**Abstract**

The study was carried out in the Bangabandhu Safari Park, Dulahazra, Cox’s Bazar for 1 month from 25 December 2013 to 23 January 2014 to estimate the anthelmintic efficacy against gastrointestinal parasites and antibiotic sensitivity of gastrointestinal microbes in Asian elephants. Four fecal samples of elephants were collected. Fecal examination indicated the presence of Strongyles eggs and larvae. The male had a higher eggs burden while larvae were higher in female. Below 30 years of age group elephants had higher amount of eggs and larvae than above 30 years of age group before anthelmintic treatment. Eggs and larvae per gram of faeces were considerably decreased after 14 day of treatment with Nitroxynil. Besides, gastrointestinal bacteria (*Salmonella* spp., *Shigella* spp., *Campylobacter* spp. and *E. coli)* were also determined by culture in selective media from fecal samples. And antimicrobial sensitivity tests were also performed. A total of 9 antimicrobials were tested among which Gentamycin (100%), Ciprofloxacin (75%) ampicillin (25%) and cefradoxin (25%) were found strongly sensitive. Considering the semi-captive condition of wild elephant, more controlled drug trial with a control group is suggested for further study.

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| **Key words:** Anthelmintic efficacy, Antimicrobial sensitivity, Fecal examination , drug trial, Eggs, Larvae, Semi-captive |

**CHAPTER - I**

**Introduction**

Human population is increasing day by day in the world. Due to growth of over population and tremendous growth of agricultural production, the habitats of the wild animals are decreasing. Therefore, everywhere of the world the wild animals are facing threats to be endangered. Moreover, they are infected with different types of diseases due to change of habitats. Since, these types of animals are more important for ecological balance and maintenance of environment, conservation of endangered animals are very much important globally. Otherwise, ecological balance will be hampered. For conservation of these animal animals, health status monitoring programs are also important.Among different animals of the world various types of elephants are found in the globe.Asiatic elephant is one of them.In Bangladesh almost 250-300 elephants are found (Sukumar 2006).Mostly in the Chittagong hill tracts and north east district of Bangladesh.Moreover, people are also use these elephants for various purposes such as drought purpose and circus.Indeed, Bangladesh government have taken initiatives to conserve these endangered species. Animal parasites are organisms that live in (internal or endoparasites) or on (external or ectoparasites) a host-animal. Internal parasites are of particular importance in the case of free ranging and semi-captive Asian elephants (*Elephas maximus*) as management actions that confined elephants to restricted areas such as parks may favour the buildup of internal parasite infections through contaminated feeding grounds and nutritional stresses. Helminthes and protozoa are the two main kinds of internal parasites. Helminths can be divided into three categories; nematodes (roundworms), cestodes (tapeworms) and trematodes (flukes). Nematodes’ life cycle is very simple and they are easily detectable in faecal matter, hence are the most commonly assessed helminthes with regard to animal health. Within the phylum Nematoda, members of the super family Strongyloidea (strongyles) have been observed in wild African and Asian elephants. This superfamily comprises the genera *Choniangium*, *Decrusia*, and *Equinurbia* as large strongyles and *Khalilia*, *Murshidia*, and *Quilonia* as small strongyles (Condy 1973; Gupta 1974; Chandrashekaran 1992; Fowler 2006). Adult nematodes live in the gastrointestinal tract of the host and produce eggs, which are expelled from the host with the faeces. Gastro-intestinal parasitic infection is responsible for most economic and production losses in livestock worldwide (Coop and Holmes 1996; Waller 2006). As eradication of parasites is not practical, the aim of control measures in livestock is to limit parasite populations to levels that are compatible with economic production (Brunsdon and Adam 1975). Nematode diseases vary in severity from asymptomatic infection to rapidly fatal exsanguinations (Bowman & Georgi 2006). These parasites can affect host survival and reproduction directly through pathological effects and indirectly by reducing host condition (Coop and Holmes 1996). The general effects of gastrointestinal nematode infection are partial or complete loss of appetite; interference with the production of digestive juices; damage to the lining of the alimentary tract so that materials such as proteins leak into the gut from the blood stream; diarrhoea which leads to dehydration; and possibly interference with digestion and the absorption of digested nutrients (Fox 2000). On the other hand, gastroenteritis is mostly caused by different agents including *E. coli, Salmonella, Shigella and Campylobacter*(McCambridge and T. A. McMeekin 1981)*.* Although the number of researches have been performed on the parasitic and microbial gastroenteritis of livestock and wild animal, but rarely any attempt was made to conduct study on the efficacy of anthelmintics and sensitivity of the antibiotics that can effectively make clinical recovery. Considering the above constraints, the present study was therefore undertaken on the elephants of safari park, with the following objectives.

