

**PARASITES OF ANIMALS AND MAN: A
DANCE IN THE FOREST OF LIFE AND DEATH**
92nd

Inaugural Lecture

Delivered by

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Date: Tuesday, 12 November, 2019.

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AGO-IWOYE, OGUN STATE.

PARASITES OF ANIMALS AND MAN: A DANCE IN THE FOREST OF LIFE AND DEATH

The Vice-Chancellor,
Deputy Vice-Chancellors (Academic /Administration)
Principal Officers of the University
Provosts, Deans and Heads of departments
Students, Members of the Press,
Distinguished ladies and gentlemen

Preamble

To God be the glory for all good things He has done in our lives, most especially mine. That I stand before you today is a testimony of God's faithfulness in all ramifications and blessed be His Holy name forever.

Mr. Vice-Chancellor Sir, I sincerely appreciate the privilege honor and approval to deliver the 92nd Inaugural Lecture of this University, which is the 9th in the Faculty of Basic Medical Sciences and the 3rd in the Department of Medical Microbiology and Parasitology and indeed the 1st to be delivered by a Parasitologist.

Introduction

I teach Pathology class of the medical program in University, a class that is the bridge between the basic and clinical subjects and indeed to me, the most important level of the program. This is so because the word Pathology is an amalgamation of five distinct subjects, namely Medical Microbiology, Parasitology, Hematology and Blood Transfusion, Chemical Pathology and Immunology, and Morbid Anatomy and Histopathology. Pathology is the science that deals with the causes and effects of diseases. It is the special branch of medicine that studies disease processes, viz, how they develop, what they are caused by, and the application of this knowledge to the diagnosis of the diseases, and eventual treatment.

The major causes of infectious diseases are pathogens which are structurally distinct from each other, and are either bacteria, viruses, fungi and parasite. Parasitology, which is the study of the relationship between a parasite and its host, is the focus of this lecture.

To survive, parasites need food, transport or shelter from a host, be it animal or man. To parasites, hosts are hosts irrespective of whether man or animals. Examples of parasites found in both man and animals are many. Birds also suffer from malaria (avian malaria), the causative organisms are from genus Plasmodium just like man and also Haemoproteus sp. also in birds. Hookworm infections are seen in both man and animals with similar pathological consequences. Ascaris lumbricoides, the largest roundworm in nature is found in both animals and man, both acquire this parasite the same way, via the mouth (per os). Therefore, a veterinary graduate (DVM) or animal doctor who is interested in parasite and its relationship with the host is qualified to write on parasites of animals and man. The dance undertaken by the host, man or animal, is in a forest that can lead to either of two outcomes, life or death. Mr. Vice-Chancellor Sir, parasites can kill and they do kill. Hence this topic, "Parasites of Animals and Man: a dance in the forest of life and death".

What Is Parasite?

A parasite is an organism that is dependent on another organism (host) for food, shelter and or transport. This definition presumes that the host is larger or bigger. This is usually so. An endoparasite lives within the host, e.g., intestinal worms, while an ectoparasite lives on the external surface, the skin, of the host, lice, and ticks. An obligatory parasite must be parasitic, while a facultative parasite may have a free living part of its life cycle, as well as having a parasitic existence at other times. Hosts, on which parasites depends on, also come in different shades. An intermediate host is one in which a parasite passes one or more of it's a sexual stages, usually designated first or second if more than one. A definitive host or final host is where a parasite attains sexual maturity, for example, mosquito in malaria. A reservoir host is a non-human, infected by a parasite and shows no signs or symptoms of disease, and serves as source of infection for humans and other animals. It is a host that is essential for the maintenance of the parasite in nature, when active transmission is not occurring. A paratenic host is a potential or substitute intermediate host that serves mainly for transportation. An accidental host is one that mistakenly harbors an organism that is not normally or ordinarily parasitic in the particular species.

Historically, human evolution and parasitic infections have run hand in hand. Dracunculiasis is one of the few diseases unambiguously described in the Bible (Numbers 21:6), and most parasitologists accept that the fiery serpents that struck down the Israelites around the Red Sea after the Exodus from Egypt between 1250-1200 B.C. were actually Guinea worms (Cox. 2003). Animal and Man acquire parasites by a variety of ways and methods and these are:

PER OS. EGGS and Ova of all intestinal protozoan parasites are ingested in food and water contaminated by these parasites.

SKIN PENETRATING, Filariform larvae of hookworms, and Cercariae of Schistosomes actively penetrate the skin of the host to continue the life cycle.

INNOCULATION BY ARTHROPODS: Female Anopheles mosquitoes introduce malaria parasite into man while feeding on blood. Also flies of Culex and Glossina sp transmit Filaria and trypanosomes into man and animals respectively. River blindness, caused by Onchocerca Volvulus, a filarial nematode, is transmitted by a Dipterous fly, similium damnosum.

INGESTION OF INTERMEDIATE HOSTS: Man and animals can acquire cestode parasites of Taenia solium and or Taenia Saginata whenever raw or insufficiently cooked pork or beef products are consumed. In addition, Man can acquire Dracunculiasis when he drinks water containing infected Cyclops.

SEXUAL TRANSMISSION: Trichomonas vaginalis, a protozoan parasite, is the most important in this category

Classification/Types of Parasites

Parasites can be broadly divided into three 3 large groups (phyla); Protozoa, Helminthes and Arthropoda.

The first group which is labeled protozoans are unicellular or single celled organisms and are present in the blood, intestine and other tissues of animal or human hosts. Important Protozoa Parasites includes Plasmodium sp, Babesia sp, Trypanosome sp Theileria sp, Entamoeba sp etc. All Protozoans are microscopic. The Helminthes group consists of worms, and are subdivided into three, Round worms (Nematoda); flat, segmented worms (cestodea) and flat unsegmented worms (Trematode). The Arthropod group consists of

insects, ticks and mites. Only the order Diptera in the class Insecta have wings, and are thus referred to as True Flies. The important insects are those that transmit viral, mycotic, bacteria and parasitic organisms to their human and animal hosts, and they are generally referred to as Vectors. Notable Vectors are Anopheles mosquito for malaria, and Aedes sp for Yellow Fever simulium species (River blindness or Onchocerciasis); Glossina species (Trypanosomiasis). Other orders in this class are - Mallophaga (biting Lice), Siphunculata (sucking Lice), Siphonaptera (fleas) are all wingless. Morphologically, Lice are dorsoventrally flattened while Fleas are laterally compressed. Livestock ticks are also wingless, and they are either hard (Ixodidae) or soft (Argasidae).

PARASITES OF ANIMALS

Mr. Vice-Chancellor Sir,

1.1 I worked only on several species of livestock ticks, namely Boophilus, Hyalomma, Amblyomma and Rhipicephalus. Ticks are important in both human and Veterinary medicine, in that they cause disease themselves, as well as acting as vectors of bacterial, mycotic, viral and parasitic pathogens.

Picture of tick

All ticks are epidermal (skin) parasites, and they undergo four basic stages in their life cycles; Egg –larva - Nymph-Adult. A female, engorged with host's blood drops to the ground to lay eggs. A six – legged larva hatches from each egg, climbs low vegetation where it quest for a host. One finding one, it feeds and molts to an eight legged Nymph. A one host tick is one in which all molting occurs on a single host e.g. Boophilus sp. If the nymph drops off, molts to adult and attaches to another host, it is a two –host tick. e.g Hyalomma sp. Amblyomma sp is a three host tick. Pathogenesis attributable to their ticks or parasites includes;

- (a) Anaemia – blood loss in heavy infections which can be considerable especially in large hosts (Roberts and Janovy, 2006).
- (b) Dermatitis – inflammation, swelling and ulcerations, with itching can result from a tick bite. These reactions may be because of constituents of tick saliva, secondary bacterial infection or caused by pieces of mouthparts remaining in a bite wound when the tick is forcibly removed.

