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Parasites of primates and their zoonotic importance

Mahendra Maharjan[1,2]

1. *Central Department of Zoology, T.U, Kirtipur, Kathmandu*
2. *National Zoonoses & Food Hygiene Research Centre, Kathmandu*

Abstract

Wild animals particularly non human primates are the potential sources of bacterial, viral and parasitic zoonoses. Primates share parasites, *Entamoeba sp., Giardia sp., Ascaris sp., Strongyloides sp.*, etc morphologically similar to human beings, although most of these parasites need to verify genetically. Some of the viral diseases have already been proved to be transmissible from non human primate to human like HIV, herpesvirus B, SV40, Polyomavirus and various simian retroviruses etc. Bacterial diseases like *Mycobacterium tuberculosis, M. leprae, Shigella* sp., *E coli*, *Salmonella* sp. etc are human diseases transmissible to non human primates. In order to break the transmission cycle of existing and upcoming dreadful diseases in human beings, regular surveillance, prevention and control strategy urgently needs to be formulated applying the one health concept.

Background

Parasites play a major role in ecosystems (Esch and Fernandez 1993), host population growth and regulation (Hochachka and Dhondt 2000, Hudson et al. 1998), and community biodiversity (Hudson et al. 2002). Several studies have been carried out regarding the parasites of wild or captive and New World or Old World non-human primates (Gracenea et al. 2002, Hope et al. 2004, Karere and Munene 2002, Phillippi and Clarke 1992). Both helminth and protozoan parasites are common in non-human primates (Munene et al. 1998, Muriuki et al. 1998). Some of the parasites are considered to be nonpathogenic (Toft and Eberhard 1998). However, a large number can result in physiologic disturbances, nutritional loss, or may produce lesions that result in serious debilitation, and can create opportunistic for secondary infections that may be fatal (Toft and Eberhard 1998).

Global scenario of parasitic infection in primates

Protozoan parasites:

Wongsawad (2009) documented *Entamoeba coli, Entamoeba histolytica, Balantidium coli, Isospora* sp. and *Eimeria* sp. from Assamese Macaque (*Macaca assamensis*) of Thailand. While, Varadharajan and Pythal (1999) reported *B. coli* and Coccidial parasites in free living Feral Bonnet Macaque (*Macaca radiata*). Three species of gastro-intestinal parasites: *E. coli, E. histolytica* and *B. coli* had been reported from wild De Brazza's Monkeys (*Cercopithecus neglectus*) of Kenya (Karere and Munene 2002). Gillespie et al. (2004) had added three more parasites along with *Entamoeba* sp. viz; *Iodamoeba butschlii, Giardia lamblia,* and *Chilomastix mesnili* from free-ranging individuals of four species of monkeys from western Uganda*. Troglodytella abrassarti* and *E. chattoni* were the most prevalent protozoan species in a Male Chimpanzees (*Pan troglodytes schweinfurthii*) (Muehlenbein 2005). The monkeys of Belgium (Levecke et al. 2007) and Baboons (*Papio anubis*) (Ryan et al. 2012) were found infected with similar protozoan parasites.

Helminth parasites:

Wongsawad (2009) investigated *Toxocara* sp., *Oesophagostomum* sp., *Strongyloides* sp., *Trichuris* sp. and *Capillaria* sp. from *Macaca assamensis* at Thailand. Another study carried out at Polonnaruwa, Sri- lanka showed *Streptopharagus pigmentata, Physeloptera* sp., *Enterobius vermicularis,* and *Hymenolepis* sp. to be prevalent in *Macaca sinica* and *Presbytis* sp. (Dewit et al. 1991). *Strongylid,* and *Strongyloides*, were common helminth parasites observed in *Macaca radiata* and *Macaca mulatta* (Varadharajan and Pythal 1999 and Eberhard et al. 2001). *Strongyloides sp., Trichostrongylus sp., Ascaris sp. and Hookworm were parasites of Barbados green monkey, Cercopithecus aethiops sabaeus (Mutani et al. 2003).* Hahn et al. (2003) observed *Strongyloides sp., Physeloptera* sp., *Trichuris* sp., *Streptopharagus* sp., *Enterobius* sp., and *Strongylid* sp. from free-ranging Kenyan Baboons (*Papio cynocephalus* and *P. anubis*). Gillespie et al. (2004) reported number of helminth parasites from free–ranging individuals of the four guenon species of western Uganda. The helminthes included six nematodes: *Strongyloides fulleborni, Oesophagostomum sp., Trichuris sp., Streptopharagus sp., Enterobius sp., and unidenfinied strongyle, one cestode: Bertiella sp. and one trematode: Dicrocoelliidae sp.* Furthermore, they observed that only adult females were infected with *Oesophagostomum sp., and Strongyloides fulleborni.* Another study showed *Strongyloides stercoralis,* and *Colobenterobius sp*. in Colobus monkeys of Uganda (Gillespie et al. 2005) and *Strongyloides fulleborni* was found to be highly prevalent in adult male compared to adult female Red Colobus Monkeys. Bezjian et al. (2008) reported high prevalence of nematodes from the Baboons (*Papio anubis)* in Kibale National Park, Uganda. Some parasites like *Ternidens sp., Abbreviata sp. and Molineus sp. were observed in Baboons.*