**1.1: Objectives of the study:**

* To know the management practices of semi-captive elephant of Safari park.
* To assess the gastrointestinal parasites and response to anthelmintic treatment.
* To identify the gastrointestinal microbes (*E. coli*, *Salmonella* spp., *Shigella* spp., *Camphylobacter* spp.) and their antimicrobial sensitivity.

**CHAPTER – II**

**Review of Literatures**

**2.1: History of Asian Elephant:**

The Asian or Asiatic elephant (*Elephas maximus*) is the only living species of the genus *[Elephas](http://en.wikipedia.org/wiki/Elephas%22%20%5Co%20%22Elephas)*  and is distributed in [Southeast Asia](http://en.wikipedia.org/wiki/Southeast_Asia) from [India](http://en.wikipedia.org/wiki/India) in the west to [Borneo](http://en.wikipedia.org/wiki/Borneo) in the east. Three subspecies are recognized — *[Elephas maximus maximus](http://en.wikipedia.org/wiki/Elephas_maximus_maximus%22%20%5Co%20%22Elephas%20maximus%20maximus)* from [Sri Lanka](http://en.wikipedia.org/wiki/Sri_Lanka), the [Indian elephant or *E. m. indicus*](http://en.wikipedia.org/wiki/Indian_elephant) from mainland Asia, and [*E. m. sumatranus*](http://en.wikipedia.org/wiki/Sumatran_Elephant) from the island of [Sumatra](http://en.wikipedia.org/wiki/Sumatra). Asian elephants are the largest living land animals in [Asia](http://en.wikipedia.org/wiki/Asia). Since 1986,  *E. maximus* has been listed as [endangered](http://en.wikipedia.org/wiki/Endangered_species) by [IUCN](http://en.wikipedia.org/wiki/IUCN) as the population has declined by at least 50% over the last three generations, estimated to be 60–75 years. The species is primarily threatened by habitat loss, degradation and fragmentation. In 2003, the wild population was estimated at between 41,410 and 52,345 individuals. Female captive elephants have lived beyond 60 years when kept in seminatural situations, such as forest camps. In zoos, elephants die at a much younger age and are declining due to a low birth and high death rate. The genus *Elephas* originated in [Sub-Saharan Africa](http://en.wikipedia.org/wiki/Sub-Saharan_Africa) during the [Pliocene](http://en.wikipedia.org/wiki/Pliocene) ranging throughout Africa into southern Asia. The earliest indications of [domestication](http://en.wikipedia.org/wiki/Domestication) of Asian elephants are engravings on seals of the [Indus Valley civilization](http://en.wikipedia.org/wiki/Indus_Valley_civilization) dated as third millennium [BC](http://en.wikipedia.org/wiki/Anno_Domini).

**2.2: Taxonomy :**

**Kingdom:** Animalia
    **Phylum:**Chordata
        **Class:** Mammalia
             **Order:** Proboscidea
                    **Family:** Elephantidae
                       **Subtribe**:Elephantina
                           **Genus:** Elephas
                                  **Species:** Elephas maximus (Asian elephant)

**2.3: Population and Distribution :** Since the Asian elephant live in dense forest and jungles, it is much more difficult to estimate the present individual population number, although official population numbers follow a minimum and maximum estimation, and a suggested average.