Otocariasis – Infections of an ear canal by tick causes a serious irritation to the host, and is usually accompanied by severe infection.

Paralysis – A condition known as tick paralysis is common in humans, dogs and cattle, and in other animals when bitten at the base of the skull. This is very typical in Ixodes sp of ticks.

Infections; Ticks can and do transmit viruses, bacteria, rickettsias, Spirochaetes, protozoan and filarial parasites. Livestock losses from all arthropod infestation were estimated at almost \$3b in the early 80's.

Mr. Vice-Chancellor Sir, in this section, I would like to discuss the parasites of animals under four major categories which are:

- a. Tick bionomics, Resistance to tick infestation, Effect of Ticks on productivity and Parasites of Earthworms.

Tick Bionomics

Bionomics is the study of the mode of life of organisms in their natural habitats and their adaptations to their surroundings or environment. It is synonymous to ecology.

Previously, the vector status of *Hyalomma* species of ticks in Nigeria has been limited to Bovine Theileriosis, caused by *Theileria annulata* (Dipeolu and Ogunji 1977). Also, two *Babesia* sp, namely *B. bigemia* and *B. bovis* are known to infect cattle in Nigeria (Folkers and Kuil 1967; Folkers et al 1967), and both are of economic importance. Only *Boophilus* sp of ticks have been incriminated as vectors in the country (Dipeolu 1975, Akinboade et al 1980).

In South Africa, Thomas and Mason (1981) found large merozoites of a previously unidentified *Babesia* species in the haemolymph smear of a number of *Hyalomma* species, which was later named *Babesia occultans* (Gray and Devos 1981). The aim of this investigation was to determine if *Babesia* Kinetes are present in *Hyalomma* species of ticks in Nigeria and to attempt to identify them. 36 out of 50 undifferentiated *Hyalomma* ticks were positive for Kinetes. 71 out of 110 ticks consisting of 5 species of *Hyalomma* were seen to contain Kinetes of *Babesia*. (Table1). Our results show;

Ticks were kept in incubators maintained at 24°C and 85% RH. The smears were prepared as described by Burgdorfer (1970), fixed in methanol, and stained with Giesma's stain. Conventional microscopy was used for examining the smears for protozoan parasites. Secondly, we separately studied engorged female *Hyalomma* ticks. The dimensions of kinetes seen were determined with the aid of an ocular micrometer (15 X 100). Table 2

Mr. Vice-Chancellor, Sir, our results showed that *Hyalomma rufipes* had the highest percentage of infection; which was significantly higher than those of *H. truncatum* and *H. Impressum* but similar to those of *H. marginatum* and *H. impetatum*. Studies of the morphology, rod or club shaped (Figure 1) and dimensions of the kinetes show that they were larger than those of *B. bigemina*, but smaller than those of *B. major* and *B. bovis*, but similar to those of *B. occultans*. Although, Thomas and Mason (1981) found the kinetes of *B. occultans* in the haemolymph of *H. rufipes* only, our results show that other *Hyalomma* species harbor similar *Babesia* kinetes in the haemolymph with *H. rufipes*, *H. marginatum*, and *H. impetatum* having the greatest capability to do this. However, it is only *H. rufipes* which had been shown to transmit the infection further transovarially (Gray and De Vos, 1981). This is the first report of the occurrence of large Kinetes of a *Babesia* species in the haemolymph of *Hyalomma* ticks in Nigeria. Trade cattle from which the ticks had fed must have been the source of infection, and excludes the possibility of the Kinetes being those of *B. caballi*, *B. equi*, *B. canis*, *B. trautmani*, and *B. peroncitoi* which are found in the blood of horse, dog and pig respectively. (Dipeolu and Oduye 1976), Oduye and Dipeolu (1976) and Dipeolu et al (1982). *Hyalomma* sp. therefore are capable of transmitting bovine babesiosis in conjunction with *boophilus* sp. that had been earlier incriminated.

Mr. Vice-Chancellor, Sir, the continuity of generations and generations of Ixodid ticks in pasture depends on the adequacy of the host finding process, which also depends on temperature, humidity and host factors. We examined the attachment and survival of *Boophilus decoloratus* and *B. geigy* larvae using skin slices from cattle, sheep and goats which were obtained from white Fulani cattle, West African dwarf goat and Yankasa sheep, sourced from the teaching and research farm, and the Veterinary Control Post. Phosphate Buffered saline (PBS) of pH 7.2 was also used. A modified method of Doube and Kemp (1979) was adopted. About 100

larvae (4-6 days old) of *B. decoloratus* and *B. geigy* each were placed in the feeding chamber and confined by finely perforated nylon. The skin temperature and ambient temperature were kept constant in an incubator and the required relative humidity maintained by using salt solutions in desiccators (Winston and Bates 1960). Each treatment was investigated by a minimum of three replicates. The number or percentage of larvae attached was ascertained by the method described by Doube and Kemp (1979).

We obtained that *B. decoloratus* has a wider range of temperature (24 – 40°C) at which more than 50% of larvae would attach to bovine skin, while *B. geigy* has a narrower range (24 – 30°C) (Figure 2). Because of its wider range of temperature tolerance, *B. decoloratus* occurs in all ecological zones in the country and is the predominant species in the Sahel zone where the temperature approaches 40°C for most part of the year. The larvae of both species had two peaks (figure 3) of attachment- the 4th and 20th hour, the value for the second peak being greater than the first. The influence of humidity on larval attachments was only apparent where the temperature was high and in such cases more than 70% of *B. decoloratus* larvae attached, while less than 20% of *geigy* larvae attached by the 20th hour. Less than 50% of larval attachment was recorded on both sheep and goats. Thus, it may be suggested that there are some responses from the host which trigger attachment and detachment of larvae; this may be responsible for the low infestation of ticks on sheep and goats as observed by Beaton (1939) and Dipeolu (1975). This study thus explained the geographical distribution of these *Boophilus* ticks, where *B. decoloratus* has a wider range of temperature tolerance and thus are seen in all the ecological zones in the country, and in fact, is the predominant species in the Sahel where the temperature approaches 40°C for most part of the year.

The Developmental Viability and Sizes of Sequentially Oviposited Eggs of *Boophilus decoloratus* and *Boophilus Geigy*

Prior to this study, there was no information on the developmental viability of sequentially deposited eggs of *Boophilus* sp in Nigeria. We studied viability and sizes of eggs sequentially laid up to the 10th day of oviposition by *Boophilus decoloratus* and *Boophilus geigy*. Ten ticks, each of *B. decoloratus* and *B. geigy* which had engorged on cattle were used in this investigation. Each engorged tick was kept in a well- labeled universal bottle plugged tightly with cotton wool and incubated in an insectary maintained at 24°C and 85% r.h.

In our findings, the average length and breadth of eggs laid on the 1st and 2nd day of oviposition were statistically greater than at subsequent ovipositions. The eclosion periods of eggs laid from 7th to 10th day of oviposition were shorter than those of eggs laid earlier by both *Boophilus* species. The percentage mortality of eggs of 9th and 10th day of oviposition was significantly higher than that of the earlier ovipositions. The numbers of larvae which engorged on rabbits after hatching eggs of 7th – 10th day ovipositions were significantly fewer than those which hatched from eggs of earlier ovipositions. We concluded that eggs of early ovipositions of *B. decoloratus* and *B. geigy* are viable and survive longer than those of later ovipositions. We also suggested that the shorter eclosion period of the eggs of later ovipositions was due to the process of embryogenesis which occurs gradually in the eggs of earlier ovipositions, but faster in those of later ovipositions.

Bacterial Isolation from and Transmission by *Boophilus decoloratus* and *Boophilus geigy*

Mr. Vice-Chancellor sir, although the role of ticks as Vectors of some Protozoan Parasites, and Viruses have been well documented, there is none or little information as to their ability to transmit bacteria (Mahoney and Mirre, 1974; Dagleish and Stewart 1978; Akinboade & Dipeolu 1983, 1984).

