked rice (3 kg) and half-boiled or water-soaked pulses especially chickpeas (*Cicer arietinum*) (≈2 kg) given once or twice daily. Sugar cane molasses can be added to improve the taste of the supplement and it is believed that it has some positive effects on digestion and energy. It is advised not to add sweetness when not necessary.

Nutrition programme for retired (>55 years) elephants

Elephants that eat natural fodder are healthier than those eating prepared food or pellets. If an elephant needs hand feeding, the staff has to find 400 kg of fodder per animal on a daily basis. The fodder given to elephants should be of young age and lush in nature. Fodders are cut into small portions to avoid indigestion or to prevent constipation.

In Asian elephants, the sixth molar – the largest and last molar – begins to wear when the elephant is about 50 years old. By the time the elephants reach retirement at age 55, many old elephants lose the ability to chew and digest food. Therefore, one of the leading causes of death in old elephants is chronic malnutrition.

Nutritionists suggested to give mineral salt blocks that are used for equines and livestock animals to working elephants as the salt blocks can improve appetite, muscle flexibility, healthy nerve impulses, balanced blood pH, water balance (hydration) and help alleviate nutritional deficiencies.

In Myanmar, each retired elephant is managed by one mahout who monitors and provides the care they need until they die. Elephants with problem teeth are taken to a good habitat area and allowed to forage ab libitum 24/7. Their health is checked daily, especially in the morning when the elephants are bathed by their mahouts.

If stool from old elephants contains undigested forage, supplementation with cooked rice (2–4 kg) and half-boiled or water-soaked pulses especially chickpeas (Cicer arietinum) or groundnut cake or flour (≈2 kg) should be fed in 2–4 divided portions daily. Vitamin premix used in livestock and molasses or jaggery can be added according to manufacturer's instruction. Young banana stem should be given in short pieces to avoid constipation.

Conclusion

Extensively kept logging elephants thrive well on the jungle forages, tree fodders, shrubs, herbs and other natural vegetation. The excessive use of natural resources by human causes shrinking of suitable elephant habitat and leads to competition between free-ranging wild elephants and captive logging elephants that share food sources in the same habitat. The availability of habitat is also compromised if grazing areas are also visited by domestic ruminants from nearby villages.

For animals used for draught purposes, inadequate nutrition is one of the major factors that affects their general health and draught power because their energy requirements are higher than those of non-working animals (Lawrence 1990; Pearson & Dijkman 1994). For example, the extra energy intake in draft cattle increases up to 1.8 times maintenance levels, and in horses up to 2.4 times (Pearson & Dijkman 1994). The nutritional implications of work in elephants are less completely understood than those for equines, camels, cattle and buffaloes. No research so far was done to measure energy expenditure and draught power of elephants to quantify their needs to the same extent as those of other livestock or hoof stock species.

Agricultural by-products, crop residues and low-quality roughage are normally regarded as elephant feed and are mostly given to captive

elephants with no or limited access to natural foraging. However, in this manuscript, attempts are made to document how Myanmar logging elephants are managed in semi-extensive living environment in order to maintain the vitality of elephants under our care.

References

Campos-Arceiz A, Lin TZ, Htun W, Takatsuki S & Leimgruber P (2008) Working with mahouts to explore the diet of work elephants in Myanmar (Burma). *Ecological Research* **23:** 1057-1064.

Dierenfeld ES, Han YAM, Mar KU, Aung A, Soe AT, Lummaa V & Lahdenperä M (2020) Milk composition of Asian elephants (*Elephas maximus*) in a natural environment in Myanmar during late lactation. *Animals* **10:** e725.

Himmelsbach W, Gonzalez Tagle MA, Fueldner K, Hoefle HH & Htun W (2006) Food plants of captive elephants in the Okkan Reserved Forest, Myanmar (Burma), Southeast Asia. *Ecotropica* **12:** 15-26.

Lawrence PR (1990) Nutrition and fuel utilization in the athletic horse. *Veterinary Clinics of North America: Equine Practice* **6:** 393-418.

Lynsdale CL, Mumby HS, Hayward AD, Mar KU & Lummaa V (2017) Parasite-associated mortality in a long-lived mammal: Variation with host age, sex, and reproduction. *Ecology and Evolution* **7:** 10904-10915.

Mar K, Lahdenpera M & Lummaa V (2012) Causes and correlates of calf mortality in captive Asian elephants. *PLoS One* **7:** e32335.

Miller MA, Hogan JN & Meehan CL (2016) Housing and demographic risk factors impacting foot and musculoskeletal health in African elephants (*Loxodonta africana*) and Asian elephants (*Elephas maximus*) in North American zoos. *PLoS One* **11:** e0155223.

Minn ST, Ota T & Mizoue N (2022) Movements of semi-captive elephants during skidding season in Myanmar. *Journal of Forest Planning* **29:** 11-15.

Pearson RA & Dijkman JT (1994) Nutritional implications of work in draught animals. *Proceedings of the Nutrition Society* **53:** 169-179.

Sukumar R (1990) Ecology of the Asian elephant in southern India. II. Feeding habits and crop raiding patterns. *Journal of Tropical Ecology* **6:** 33-53.

Wendler P, Ertl N, Flügger M, Sós E, Schiffmann C, Clauss M & Hatt J-M (2019) Foot health of Asian elephants (*Elephas maximus*) in European zoos. *Journal of Zoo and Wildlife Medicine* **50:** 513-527.