|  |
| --- |
|  **Wild population** |
|  **Country** | **Min** | **Max** | **Average** |
| [Bangladesh](http://www.elephant.se/country.php?name=Bangladesh) | 300 | 350 | 325 |
| [Bhutan](http://www.elephant.se/country.php?name=Bhutan) | 60 | 150 | 105 |
| [Cambodia](http://www.elephant.se/country.php?name=Cambodia) | 250 | 600 | 425 |
| [China](http://www.elephant.se/country.php?name=China) | 178 | 193 | 186 |
| [India](http://www.elephant.se/country.php?name=India) | 26000 | 28000 | 27000 |
| [Indonesia](http://www.elephant.se/country.php?name=Indonesia) | 2400 | 2800 | 2600 |
| [Laos](http://www.elephant.se/country.php?name=Laos) | 600 | 800 | 700 |
| [Malaysia](http://www.elephant.se/country.php?name=Malaysia) | 2423 | 5347 | 3885 |
| [Myanmar](http://www.elephant.se/country.php?name=Myanmar) | 1181 | 2056 | 1619 |
| [Nepal](http://www.elephant.se/country.php?name=Nepal) | 109 | 142 | 126 |
| [Sri Lanka](http://www.elephant.se/country.php?name=Sri%20Lanka) | 5879 | 5879 | 5879 |
| [Thailand](http://www.elephant.se/country.php?name=Thailand) | NA | 1000 | 1000 |
| [Vietnam](http://www.elephant.se/country.php?name=Vietnam) | 83 | 110 | 97 |
| **Total** | 39463 | 47427 | 43947 |
| **Captive population** |
| Asia | ´ ± 20 000 **(Sukumar 2006)**  |  |

**Table-1:** Population of Asian Elephants

**Source:** [Gajah nr 35, 2012. *(Journal of the IUCN/SSC Asian Elephant Specialist Group)*](http://www.asesg.org/gajah35.htm)

**2.4: Management practices of Asian Elephants:**

**2.4.1: Feeding:** Elephants consume mainly banana trees. Besides of banana trees, grasses, small plants, bushes, fruit, twigs, tree bark, and roots also consume. Mature elephants feed continuously for a considerable length of time. In captivity the main cut fodder in India is palm leaves and coconut leaves. Working animals are fed with concentrates consisting of grains, millets and pulses. Common salt should also be added. Elephant’s capacity to digest food is poor and only 40 per cent is digested and the rest (60%) is passed out as faeces (Choudhury 1999). The standard practice is to supply fodder at the rate of 5per cent of the body weight. So a cow elephant will need 150-175 kg of fodder and a bull will need 200-275 kg of fodder. The growing calves and pregnant and lactating cows may take more food. The concentrate can be powdered and cooked depending upon the nature of the concentrate. This will help in better digestion and assimilation of the food given. Horse gram, ragi, rice, salt (100 gm) and jaggery are the common ingredients of the concentrate. Ordinarily 12-15 kg of the concentrate are fed every day. On rest days concentrate ration is reduced. It has been found from practice in Kerala that if enough greens are available no concentrate is needed unless the animal is put to heavy work like timber hauling.

**2.4.2: Watering:** Elephants trunk works as a drinking-straw, with the help of this, they suck up about 10 liters of water into their trunk, and blows the water into the mouth. In the nature elephants go to water wholes or lakes in the early morning and in evening at dusk, often combined with bathing. Adult elephants drink about 70 to 200 litres/day, depending on the temperature. An extreme higher intake may indicate that something is wrong, and therefore it is important to know what is "normal" for every animal. An individual span up to some 200 litre is acceptable (McKay 2006), above that is not ok and should be researched. Elephants suffering from TBC might have an intake upto 600 litre a day.