We isolated bacteria from the haemolymph of *Boophilus decoloratus* and *Boophilus geigyi*; All the genera of the bacteria were isolated from the eggs. Engorged ticks were collected into sterile universal bottles from cattle stationed at the Veterinary control post in Ibadan using sterile forceps. The ones belonging to the genus *Boophilus* were separated into sterile petri-dishes in the laboratory for species identification. There were four (iv) phases in all. In Phase I, each tick of *B. decoloratus* or *B. geigyi* had its fourth leg amputated and a puncture made with a fine aseptic dissecting pin for haemolymph at the joint of amputation. A platinum loop was used to streak a small inoculum of the haemolymph on Blood Agar (BA), cysteine- lactose deficient and (CLED) and selenite broth (SB) and the organ media were left overnight at 37°C. The isolation of bacteria isolates was based on their morphological, cultural and biochemical characteristics (Cowan and steel, 1996). The engorged ticks from which haemolymph was extracted were incubated in the insectary, maintained at 24°C, and 85% relative humidity. Twenty engorged ticks of *B. decoloratus* and 20 of *B. geigyi* collected on trade cattle on various occasions were used for this experiment. In phase II, about 1000 eggs out of the egg mass laid by each tick were put in a sterile mortar and crushed with sterile pestle after the addition of 2 drops of sterilized normal saline. About 1000 larva, hatched from the egg mass of each tick were cultured in the different media (Phase III). In Phase IV, six laboratory bred rabbits whose blood were negative for any bacteria infection were infected with clean laboratory bred larvae (1000 each). The rabbits were each inoculated peritoneally with 1ml of phosphate buffered bacterial solution, standardized by the method of Miles and Mistra (1938) On day 18 post larval infestation. Engorged ticks were removed by day 21-23 post infestation.

Our results showed that *Staphylococcus pyogenes* and *Pseudomonas aeruginosa* were consistently encountered in the haemolymph, eggs and larvae of both *Boophilus* species while *Proteus mirabilis* was additionally consistent in *B. geigyi*, thus indicating transovarian transmission. This study demonstrates the high functionability of ticks transmitting bacteria to most animals.

Escherichia Coli is found in the haemolymph of *B. decoloratus* and eggs but not in the larvae. *Bacillus subtilis*, seen in the haemolymph of *B. geigyi* was not found in the eggs and larvae. No bacteria was isolated from all ticks engorged on controlled rabbit. Results from this study is important because *Boophilus* sp of ticks constitute about 35% of total tick population in Nigeria (Dipeolu 1983) and they are widespread in all ecological zones of the country (Dipeolu 1975). Therefore, their contribution to the epidemiology of bacterial infections of livestock must be substantial. Thus, in all epidemics, due to bacterial infections in both animals and man, the role of ticks especially *Boophilus* ticks must be suspected and thoroughly investigated. In addition, these bacteria may also reproduce to release toxins which supplements tick toxins responsible for tick paralysis (Doubé 1975, Allen 1977, Dipeolu 1972 and Akinbade 1982).

Mr. Vice-Chancellor, we also looked at the effect of photoperiod on the oviposition pattern of engorged *Boophilus*, *Amblyomma* and *Hyalomma* sp of ticks in Nigeria. The oviposition pattern under artificial and natural photoperiods was considered, and the same procedure was adopted for all species. Laboratory conditions were set as photo periodic conditions; viz, LL is 24hrs light, DD 24hrs darkness, DL 12hrs darkness, 12hrs light; LD 12hrs light, 12hrs darkness; LD6:18 6hrs light, 18hrs darkness; LD 18:6 18hrs light, 6hrs darkness.

The start of oviposition took place in the Scotophase in all photoperiods except in those placed in continuous light. The oviposition periods of both *A. variegatum* and *H. truncatum* placed in artificial photoperiods were prolonged than that those in natural conditions. None of those occurred in *Boophilus* sp.

We obtained that *A. variegatum* and *Boophilus* species kept in the other photoperiod exhibited ovipositional rhythm characterized by higher peaks during the scotophase, while engorged *H. truncatum* failed to oviposit. We concluded that light indirectly inhibits oviposition and high temperature tends to eliminate the inhibitory effect of light in *Boophilus* sp and *Hyalomma* species. We obtained that no effect was manifested on disturbed ticks in terms of preoviposition and oviposition periods when compared with undisturbed ones. This observation agrees with Drummond and Whetstone (1970) and Fijusaki *et al* (1973) for other ticks but it is at variance with the reports of Sonnenshine and Trager (1969).

Farming at the resource poor level within the African continent combine both crops and livestock production to boost earnings for improved standard of living. Chickens, goats, sheep and cattle are familiar sites in such homesteads. Chickens were observed to visit the cattle confinements in the morning and in the evening after the cattle return from grazing. From this observation, we decided to look more closely and then investigate.

This study was conducted in Kenya to ascertain whether Chickens predated on ticks from bodies of cattle, as well as from vegetation. In Rusinga Island (Kenya), five home steads were visited on different days early in the morning before the chickens were released for scavenging. On each occasion, two chicken, each 24 months old were selected randomly among those in the homestead and released into the cattle pen.

Chickens were seen and observed to be natural predators of ticks found on cattle. *Rhipicephalus appendiculatus* were recovered in large numbers from the crops and gizzards of chickens which had scavenged for 30 min - 1 hr among tick- infested cattle. Other ticks recovered were *Amblyomma variegatum* and *Boophilus decoloratus*. The numbers of ticks of recovered ranged from 3 to 331, with an average of 81 per chicken. Cattle facilitated the predation of ticks by certain behavioral actions. Chickens also picked up both engorged and unengorged ticks seeded on vegetation, but un-engorged ticks were preferred. From results obtained, we concluded that chickens have preference for un-engorged ticks. It is probable that the size of ticks is important in the process of pecking. This preference however may be useful during predation on vegetation. It appears that chickens were attracted to unengorged ticks as a result of their high degree of mobility rather than their size. The chickens picked all the active and highly mobile male *A. variegatum* before they picked any of the sluggish engorged females. This is the first scientific report of predation of ticks by chickens, where results give strong indication that chickens are natural predators of livestock ticks, and could become a viable biological method of tick control within the ambit of resource poor farming in the homesteads.

Mr. Vice-Chancellor Sir, the second category of my research work under parasites of animal was on resistance to tick infestation. Tick resistance is either innate or acquired. Bovine (Cattle) resistance to tick infestation was first reported by Johnston and Bancroft (1918). The natural resistance of Zebu cattle (humped) and their crossbreeds had become an adjunct to the management of *Boophilus microplus* in Australia. (Wharton et al 1973, Powell 1971, Utech et al 1978). Cattle and rabbits can be induced to develop resistance by repeated infestation with *Rhipicephalus appendiculatus*, *R. evertsi evertsi*, *Amblyoma variegatum* and *hyalomma anaticum anaticum* (Akiki-Rubare and Mutinga 1980' Latif 1984, Rechav 1987. Latif et al 1988). Also, Dipeolu and Harunah (1984) reported acquired resistance to larval, nymphal and adult forms of *A.variegatum*. In this study, tick-naive cattle of different age groups were exposed to the primary infestation with *Rhipicephalus appendiculatus* to enable a comparative study of their susceptibility to these ticks, perhaps heritability and if ages at first exposure determines their susceptibility.

Rhipicephalus appendiculatus are brown hard ear tick found in Africa where it spreads the parasite--*Theileria parva*, which is the major cause of East Coast fever in cattle. These ticks have a three-host life-cycle, spending around 10% of its life feeding on animals.