National Scenario of Parasitic Infection in primates

A few investigations have been done in gastro – intestinal parasites of non-human primates in Nepal. Most of the studies performed survey in ecological basis like ecology, behaviour, and population status of primates in different ecological zones of Nepal (Chalise 2003, Chalise 2010, Bashyal 2005, Wada 2005, Sayers and Norconk 2008, Khatiwada 2007, Regmi and Kandel 2008 and Pandey 2012). Assamese Macaque is least studied primate in Nepal. It appears that the literature regarding parasites of monkeys is very much scanty and almost wholly unsystematic. However, little information about

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Mailing address: G.P.O. Box: 1885, Kathmandu, Nepal. Phone +977-1-4270667, Fax: +977-1-4272694,
Email: ddjoshi.nzfhrc17@gmail.com, ddjoshi@healthnet.org.np, Website: www.nzfhrc.org.np

Rhesus macaques is known but not about Assamese Monkeys till now.

Limbu and Pant (2005) reported *Strongyl*es and *Paramphistome* group in Rhesus Monkey in Nilbarahi Community. Dhoubhadel (2007) documented several types of helminth parasites from Rhesus Monkey in Nepal. Some parasites like: *Dictyocaulus sp., Taenia sp., Ostertagia* sp., *Cooperia* sp*., Prosthenorchis elegans, Dicrocoelium* sp., *Oxyuris* sp. and *Chabertia* sp. were not reported previously. *Ancylostoma duodenale* and *Haemonchus contortus* were noted by Malla (2007) from similar species. Moreover, Malla (2007) highlighted that the nematodes were the most prevalent gastro-intestinal helminth parasites where as trematode was the least prevalent. Among the nematodes, prevalence of *Strongyloides fulleborni* was found to be highest and that of *Cooperia* sp. was found to be lowest. On the contrary, Dhoubhadel (2007) indicated that the trematodes were the most prevalent gastro-intestinal helminth parasites and that of acanthocephalan was the least. *Prosthenorchis elegans* was also observed in Rhesus Monkey in Nepal (Dhoubhadel 2007 and Malla 2007). *Schistosoma* sp., *Bunostomum* sp., and *Dipylidium* sp. added upon parasitic fauna on Rhesus Monkeys (Nepal 2010) were reported from the Nepal. *Strongyloides* sp., *Trichostrongylus* sp., *Toxocara* sp., *Schistosoma* sp., and *Dipylidium* sp., were found to be most prevalent. Recently, Pokhrel and Maharjan (2014) reported *Balantidium coli Entamoeba* sp., *Isospora* sp. *Ascaris* sp. *Trichuris* sp. *Strongyloides* sp. *Moniezia* sp. *Oesophagostomum* sp. Hookworm and *Physeloptera* sp. from Assamese Macaque (*Macaca assamensis*) of Shivapuri Nagarjun National Park (SNNP), Kathmandu, Nepal

Risk Factors of Intestinal Parasitic Infection

Habitat attribute is one of the risk factors of intestinal parasitic infections that positively influence patterns of parasitism in free ranging primates (Hausfater and Meade 1982) in which more humid habitat is more prone to parasitic infection than the arid one (Stuart et al. 1990, 1993). In the same way the research of Gillespie and Chapman (2005) ranked forest-fragmentation as one of the major risk factors for parasitic infection, although climate pattern of disturbance etc. also play a role for its prevalence rate (Gillespie et al. 2005b).

Intraspecific studies documented that greater the host density, higher the disease prevalence and diversity (Morand and Poulin 1998, Packer et al. 1999) Nonetheless, density of hosts remains of prime importance for studying parasite infection rates (Poulin 1998). Likewise, it has been demonstrated that the prevalence of protozoan infections increased with group size for Mangabeys (Freeland 1980). However, recent experiment had showed that habitat characteristics may be a better predictor than density in primate parasite infections (Gillespie 2004, Gillespie and Chapman 2005, Stuart et al. 1993).

Specific feeding and drinking behavior of primates also determine the parasite species richness, prevalence, and parasite intensity, for example, insectivory, folivory or omnivory. Frugivorous animals tend to feed on a wider variety of plants which potentially expose them to a wider variety of parasites and insectivores consume arthropods which are often intermediate hosts for parasites (Nunn and Altizer 2006). Conversely, dietary stress & malnutrition can affect parasitism through immunosuppressant of the host (Chapman et al. 2006).

Primate behaviours including pattern of ranging, grooming and foraging may influence parasitic infection. For example, Yellow Baboons (*Papio cynocepshalus*) appear to avoid potential infection by regularly rotating their sleeping sites (Hausfater and Meade 1982). Similarly, mangabeys (*Lophocebus albigena*) probably reduce the risk of contact with faecal contamination and consequent infection by travelling further on days of heavy rainfall and avoiding foraging in the same areas on these days (Freeland 1980). Likewise, Gilbert (1997) suggests that red howlers (*Alouatta seniculus)* reduce contact with parasites by consistently defaecating above gaps in the forest vegetation. In the same way grooming behaviour among primates is an important mechanism for removing ectoparasites (Freeland 1981 and Gilbert 1997) but there is no literature regarding grooming behaviour may alter the risk of gastrointestinal parasite infection. However, the risk of transmission of parasites with direct life cycles increases due to close contact of the individuals. Consequently, primates may unintentionally infect themselves with parasites with intermediate hosts by ingesting ectoparasites while grooming.