**2.4.3: Habitat and Ecology:** Asian elephants are generalists and they occur in grassland, tropical evergreen forest, semi-evergreen forest, moist deciduous forest, dry deciduous forested and dry thorn forest, in addition to cultivated and secondary forests and scrublands. The Asian elephant is one of the last few mega-herbivores (i.e. plant-eating mammals that reach an adult body weight in excess of 1,000 kg) still extant on earth . Given their physiology and energy requirements, elephants need to consume large quantities of food per day. They are generalists and browse and graze on a variety of plants. The proportions of the different plant types in their diet vary depending upon the habitat and season. During dry season in southern India(Sukumar 1989) observed that 70% of the elephant's diet was browse, while in wet season, grasses make up about 55%. However, in an adjoining area, observed that browse formed only 15% of the diet in dry deciduous forest and 47% of the diet in the thorn forest in the dry season, while the annual diet was dominated by grass (84%). In Sri Lanka, elephants may feed on more than 60 species of plants belonging to 30 families. In southern India, (Choudhury 1999 )recorded that elephants fed on 82 species of plants (59 woody plant species and 23 grass species). Elephants may spend up to 14–19 hrs a day feeding, during which they may consume up to 150 kg of wet weight. They defecate about 16–18 times a day, producing about 100 kg of dung. Dung also helps disperse germinating seeds. Elephants range over large areas and home ranges in excess of 600 km² have been recorded for females in south India. In north India, female home ranges of 184–326 km² and male home ranges of 188–407 km² have been recorded (Williams, 2002). Smaller home range sizes, 30–160 km² for females and 53–345 km² for males, have been recorded in Sri Lanka**.** Given their requirements for large areas, elephants are regarded as an “umbrella species” because their conservation will also protect a large number of other species occupying the same area. The life span of Asian elephants is 60 to 70 years, and males reach sexual maturity at between 10–15 years of age; females usually first give birth in years 15 or 16(Shoshani and Eisenberg 1982).

**2.5: Common Endoparasites are found in Elephants:**

Nematodes are mainly Murshidia, Quilonia, Amira, Decrusia, Equinurbia, Choniangium, Bathmostomum, Grammocephalus and Parabronema and trematode flukes are represented by species of Fasciola and Pseudodiscus and cestode tapeworms by Anoplocephala (Fowler and Mikota 2006).

**2.6: Common infectious diseases of Elephants:**

***2.6.1: Viral Infections:*** [Elephant pox](http://www.elephant.se/elephant_smallpox.php?open=Elephant%20diseases) is one of the most dangerous diseases for elephants, it is lethal, and was until vaccination programmes, responsible for the death of many elephants (Infectious to humans) (Gehring and Mayer, 1978). [FMD - Foot and mouth disease](http://www.elephant.se/foot_and_mouth_disease.php?open=Elephant%20diseases); [Herpes virus](http://www.elephant.se/elephant_herpes_virus.php?open=Elephant%20diseases) (probably not infectious to humans); [Encephalomyalitis virus (viral EMC)](http://www.elephant.se/elephant_encephalomyocarditis_virus.php) (infectious to humans); Coryzalike syndrome (probably not infectious to humans); [Rabies](http://www.elephant.se/rabies.php?open=Elephant%20diseases) (infectious to humans).

## *2.6.2: Bacterial Infections:* [Anthrax](http://www.elephant.se/elephant_anthrax.php?open=Elephant%20diseases)  (infectious to humans); [Salmonellosis](http://www.elephant.se/elephant_salmonella.php?open=Elephant%20diseases) (infectious to humans); [TB - Mycobacterium tuberculosis complex/M. bovis/M africanum/M microti (infectious to humans)](http://www.elephant.se/mycobacterium_tuberculosis.php) (Nowak 1983); [Tetanus](http://www.elephant.se/elephant_tetanus.php) (infectious to humans); Enterotoxemia(Clostridium, dangerous in immune-compromised individuals); *E. coli* (has caused death in humans, commonly seen in infected hamburger); Pasteurellosis (probably not infectious to humans).

**2.7: Anthelmintics, Antibiotics and Vaccines are used:** Mainly Fenbendazole, Levamisol, Piperazine citrate, Nitroxynil against gastrointestinal parasites and Ivermectin used for ectoparasites. On the other hand, gastrointestinal bacterial diseases are usually treated with Ciprofloxacin, Gentamycin, Cotrimoxazole, Tetracyclin and Amphicillin ( Delshad 1985). Anthrax live vaccine, Inactivated Rabies virus vaccine and Tetanus vaccine usually given in elephant([Michele A](http://avmajournals.avma.org/action/doSearch?action=runSearch&type=advanced&result=true&prevSearch=%2Bauthorsfield%3A(Miller%2C+Michele+A.)) and  [Francisco  OP](http://avmajournals.avma.org/action/doSearch?action=runSearch&type=advanced&result=true&prevSearch=%2Bauthorsfield%3A(Olea%5C-Popelka%2C+Francisco)) 2009).