Figure 1 shows the male tick on the left and female on the right. (Source: Joel Kanunga on InfluentialPoints.com)

Four biological parameters were used for quantification of their susceptibilities to ticks. Statistical analysis was carried out with Duncan's multiple tests, and 0.05 was the adopted level of significance. Findings depicted steers as the most susceptible to *Rhipicephalus appendiculatus* ticks as calves. Hence, infestation at an early age does not make them more susceptible than when they attain an older age. (Graph pad suggested for figures 1-3) Immunological basis for their susceptibility requires further investigations.

Host resistance to Ixodid ticks: Response of tick naive calves to repeated infestation with larvae of *Boophilus decoloratus* (Koch, 1844) and *Boophilus Geigy* (Aeschiliman and Morel, 1965).

This study was conducted to ascertain the degree of resistance acquired by calves after repeated infestation. This is with a view to explore the likelihood of tick immunization attachment and (AS)

Four female crossbreed calves, below 3 months of age were infested with larvae of *Boophilus decoloratus* and *Boophilus Geigy* on three successive occasions at 30 days intervals. They presented with the development of immunity by the first cycle of infestation subject to survival of subsequent developmental stages, duration of

feeding (DF) and weight of engorged ticks, (wT) thereby inducing resistance against these ticks. However, the growth and feeding durations for second and third infestation (mean engorgement index (MEI) 0.91 and 0.87 respectively) were significantly longer than the first infestation. No breed difference in the development of resistance to *Boophilus* sp. Both *B. decoloratus* and *B. geigy* exhibited a higher level of resistance at the third than second infestation. If a major component of host resistance to ticks was acquired through previous infestation, as evidenced in this study. (Wagland, 1975; Roberts and Kerr, 1976; Willadsen et al., 1978), then, subsequent manifestations of this immunity suggest the future implementation of tick-immunization of cattle for effective managements of ticks guaranteeing proper antigenic delivery system, longer interval between vaccination, increased livestock productivity and economic benefits in Nigeria. Antigens could be from serum, salivary glands or tick midgut. (Dipeolu and Harunah (1984); Wikel, 1981; Brown et al 1984, Nyan and Oyindo 1987; Nyindo (1989); Ackerman et al 1980, Mongi et al 1986.)



Figure 2 presents female calves with inserted *Boophilus* tick. All *Boophilus* ticks are **one-host** ticks, i.e. only the engorged adult female ticks drop off the host to lay eggs in the environment. Once the hatching larvae find a host, they will remain on it for the rest of their development to adult ticks.

Studies on naturally acquired immunity to African ticks. II. Observations on cattle exposed to *Rhipicephalus appendiculatus* under varying periods of repeated infestations.

Groups of twelve Friesian cattles, about 12 months old bought from tick-free commercial farm in Kenya were repeatedly infested with *Rhipicephalus appendiculatus* at weekly intervals (for eight infestations) and 3 weekly intervals (for seven infestations). Engorgement weights of adults, nymphs and larvae decreased significantly initially but rose at a significant rate on second infestation onwards. Subject to the escalating cost of acaricides application; environmental pollution and development of resistance to acaricides thereof; the significance of utilising host resistance as an alternative approach for tick control was inevitable hence the need to re-appraise the criteria for assessing tick natural resistance.

Rhipicephalus ticks were raised in the tick colony of the International Centre of Insect Physiology and Ecology (ICIPE). In this study, tick resistance have usually been expressed either by ways of: (i) reduced number of

engorged ticks (ii) reduced blood-meal weights (iii) reduced numbers and viability of ova (iv) prolonged period of engorgement and (v) death of ticks on host. Meanwhile, we observed that copulation was significantly higher in first infestation than subsequent infestation but ticks either die due to squashing mostly females. Although, this study was unable to ascertain the mechanism of tick resistance during attachment of all instars of *Rhipicephalus* ticks on cattle. A new method for quantifying the resistance status of animals was introduced, and this method showed that resistance acquired by cattle during the 6 weekly re infestations was more stable than that acquired during weekly and 3 weekly infestation. In this study, rejection of ticks corresponds with *R. appendiculatus* being unable to feed after successful attachment rather than an inability to attach; and this may be in line to Branagance 1974 suggestions that three mechanism operates during the development of natural resistance, the first appearing at the initial stage of infestation during attachment. The significant information about this study is that immunization against East Coast fever transmitted by this tick is eminently possible and is a prelude to that realization.

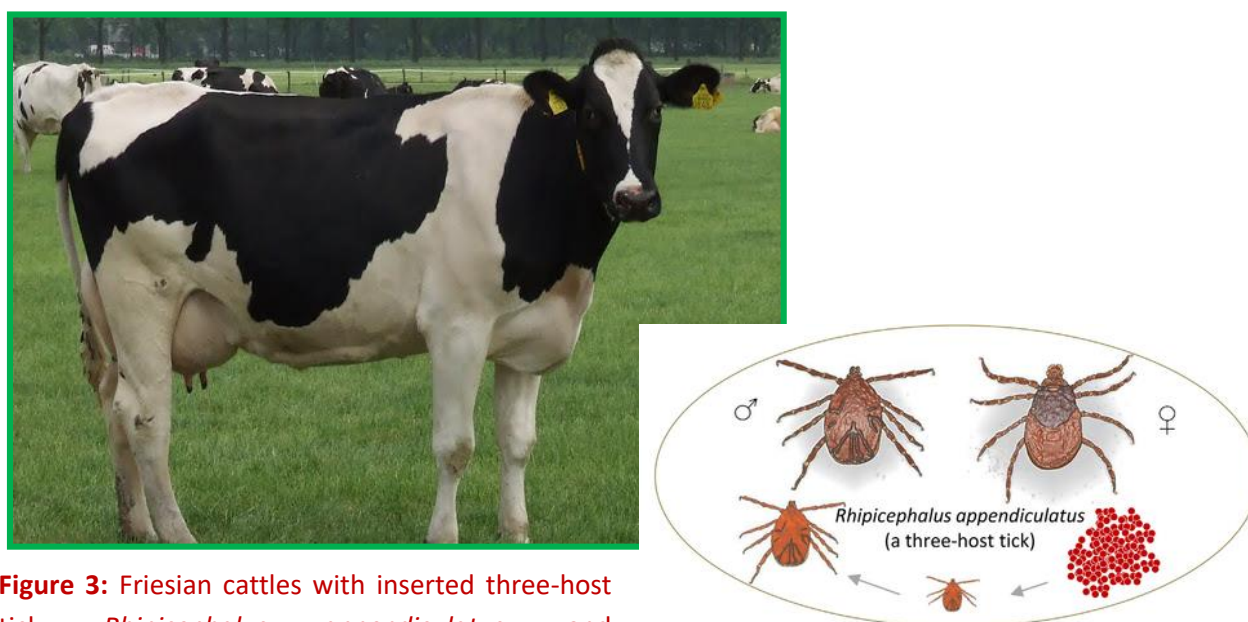


Figure 3: Friesian cattles with inserted three-host tick, *Rhipicephalus appendiculatus*, and developmental life stages: eggs, larvae, nymphs and adults (male (left) and female (right)). Mr. Vice-Chancellor Sir, in South America, Menchadez (1924) demonstrated the repellent properties of *Melinis minutiflora* (molasses grass on the tick (Beasley, 1982) and this was demonstrated by Thompson et al, 1978) who observed the inimical effect of molasses grass on *Boophilus australis* Cattlemen in Columbia frequently observed that cattle grazing molasses grass carried fewer ticks than than cattle grazing on other improved or nature pastures. Prior to this study, there were no records in Africa of any plant with tick repellent properties although attention has been drawn to the possibility of the use of plants and natural products for control of livestock ticks within the context of resource poor farming (Dipeolu et al 1992). In the course of such research, attention was drawn to a shrubby plant *Gynandropsis gynandra* (L) Brig, which is used by poultry farmers in Kitui district of Kenya to prevent infestation of local chickens with mites. Because of the close taxonomic relationship between mites and ticks, an experiment was designed to determine whether or not the plant demonstrated anti tick properties. The mean number of larva of *R. appendiculatus*, the nymph and adults which moved towards the test (fig 1-3) leaf was low, as against the positive and negative controls. Mostly planted in the homestead for demarcation, was shown to exhibit repellent and acaricidal properties to larvae, nymphs and adults *Rhipicellapus appendiculatus* and *Amblyomma variagatum* ticks. All stage of tick avoided the plants' leaves to

about 2 – 5 metres while ticks on continual exposure died. However, surviving ticks were weak and/or inactive. Hence, potential use of this plant as tick control agent within the integrated tick management system is significant as compared to the socio-economic factors that prohibit use of chemical treatment of livestock owned by resource –poor farmers.