Zoonotic Importance of Primates diseases

Parasitic diseases are prevalent among the human and non human primates throughout the world including Nepal at varying rates. Generally, monkeys and apes often share parasites with humans. This is well illustrated by the HIV viruses, the causative agents of human AIDS, which evolved recently from related viruses of Chimpanzees (*Pan troglodytes*) and Sooty Mangabeys (*Cercocebus atys*) (Hahn et al. 2000). There are some diseases which are shared in between human and non-human primate such as, yellow fever virus, arbovirus. Monkeys are reservoir for these viruses which is most important to human health in Africa and South America (Monath 2001). Other important human virus stemming from non-human primates include herpesvirus B, SV40, Polyomavirus and various simian retroviruses (Engel et al. 2002). In case of bacterial parasites, *Mycobacterium tuberculosis* can be transmitted zoonotically both in captive and in the wild (Michel & Huchzermeyer 1998). Similarly, *Mycobacterium leprae* (Rojas- Espinosa and Lovik 2001), *Shigella* sp., *E coli*, and *Salmonella* sp. (Nozeyi et al. 2001) are also human diseases transmissible to non human primates.

Distance between human and non-human primates is decreasing day by day either due to anthropogenically disturbed habitat or by the forest fragmentation (Chapman and Peres 2001). The hunting and butchering of wild non-human primates lead to extremely close contact and will cause humans to come into contact with the body fluids of living or recently dead non-human primates (Chapman et al. 2005). As a result, interspecific disease transmission increases (Daszak et al. 2001). Henceforth, parasites pose significant conservation risks to non-human primate population. One of the best evidences is that between 1983 and 2000 Ebola virus outbreaks contributed to the reduction of ape population densities by more than 50% over a broad geographic scale (Goodall 1986). Some cases have been documented of primates in eco-tourism and research sites contracting infections with likely human origins. For example, in 1966 six chimpanzees at Gombe National park, Tanzania, died from a polio-like virus and six others were paralyzed for life (Wallis 2000). Also, in 1996, a severe skin disease was indicated in gorillas in Bwindi Impenetrable National Park (BINP), Uganda. Their skin biopsy confirmed the presence of scabies (*Scrcoptes scabiei)* (Wallis 2000).

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Mailing address: G.P.O. Box: 1885, Kathmandu, Nepal. Phone +977-1-4270667, Fax: +977-1-4272694,
Email: ddjoshi.nzfhrc17@gmail.com, ddjoshi@healthnet.org.np, Website: www.nzfhrc.org.np

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Email: ddjoshi.nzfhrc17@gmail.com, ddjoshi@healthnet.org.np, Website: www.nzfhrc.org.np

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NEWS

South Asia Health Consultation:

Ms. Minu Sharma, Program Coordinator participated on the **Regional Public Health Consultation with the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH)** on May 28-29, 2015, at IFPRI South Asia Office, Committee Room 1, NASC, Opp. Todapur, Pusa, New Delhi. This consultation was organized by the International Food Policy Research Institute, in collaboration with the Public Health Foundation of India (PHFI). The expected outcome from the consultation were identification of concrete actions aimed at developing opportunities for collaborative projects and initiatives that in particular can apply and leverage multi-inter-disciplinary expertise, knowledge, tools and resources.

DDJ Research Award:

Please kindly submit your research work report on zoonotic diseases for to consideration of DDJ Research award for the year 2015 by the end of October 2015 to NZFHRC office Chagal, G.P.O. Box 1885, Kathmandu, Nepal, Phone: 4270667, 4274928 and Fax 4272694. This award was established by DDJ Research Foundation in 2071 B.S. (2014) on the memory of Founder of this Foundation, Late, Dr. D.D. Joshi. The award includes a grant of NCRs. 25,001/- (Rs. Twenty Five Thousand and One) with certificate.

K.D.M.A. Research Award:

Please kindly submit your research work paper on allergy award for the year 2015 for the consideration by the end of September to KDMART office Chagal, G.P.O. Box 1885, Kathmandu, Nepal, Phone: 4270667, 4274928 and Fax 4272694. This award was established by Late Dr. Durga Datt Joshi in 2049 B.S. (1992) on the memory of his wife, the late Mrs. Kaushilya Devi Joshi. The award includes a grant of NCRs. 15,001/- (Rs. Fifteen Thousand and One) with certificate.

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Mailing address: G.P.O. Box: 1885, Kathmandu, Nepal. Phone +977-1-4270667, Fax: +977-1-4272694,
Email: ddjoshi.nzfhrc17@gmail.com, ddjoshi@healthnet.org.np, Website: www.nzfhrc.org.np