**CHAPTER – III**

**Materials and methods**

A cross sectional study was conducted on semi-captive elephants of Bangabandhu Safari Park, Dulahazra, Cox’s Bazar for a period of 30 days, 25, December 2013 to 23, January 2014. For this study official approval was taken prior to study from Divisional Forest officer, Department of Forestry, Chittagong.

**3.1: Data collection:** Demographic (age, sex, type), body condition, nutritional status and management (feeding and housing) information on individual elephant were gathered following a structured questionnaire.

**3.2: Collection of faecal samples:** A total of four elephants were brought under study. 200-300 gm of fresh fecal samples was collected from each elephant after defecationand kept in separate zipper bags and carried out through ice box from Safari park to CVASU laboratory.

**3.3: Preservation of fecal samples:** Fecal samples were preserved in two different procedures. Each sample for parasitological tests was preserved with 2 ml of 10% formalin for 2 days and the samples for microbiological test were preserved without formalin in refrigerator at 4 ºC for 2 days.

**3.4: Parasitological tests:**

For examination of larvae and eggs, we have used “Berman technique”. Four funnels of Berman apparatus were taken. 1 gm of the feces from different sites of each sample was collected due to different placement of larvae and eggs in a fecal boli. Then collected 1 gm feces transferred to a 10 x 10 cm piece of double-layered cheesecloth and the edges of the cloth gathered and tied forming a bag. A short piece of rubber tube was attached to the end of the glass funnels and the free end closed with a clamp. The funnels were placed on a rack. The tied cloth bag with the sample was suspended in the funnel by attaching to two applicator sticks resting on top of the funnel or to a wire strung above. The funnel was filled with lukewarm water to cover the cloth bag and allowed to sit overnight for 24 hours. Then the cloth bag was removed and the liquid in the top of the funnel was siphoned off without disturbing the sediment at the bottom. From the homogenized sediment, 0.5 ml was transferred to a 1 mm Sedgewick Rafter Counting Cell Slide (50 mm long x 20 mm wide and 1 mm deep) using a pipette and bulb, and examined under the compound microscope, using the 10X objective. L3 nematode larvae were identified based on their characteristic morphological appearance as a ‘tube within a tube’ referring to the alimentary canal which extends from the mouth on the anterior end, to the anus located near the tail. The chamber was scanned methodically and all larvae were counted. The process was repeated till the entire sediment quantity was examined.

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**Fig:** Sediment of fecal sample

***2.5: Microbiological tests:***

**Fig:** Microscopic examination of feacal samples

Rest of the samples which were preserved in refrigerator transferred into microbiology laboratory to identify the bacteria usually present in feces of the Asiatic elephants and antibiotic sensitivity by CS test.

**3.5: Microbiological tests:**

***3.5.1: Culture of bacteria:***

***3.5.1.1:*** ***Culture in Selenite broth:*** The fecal swab of the each sample was inoculated in each of test tube of Selenite broth. Then these samples were incubated at 37º C for 48 hours.

***3.5.1.2:*** ***Culture on Agar:*** Then the inoculums were streaked on the MacConkey agar, Sabouraud Dextrose Agar (SDA), EMB agar, Preston agar and Salmonella-Shigella (SS) Agar by a sterile inoculating loop. Then the agar plates were kept in incubation at 37 ºC for 24 hours for formation of colony.

***3.5.2: Isolation and Identification of bacteria:***

In MacConkey and Sabouraud Dextrose Agar (SDA) several types of bacteria were found. The colony were taken by sterile inoculation loop and streaked on selective media. EMB agar is the selective media for *E. coli* , *Salmonella-Shigella* (SS) agar is the selective media for *Salmonella* and *Shigella* and Preston agar is the selective media for *Campylobacter* . Then bacteria were isolated based on their colony growth on selective media.