Mr. Vice-Chancellor Sir, at this point, one may begin to wonder, what exactly is or are the effects of tick infestation on productivity. We therefore examined the effects of varying Acaricide treatments on ticks and productivity in East Coast Fever-immunized weaner and dairy cattle. East Coast Fever (ECF), caused by the *Theileria parva*, a protozoan parasite, transmitted by the 3- host tick, *Rhipicephalus appendiculatus* is the most prevalent tick borne diseases of cattle in Kenya, and other 10 countries in East, South and central Africa. More than 30 million cattle are at risk and it kills more than 1 million cattle yearly (Mingaur and Mcleod, 2003).

In a pilot trial to evaluate cost effective methods of acaridae applications, ECF immunized weaner and dairy cattle were subjected to varying tick control regimen. Their monthly tick load, packed cell volumes, incidence of blood protozoans, weight changes, and daily milk production were noted. All experimental cattle were maintained under the same extensive system of management.

The trial was done at Kenya Agriculture Research Institute (KARI) in Mariakani 38km west of Mombasa, Kilifi District of Coast Province of Kenya. Routinely, animals on the farm were dipped once weekly with backdip (Bayer EA). Trypanosomiasis was controlled by quarterly prophylaxis with a trypanocide Samorin (May & Baker). Other prophylactic measures included regular deworming and vaccinations against viral epidemics such as Foot and Mouth Disease (FMD) and Lumpy skin disease.

The weaner and dairy animals were divided into six groups, each group having 10 animals each.

- | | |
|-----------|--------------------------|
| Group 1 - | weekly dipping (control) |
| 2 - | Every 2 weeks |
| 3 - | Every 4 weeks |
| 4 - | Every 6 weeks |
| 5 - | Every 8 weeks |
| 6 - | Undipped |

Results showed that all ticks of Genera Boophilus, Amblyomma, apart from Rhipicephalus were found on all the experimental weaner and dairy cattle. The pattern of infestation was the same in all the groups with a peak between September and October. In Fig1, the control group had fewer monthly ticks than either of the other groups. There was no significant difference in the number of ticks picked by any group within the first 8 months when tick challenge was low. Tick challenge was generally higher during the second year of the study.

Fig 2 shows the monthly means of milk produced by the various groups of dairy cattle. The pattern of production was the same for all groups and was characterized by a decline of production during the second half of the study, an indication of an effect of high tick challenge on production.

A comparison of the weight gains of weaner cattle to correspond with low, medium and high tick challenge is shown on Fig 3. No significant weight change differences occur during the period of low tick challenge, but weaners in the control group gained significantly less weight than any of the other groups during periods of medium and high tick challenge.

Table 1 shows the outcome of ECF and other diseases of the experimental dairy and weaner breeds of cattle. The incidence of ECF was irrespective of dipping frequency, and group 1, 5 and 6 had the highest mortality.

Table 2 shows the analysis of the milk production of dairy cattle, where no significant differences in the mean milk produced between the control group and any other group. The end of trial weight gains of weaner cattle is shown in Table 3, and the control group under the most intensive regimen of acaricide use had the least weight increase (43%) compared with the other groups, especially group 2 (>180%). The preliminary cost and benefit analysis of production in the various groups is shown in Table 4.5.

Table 4

In conclusion, this was the first report of the effect of natural field challenge of ticks within the context of east coast fever immunization in dairy cattle. The immunization by the Infection and treatment method, shown to be beneficial to beef cattle (Morzaya et al 1988), has also been proven to be beneficial to dairy cattle and weaners. As also shown in this study, east coast fever can occur in cattle under the most intensive dipping regime. It is also evident from this study that intensive use of acaricides, as in weekly dipping, led to low tick burden in both weaner and dairy cattle, but did not allow those animals to develop or acquire resistance to ticks and hence to tick borne diseases. Following successful immunization, it is logical to assume that the enzootic stability reestablished by artificial induction through immunization should be maintained by an adequate exposure to ticks; as also observed by Young (1981). Intensive dipping also depressed weight gains in weaners, while dairy cattle showed no significant changes in weight. The milk production by dairy cattle in the control group was not significantly different from that of any other group, and was only higher than that of undipped cattle. This might indicate the lack of any real benefits from any form of chemical control of ticks in these ECF immunized cattle. However, the undipped cattle had higher mortalities and fewer calvings than any other group, which might indicate that it is uneconomical to keep ECF immunized dairy cattle with no form of tick control whatsoever. A strategic use of acaricide in these animals, depending on a knowledge of the population dynamics of ticks in such an area will be most beneficial. The cost benefit analysis of the various dipping regimens showed that the groups under relaxed dipping intensities of monthly or six weekly acaricide application gave the highest profits per animal. It is recommended that efforts should be made to develop similar immunization procedures for or against other tick borne diseases such as Babesiosis, Anaplasmosis and heartwater disease, and thereby increase the dipping intervals of immunized cattle. Based on empirical data, primarily from these pilot trials, and from other larger trials in all the geographical zones and in different farming systems, the Kenya Government, through the ministry of Livestock Production approved the ECF immunization in all the production systems because of 3 factors. (i) Higher weight gains. (ii) Resultant lower calf mortality and (iii) the natural boosting of the immunity by infected ticks. A Final ECF Vaccine Roll out was announced (GOK, 2011). The conclusion from this study is that immunization against tick infestation is feasible as results have demonstrated. Immunized dairy cattle will produce more milk with less or highly reduced acaricide treatment, which also will allow weaner calves to develop resistance to ticks hence boosting immunity.

Mr. Vice-Chancellor Sir, due to the fact that efforts were being made to utilize earthworms as protein content for the manufacture of animal feeds we decided to investigate the possibility of these earthworms harbouring parasite which may or could be responsible for zoonotic diseases. Zoonotic diseases are those that are transferable between man and animals or vice-versa. 140 earth worms (75 *Alma millsoni* and 65 of *Libyodrilus violaceus*) were found in Ago-iwoye and were collected during the raining months of May to August 2006 by digging and hand sorting method. The worms were dissected and examined for protozoan and helminth parasites.

Of the 75 individuals of *A. millsoni* sampled, 46 (61.3%) are infected with protozoan and 2 helminthparasites. Of the 75 individuals of *A. millsoni* sampled, 46 (61.3%) were infected with protozoans namely *Apolocystis libyodrilii*, *Monocystis abegei*, and *Monocystis libyodrilli*, and *L. violaceus* had 83.1% prevalence of protozoan infection with an overall mean prevalence of 72.2%. There is a significant difference ($p < 0.005$) in population of *Libyodrilus violaceus* and *Alma millsoni*. The study revealed that parasitic protozoans (Monocystids) are present in the earthworms' species. *A. millsoni* had a lesser parasitic load than *L. violaceus*. Also, we realized a possibility of the earthworm serving as intermediate host in the transmission of zoonotic disease. Hence intending users of earthworm as source of protein in livestock feeding and rearing should employ care to rid the food of the parasites present in these earthworms, or to discard the idea all together.