***3.5.3: Cultural Sensitivity (CS) Test:***

***3.5.3.1:* *Materials Required:***

Patri dish, Inoculating loop, Conical flasks, Incubator, Laminer air flow, Selenite broth, Agar powders, antibiotic discs.

**Table-2:** Used Antibiotic discs

|  |  |  |
| --- | --- | --- |
| SXT-Cotrimoxazole  | CN- Gentamycin  | AMP-Ampicillin |
| C-Chloramphenicol  | DO-Doxycyclin  | CFR-Cefradoxin |
| P-Penicillin  | CIP-Ciprofloxacin  | TE-Tetracyclin |

**Table-3:** Zones of inhibition for various antibiotics

|  |  |  |
| --- | --- | --- |
| **Antibiotic disc** | **Disk potency** | **Inhibition zone diameter (mm)** |
| **Strongly sensitive** | **Moderately sensitive** | **Resistant** |
| Gentamycin | 10 µg | ≥ 18 | 13-14 | ≤ 12 |
| Doxycyclin | 30 µg | ≥ 16 | 13-15 | ≤ 12 |
| Cotrimoxazole | 25 µg | ≥ 17 | 13-16 | ≤ 12 |
| Penicillin | 10 IU | ≥ 15 | 13-14 | ≤ 12 |
| Chloramphenicol | 30 µg | ≥ 18 | 13-17 | ≤ 12 |
| Ampicillin | 10 µg | ≥ 14 | 12-13 | ≤ 11 |
| Cefradoxin  | 30 µg | ≥ 20 | 17-19 | ≤ 16 |
| Tetracyclin  | 30 µg | ≥ 19 | 15-18 | ≤ 14 |
| Ciprofloxacin | 5 µg | ≥ 21 | 16-20 | ≤ 15 |

***3.5.3.2:* *Methods:***

1. Bacteria were inoculated on agar plate from selenite broth.
2. Then antibiotic disks were placed on agar 1 inch apart from one another.
3. Then incubated at 37 ºC for 24 hours.
4. Then observed the zone of inhibition.

 ** **

**Fig:** Cultural Sensitivity (CS) test

**Fig:** Growth of bacterial colony on different types of agar

**3.6: Drug selection and trial:** Nitroxynil (Nitronex® , Reneta Drugs Limited ) @ 10mg/kg body weight was administered subcutaneously.

**3.7: Evaluation of clinical success:** To evaluate treatment success, feces from each elephant, administered with anthelmintics was recollected and examined following the same techniques as described after 14 days of treatment.

**3.8: Statistical analysis:** Data were entered into the MS excel-2007 and exported to STATA-11.0 for descriptive statistical analysis.**CHAPTER - IV**

**Results and Discussion**

**4.1: Management practices of Elephants of safari park:**

Elephants eat about 149 to 169 kg (330-375 lb.) of vegetation daily. Ration for each elephant are- Green grass-50kg**;** banana tree-200kg **;**Boiled rice-04kg**;** Wheat bran- 04kg **;** Jiggery - 250gm**;** Salt-50gm

Theydrink about 80 to 150 liter water/day, depending on the temperature of the day.The elephants are usually keep in free range condition as semi-captive state. But during rainy season these are usually keep under a shed. No disease were recorded except non descriptive diarrhea.Moreover the authority give Anthrax live vaccine and provide anthelmintic in every four to six months. Commonly used anthelmintics are Ivermectin, Nitroxynil, Triclabendazole and Levamisol.