2.1 PARASITES OF MAN

Mr. Vice-Chancellor Sir, a second major area of my research activities was in the area of parasites affecting man. These parasites include those of Malaria, Schistosomiasis, Soil transmitted helminthes, and Trichomoniasis and Toxoplasmosis

MALARIA

Malaria is a life threatening disease caused by protozoan parasites of Genus Plasmodium and transmitted to man by female anopheles mosquito, and its incidence often has seasonal patterns.. Symptoms include fever, chills and sweating, body pains and a general feeling of unwell. Five types of parasites cause disease in man and they are: Plasmodium Falciparum, *P. vivax*, *P. ovale*, *P. malariae* and *P. knowlesi*. The parasite lifecycle takes place in both man (Schizogony: asexual) and mosquito (Sporogony: sexual).

We evaluated Gametocyte Carriage in Plasmodium Falciparum Malaria in Children during high and low transmission seasons and their response to Oral Chloroquine

Plasmodium falciparum malaria was evaluated in 1031 children treated with different antimalarial drugs during high (693 children) and low (338 children) transmission seasons in a hyperendemic region of southern Nigeria between 1996 to 2003.

Gametocytes generation, carriage and infectivity to mosquito are crucial to successful transmission of falciparum malaria infection. Assessment of parasitaemia and gametocytemia was carried out using either

thin or thick blood film prepared from finger prick; giemsa-stained and examined by light microscopy under oil-immersion objective lens at $\times 1000$ magnification by two independent assessors.

Further still, response to chloroquine treatment was evaluated during HTS and LTS, using WHO (1973) criteria, a 25mg/kg body weight of drug over three days (10 mg/kg on day 1, 10 mg/kg on day 2 and 5 mg/kg on day 3) were administered to the children.

While gametocytes carriage rates may vary widely, it is dependent on several factors. Observed prevalence of malaria infectivity was significantly higher in the high transmission season (67.2%) than in the low transmission season (32.8%). However, the gametocytes carriage rate was slightly higher in the latter. It was also discovered that the male gender were risk factor for gametocytes carriage perhaps due the effect of testosterone and/or corticosteroids. Parasite clearance times were significantly different in the two transmission seasons. Patients with slow response to treatment are likely to carry gametocytes than those that respond rapidly, since Smalley et al (1981) had observed that longer established *P.falciparum* infections are likely to produce gametocytes. It is therefore likely that longer duration of illness before presentation in the LTS may allow sufficient time for the progression of committed asexual parasites to gametocytes. Overall, a strategy that avoids the identified risk factors for gametocyte carriage in the two transmitting seasons and controlled use of antimalarial drugs may reduce gametocyte prevalence and contribute to a reduction in malaria transmission.

Early treatment to clear parasite in the blood will not allow further development to gametocytes, thus, halting the transmission chain.

Tables 1, 2, 3, 5

Mr. Vice-Chancellor sir, in another, but related study, we evaluated the role played by gametocytes at the time of treatment with chloroquine and during follow-up on clinical outcome and resistance pattern in children with uncomplicated malaria. Chemotherapy still remains the most widely used approach to combat malaria infection. The increasing failure (40 – 80%) of chloroquine to clear parasites in patients resident in endemic areas of West and East Africa has necessitated the development of alternative anti-malaria drug therapy (Worklay, et al 1995; Sowunmi and Fateye 2003). The gametocyte generation, host carriage and infectivity of mosquitoes are crucial for the successful transmission of malaria and spread of chloroquine resistance in most endemic regions. Thus, this study was conducted to evaluate the role played by gametocytes at the time of treatment with chloroquine and during follow-up period on clinical outcome and resistance patterns in children with acute uncomplicated falciparum malaria. A total of 142 children comprising of 71 children with gametocytes and 71 children without gametocytes at enrolment were all treated with chloroquine (25mg/kg body weight). Data was analysed using version 6 of Epi-info software (CDC, Atlanta,GA, USA) and difference was given in p value < 0.05 .

Therapeutic response differs in the two groups. And there was significant difference in the children who had gametocytes at presentation with shorter time of parasite and fever clearance compared to the other group that presented without gametocytes at enrollment. Likewise, these group presenting with gametocytes at enrollment posed chloroquine resistance unlike the second group. Hence, once a child presents with gametocytes in the peripheral blood at enrollment, alternative antimalaria drug superior to chloroquine may be administered, or chloroquine with another antimalarial drug active against all parasitic stages and this is the most significant finding in the study.

Table 1

The effects of arthemether-lumefantrine versus amodiaquine-sulfalene-pyrimethrine on the hepatomegaly associated with Plasmodium falciparum malaria in Children

Multiple organ involvement is an important feature of Plasmodium falciparum infection (White 1986; White and Ho, 1992). The standard methods for the assessment of the therapeutic efficacy of antimalarial drugs in acute falciparum infections have focused on (a) the rate of clearance of the asexual parasitemia, (b) symptoms and clinical signs associated with the disease, (WHO 1973, 2003; White 1997), (c) and on subsequent development of gametocytemia following treatment (Suputtamongkol et al 2003). Very little attention has been focused on the effects of treatment on organ pathophysiology processes and changes that are associated with the disease eg. Hepatomegaly. The WHO (2001) have recommended Artemisinin combination antimalarias (ACT) for use because they quickly reduce the burden of parasitaemia and gametocytaemia, and the chance of drug resistance (Hien and White, 1993, White 1999). ACT's appear to be effective alternatives to monotherapy (Sowunmi et al, 2005). It is not clear whether or not ACT's or non-ACT's would provide additional beneficial effects in terms of pathophysiological processes and changes associated with acute falciparum infections in children eg hepatomegaly. The main aim of this study were to evaluate and compare how treatment with arthemether-lumefantrine (AL) and amodiaquinsulfalene-pyrimethamine (ASP) affected the malaria-attributable hepatomegaly between November 2005 and January 2006. 181 patients were enrolled for the study, 90 in AL and 91 in ASP groups.

Fig. 1

Table 1, 2, 3

The study showed high prevalence of hepatomegaly on presentation in children with acute falciparum malaria (Fig. 1), and thus its potential use as a possible malariometric index of the intensity of transmission (Sowunmi, 1996a; Sowunmi et al 2001; Sowunmi and Adedeji 2002).

The two drug combinations have equivalent antimalarial efficacy. Recurrence of hepatomegaly is irrespective of recurrence or not of parasitaemia. The potential application of this study includes (1) In routine antimalarial efficacy studies, liver rates may be measured before treatment, on day 3 and on weekly basis and be used to compare effects of antimalarias on the resolution of malaria-attributable hepatomegaly. (2) Recurrence of hepatomegaly in a child in whom, following therapy, there was resolution after initial treatment may indicate a recurrence of the infection (Sowunmi 1996a).

Furthermore, we investigated the distribution of malaria parasitema among suspected cases of malaria, within the context of ABO blood group and haemoglobin genotype and to know whether bacteremia is a normal concurrent infection in malarious patients. 515 suspected cases were examined by Giemsa staining method using both thick and thin blood films. This code from 1 to 4 crosses was used to determine relative malaria parasite count.

We found that 415 (80.6%) were positive for malaria parasite and is in agreement with Alaribe et al (1998 and Adefioye et al 2007). The prevalence was 222 (89.2%) and 193 (72.6%) for males and females respectively. The highest prevalence of malaria parasitemia was obtained in blood group O (90.0%), and the lowest (31.3%) in blood group AB. For haemoglobin genotypes AA, AS, AC and SS taken, the % prevalence of malaria parasitemia obtained were 85.2, 75.0, 69.2, 44.0 respectively. Table 2. The high prevalence 85.2 in the AA haemoglobin is consistent with the work of Emeribe and Osun (1993); Christina and Walter (2007) who reported that subject with AA had highest incidence of malaria parasitema. We also obtained that the co-infection of malaria parasite and bacteria is not a usual occurrence in agreement with (Emeribe and Osun, 1993) with a low prevalence of 1.6% Bacteremia obtained in patient with malaria parasitemia may be considered to be a secondary infection as a result of severe and prolonged malaria infection.

We suggested that the malaria parasite could be controlled by massive education at all level by the government such as home, school and worship centers. Every effort must be made to prevent human and vector contact, particularly the people in high risk group e.g., the infants, young ones, people with genotype AA and individual with blood group O. This should include the use of chemical impregnated nets, windowed nets etc. Breeding sites should also be destroyed while all stages of mosquitoes must be attacked by all means. It is advisable for people to go for medical diagnosis before it becomes severe; this will assist in controlling drug resistant strains in all anti-malaria drugs.

Table 1, 2, 3, 4

Mr. Vice-Chancellor Sir, malaria is endemic in most parts of Nigeria with stable transmission all year round. High temperature, humidity and rainfall are some of the factors that enhance mosquito breeding and malaria transmission. Pregnant women and children under five years bear the greatest burden. Malaria in pregnancy is believed to contribute up to 5% of maternal anemia, about 14% of low birth weight and 5% of infant mortality rate. We investigated the most common mosquito control measures employed by the pregnant women in Lagos and their effects on malaria infection. The study was carried out over a period of 6 months during which trained interviewers administered questionnaires to 400 pregnant women.

The prevalence of malaria obtained was 8.4% by, Nested PCR. There was no statistically significant association between prevalence of malaria, age, level of education, or occupation of the participants. Pregnant women in the age range 26 – 30 had the mean parasite density (409.9 ± 196.80). 32.8% of the respondents used Insecticide spray. Mosquito coil (27.5%). The use of insecticide treated net was 15.5%. 28% of the respondents used non-treated nets. Only 18.3% of the women had taken more than one dose of intermittent preventive treatment (IPT), while another 11.8% had taken a single dose. The infection rate among them was 4.1% and 6.4% respectively. Malaria prevalence was highest among those who had not received any dose of IPT (10%). This study showed that the use of ITN and IPT among pregnant women were still unacceptably low. It also showed that the use of insecticide spray which was the most common malaria control measure adopted by the participants was effective despite the fact that it is not a National malaria control policy. We recommend that a sustained integrated mosquito management and public education should be strengthened in Nigeria to reduce the burden of malaria on the more than 97% of Nigerian that are at risk. (WHO 2008). Indoor Residual Spraying (IRS) which was later adopted by the country, is an improved form of insecticide spraying because it targets adult mosquitoes which are responsible for transmission.

Table 1, 2, 3, 5

SCHISTOSOMIASIS

Mr. Vice-Chancellor Sir, the second area of my research activities with respect to parasites of man is in the diseases caused by flat unsegmented worms found in man. Schistosomiasis, also known as Bilhazia, is a disease caused by the digenetic fluke worms of the genus *Schistosoma*, Infection with *Schistosoma masoni*, *S. haematobium* and *S. japonicum*, and in a few cases *S. intercalatum* causes illness in humans (Monica 1982).

Other species, *S. bovis*, *S. matheei*, *S. rhodani*, and *S. mekongi*, which naturally are parasites of animals are occasionally found and reported in man (Noble and Glen, 1982). About 300m people in more than 74 countries are infected, with over 600m at risk of infection. Disease is endemic in 54 Africa countries including Nigeria (Adeyeba and Ojeaga 2002). Although endemic in Nigeria, it is usually a neglected common disease of childhood (Adewumi et al, 1994; Bello and Edungbola 1992). Parents in the study area have always regarded reported cases of scanty blood in the urine of their wards as evidence of manhood and fertility, and very few or no reported systematic study in place for this area. Thus, surveillance is important to establish endemicity. These series of studies were designed to determine prevalence and intensity of Schistosomiasis compare diagnostic techniques evaluate predisposing factors, search for concurrent urinary tract pathogens and examine the nutritional status of children infected by Schistosomiasis.

We examined the prevalence of urinary schistosomiasis in apparently healthy primary school pupils in Olorunda local government which comprises cosmopolitan areas like Osogbo and rural area like Ilie was surveyed using 523 samples of urine. The urine samples were processed by centrifugal sedimentation method at 2000rpm for 5 minutes, taking care to observe for the presence of blood and or pus cell in the samples and *S. japonica* was - .39%.

The overall prevalence of *Schistosoma haematobium* was 31.87%, *Schistosoma mansoni* was 2.3%, significantly higher ($p < 0.05$) Rural prevalence (53.6%) than from pupils in the urban area (13.4%). Intensity of infection based on Absolute Egg count per 10ml of urine was also higher in rural area (3-1650 eggs) than urban area (1 – 50 eggs). The highest infection rate occurred in the age group 11-15 years. We concluded from results obtained that there is a linear relationship between stream water contact and infection rate, and the symptoms of haematuria are not pathognomonic of the infection in this study.

In addition, Mr. Vice-Chancellor Sir, the association between schistosomal and bacterial infection could result from a symbiotic relationship in which the bacteria either become fixed on the cutaneous surface of the worms in clearly defined places (Penaud et al, 1983), or colonize the caecum of the parasite (Ottens and Dickerson, 1972). Schistosomiasis produces inflammatory changes in the bladder from acute to chronic. It is therefore reasonable to expect pyuria and bacteriuria. Though endemic in Nigeria, it is usually a neglected common parasitic disease of childhood (Adewumi et al 1973).

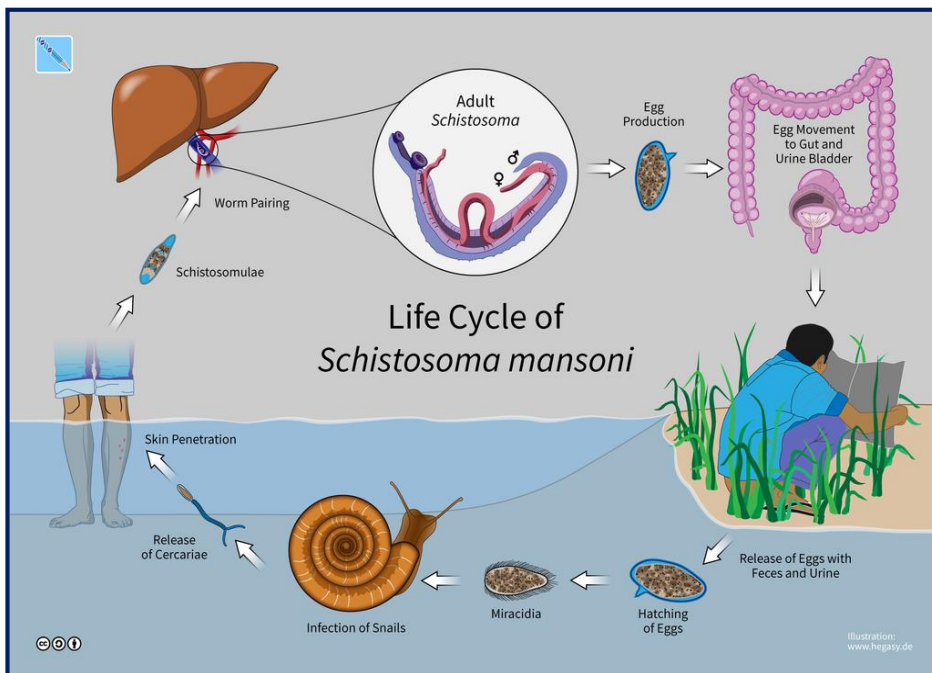
The current status of urinary schistosomiasis and urinary tract pathogens was considered between October 2004 and March 2005 among primary school children in Olorunda Local Government Area of Osun State. Urine samples were collected from pupils in primary 1 to 6 for this study and were analyzed by simple centrifugation concentration method.