**4.2: Parasitological tests results:**

**Table-4**: Number of eggs and larvae of Strongyles in feces of elephants before anthelmintic treatment

|  |  |  |
| --- | --- | --- |
| **Variables** | **Eggs** | **Larvae** |
| Mean ± SD | Min – Max | Mean ± SD | Min – Max |
| **Sex** | Male (n=3) | 18.20 ± 2.80 | 15.40–21.00 | 17.86 ± 1.30 | 16.60 –19.20 |
| Female (n=1) | 16.00 ± 0 | 16.00–16.00 | 18.80 ± 0 | 18.80–18.80 |
| **Age** | <30 years (n=2) | 18.50 ± 3.53 | 16.00–2 1.00 | 18.30 ± 0.70 | 17.80–18.80 |
| >30 years (n=2) | 16.80 ± 1.97 | 15.40 –18.20 | 17.90 ± 1.83 | 16.60–19.20 |

Table-4 shows the average number of eggs and larvae/gm of feces according to sex and age before anthelmintic treatment. Average 18.20 eggs/gm of feces was found in male elephants while minimum and maximum number was 15.40 and 21 respectively. On the other hand, 16 eggs/gm of feces was found in single female elephant. Similarly, average 17.86 larvae/gm of feces was found in male elephants while minimum and maximum number were 16.60 and 19.20 respectively. On the other hand, 18.80 larvae/gm of feces was found in single female elephant. Average 18.50 eggs/gm of feces was found in <30 years old elephants while minimum and maximum number were 16 and 21 respectively. On the other hand, average 16 .80 eggs/gm of feces was found in >30 years old elephants while minimum and maximum number were 15.40 and 18.20, respectively. Thus, 17.30 larvae/gm of feces was found in <30 years old elephants while minimum and maximum number were 17.80 and 18.80 respectively. On the contrary, average 17.90 larvae/gm of feces was found in >30 years old elephants while minimum and maximum number were 16.60 and 19.20 respectively.

***4.2.2: After anthelmintic treatment***

 **Table-5:** Number of eggs and larvae of Strongyles in feces of elephants after anthelmintic treatment

|  |  |  |
| --- | --- | --- |
| **Variables** | **Eggs** | **Larvae** |
| Mean ± SD | Min – Max | Mean ± SD | Min – Max |
| **Sex** | Male(n=3) | 8.93 ± 1.60 | 7.40–10.60 | 6.00 ± 0.52 | 5.40–6.20 |
| Female(n=1) | 7.00 ± 0 | 7.00–7.00 | 7.60 ± 0 | 7.6–7.6 |
| **Age** | <30 years(n=2) | 8.80 ± 2.54 | 7.00–10.60 | 6.50 ± 1.55 | 5.40–7.60 |
| >30 years(n=2) | 8.10 ± 0.98  | 7.40–8.80 | 6.30 ± 0.14 | 6.20–6.40  |

The table-5 depicts the average number of eggs and larvae/gm of feces according to sex and age after anthelmintic treatment. Average 8.93 eggs/gm of feces was found in male elephants while minimum and maximum number was 7.40 and 10.60, respectively. On the contrary, 7 eggs/gm of feces was found in female elephant. Thus, average 6 larvae/gm of feces was found in male elephants while minimum and maximum number was 5.40 and 6.20 respectively. On the other hand, 7.60 larvae/gm of feces was found in single female elephant. Average 8.80 eggs/gm of feces was found in <30 years old elephants while minimum and maximum number were 7 and 10.60 respectively. On the contrary, average 8.10 eggs/gm of feces was found in >30 years old elephants while minimum and maximum number were 7.40 and 8.80 respectively. Thus, 6.50 larvae/gm of feces was found in <30 years old elephants while minimum and maximum number were 5.40 and 7.60 respectively. On the other hand, average 6.30 larvae/gm of feces was found in >30 years old elephants while minimum and maximum number were 6.20 and 6.40 respectively.

The findings of above discussion it that, The male had a higher eggs burden while larvae is higher in female and the age group of < 30 had higher amount of eggs and larvae than >30 age group before anthelmintic treatment. The number of eggs and larvae were decreased after anthelmintic treatment in all age groups and sex. So, it is clear that, nitroxynil favorably decrease the gastrointestinal parasites in semi-captive elephants of safari park within 14th days of treatment.

**4.3: Microbiological tests Results:**

**Table-6:** Sensitivity of gastrointestinal Bacteria to different antibiotics

|  |  |  |  |
| --- | --- | --- | --- |
| **Bacteria** | **Strongly sensitive** | **Moderately sensitive** | **Resistance** |
| *E. coli* | GentamycinCiprofloxacin | TetracyclinCotrimoxazoleChloramphenicolAmphicillinCefradoxin | PenicillinDoxycyclin |
| *Salmonella* spp. | CiprofloxacinGentamycin | TetracyclinCotrimoxazoleCefradoxinAmphicillin | PenicillinDoxycyclinChloramphenicol |
| *Shigella* spp. | GentamycinCiprofloxacin | AmphicillinTetracyclinCefradoxinCotrimoxazole | ChloramphenicolPenicillinDoxycyclin |
| *Campylobacter* spp. | GentamycinAmphicillinCefradoxin | TetracyclinCiprofloxacinChloramphenicol | DoxycyclinPenicillinCotrimoxazole |

**Table-7:** Percentages of antibiotic sensitivity in different samples

|  |  |  |  |
| --- | --- | --- | --- |
| **Antibiotics** | **Strongly sensitivity %** | **Moderately sensitivity %** | **Resistance %** |
| Gentamycin(10µg) | 100 | 0 | 0 |
| Doxycyclin(30µg) | 0 | 0 | 100 |
| Cotrimoxazole(25µg) | 0 | 75 | 25 |
| Penicillin(10 IU) | 0 | 0 | 100 |
| Chloramphenicol(30µg) | 0 | 50 | 50 |
| Ampicillin(10µg) | 25 | 75 | 0 |
| Cefradoxin (30µg) | 25 | 75 | 0 |
| Tetracyclin (30µg) | 0 | 100 | 0 |
| Ciprofloxacin(5µg) | 75 | 25 | 0 |

The table-6 shows that, Gentamycin is strongly sensitive to all identified fecal bacteria (*E. coli, Salmonella spp., Shigella spp. and Campylobacter spp.*). Table-7 shows Gentamycin 100%, Ciprofloxacin 75%, Amphicillin 25% and Cefradoxin 25% strongly sensitive. Tetracyclin 100%, Cotrimoxazole, Ampicillin, Cefradoxin are 75%, Chloramphenicol 50% and Ciprofloxacin 25% moderately sensitive. Rest of the tested antibiotics was resistant.

In Bangladesh, forest is decreasing and the number of wild animal also reducing trend. To conserve these types of wild animals, numerous attempts usually taken by the government and non government organizations.Bangabandhu safari park, Dulahazra, Cox’s Bazar is one of the park where various types of wild animals are kept in semi-captive condition.Among these land dwelling animal-elephant is one of them.The management practices of elephants in this park is found similar to the safaris of the world (Barnes 1999). On parasitological examination revealed the Strongyles which are commonly found in other livestock ruminant (D. Van Aken ‎2000) The number of Strongyles eggs were higher in male as compare to female.That might be due to male animals move in wide range of area for vegetation (Barnes 1999).

Similar types of study also reported by Aiello SE and Mays A (1998).The highest number of eggs was found above 30 years of age elephants which is the similar to findings of early study.The number of eggs was reduced after anthelmintic treatment with nitroxynil.But not eliminate completely.That could be due to low dose of anthelmintic treatment and short duration of evaluation after treatment with nitroxynil.

Gastrointestinal bacteria also cultured from feces in selective media, from which we found four different types of bacteria. Similar types of gastrointestinal bacteria also reported by Craig SA (2009). Antimicrobial sensitivity test revealed that, gentamycin showed 100% sensitivity to all bacteria which is coincided with the findings of Craig SA (2009).

**CHAPTER - V**

**Conclusion**

In this study we found that eggs and larvae of Strongyles (*Choniangium* spp, *Decrusia* spp, and *Equinurbia* spp,*Khalilia* spp, *Murshidia* spp, and *Quilonia* spp) in fecal samples of elephant which are considerably response to the nitroxynil treatment.We also determined that gentamicin shows 100% sensitivity to the gastrointestinal bacteria ( *E. coli*, *Salmonella* spp. , *Shigella* spp., *Camphylobacter* spp) in cultural sensitivity test.

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