Of the 523 pupils examined for eggs of *Schistosoma haematobulum* in their urine, 166 (31.7%) were infected. The males also suffered from higher intensity of infection based on Arithmetic mean egg count per 10ml of

urine (44.8 eggs/10ml Urine) than female pupils (39.7 eggs/10 ml urine). There is a linear relationship between stream water contact and infection rate. Symptoms of haematuria are not pathognomonic of the infection. 54.2% of infected pupils had one bacteria pathogen or the other with *Escherichia coli* occurring more than others. The antibiogram of isolates revealed that Rocephine, Cephalexine, Peflacin and Augmentin were the most effective drugs in treatment of urinary pathogens among the pupils. We conclude that the disease is still actively being transmitted in Osogbo. We recommended that clinicians should request for Urine Microscopy Culture and Sensitivity (M/C/S) rather than only urine microscopy in suspected cases of urinary schistosomiasis because of high secondary bacterial infection. The Ethical committee recommended that all students found positive should be treated and this was done by the Local Government health authority through the Primary Health Care.

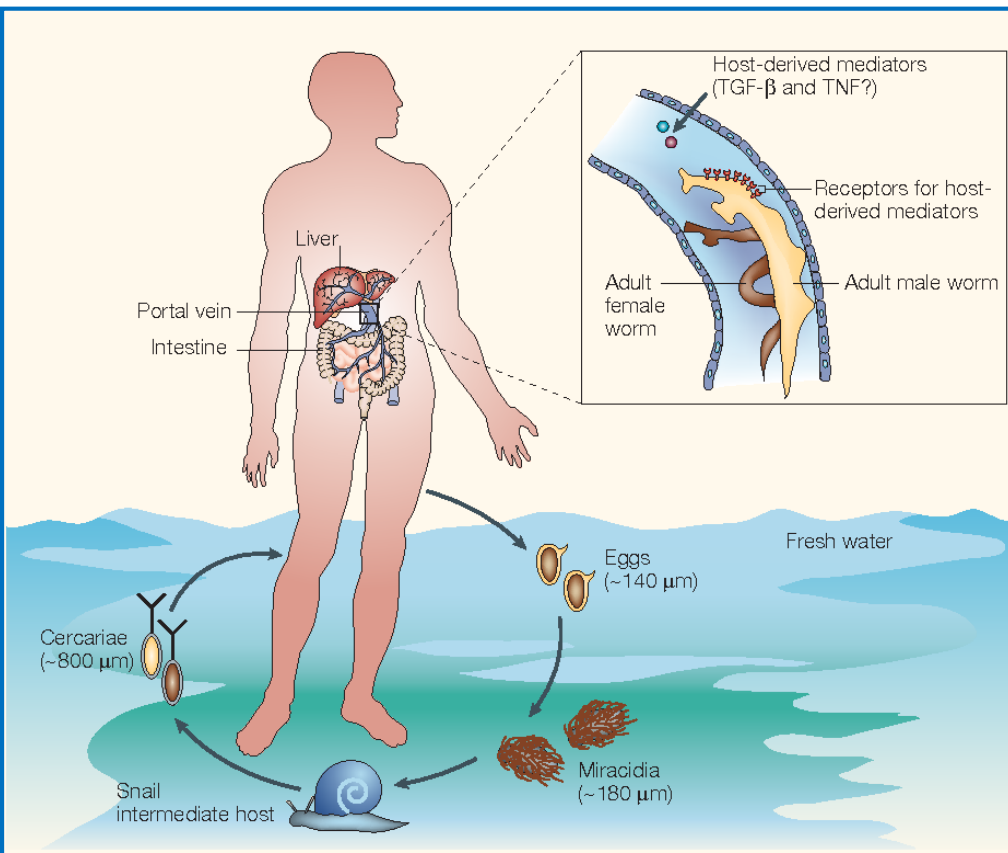
In another study on Schistosomiasis otherwise termed Bilharzia, we compared three diagnostic methods of diagnosis in Oba, a rural community. Urine samples from 420 pupils from Schools in Oba Community were examined for schistosoma infection by comparative heamaturia diagnostic chemical reagent strip, and centrifugation methods and visual examination. Structured questionnaire based on the knowledge, attitude and practise (KAP) was adopted for eliciting patients' information. Of the three methods, concentration methods (177, 42.1%) revealed the highest ova than chemical reagent methods (142, 33.7% compare to visual methods (134, 29.5%). Overall prevalence of Schistosomiasis is 42% though there was less prevalence of Schistosomiasis (36.8%) in female than (48.0%) males presenting with haematuria ($p < 0.05$). Children ages 10 –

13 are often mostly infected hence the urgent need to strategize effective control measure and creating awareness of the disease in the community. The visual or macrohaematuria method may be influenced by several factors, such as malignancies, trauma along the urinary tract, use of local herbs and or fasting. The conclusion for this study is that urinary schistosomiasis is still actively being transmitted in Oba community and thus there is need for urgent control



measures with proper awareness in the whole community.

Structured questionnaire based on



Furthermore, Mr. Vice-Chancellor Sir, the Anthropometric indices of children suffering from schistosomiasis in Eko-Ende, Osun State was evaluated. Urinary schistosomiasis in African children particularly among Nigerians has been associated with pronounced protein energy malnutrition and impaired physical growth of the affected children. Here, we sought to investigate the correlation between the anthropometric parameters (children's age, weight, height and nutritional status) of 462 school age children in Eko-Ende community in Osun state following ethical clearance.

Diagnosis of *Schistosoma haematobium* was done by microscopy as described by Piekarski, 1989) while height (cm) and weight (Kg) were measured using standard methods. Results showed that males were more infected compared to the females. And there is a highly significant figure of anthropometric indices among the infected individuals than the control group; as more children with heavy intensity of infestation were severely stunted in comparison to the lightly infested group; though there was no feasible difference in degree of wasting between these two groups.

Table 1 Age distribution by sex of studied population

Table 2 degree of infectivity by Sex.- more males (56.7%) infected than females(43.3%)

Table 3	Height for age and control (stunting). 48% of infected pupils were severely malnourished. The more malnourished the child, the higher the chances of infectivity
Table 5	Weight for age (underweight) – No significant difference between level of infectivity and weight for age when compared to the control
Table 6	The nutritional status of children infected with <i>S.haematobium</i> based on weight for age, Z scores (underweight) was not significant; $p>0.05$

Our results is in accordance with several others, that have shown *S haematobium* to be associated with low weight for height in children and adults by inhibiting growth, especially in children (Stevenson, 1987; Stevenson et al 1985).

This study has generated some useful pieces of information vital to planning effective and sustainable interventions against the transmission of urinary Schistosomiasis.

Emphasis must be placed on dietary education for parents and teachers, and provision of portable water for all must be a priority. Several efforts at killing the snail intermediate hosts will be helpful at reducing disease burden. In addition, all infected children must be treated as this leads to gain in weight and height.

Mr. Vice-Chancellor Sir, the next area of my research was on helminthes, mostly round worms and we started with the recovery rate of intestinal parasites using conventional methods in Ibadan. Parasitic infections due to intestinal parasites could pose major health hazards, thus effecting the health of the population through malabsorption, diarrhea, stunted growth in children and impaired work capacity. Other symptoms may include dysentery (with blood and mucus) itching around the rectum or valve, stomach pain or tenderness, weight loss and worms may be passed in the stool. Microscopic examination, the stool specimen is the cornerstone of detections of intestinal parasites in Parasitology laboratories. Five different techniques viz, wet preparation method(direct saline and codine mount), Brine floatation, formol Ether Techniques, Katokats techniques and stoll technique. All the routine stool samples, 232, that come to the parasitology Laboratories of the University College Hospital(UCH) from April to September 2005 were analysed by the different techniques. 58 of the 232 samples were positive for the parasites, thus a prevalence of 25% was obtained in this study.

Brine Floatation recovered the highest number of parasites 40(69%), followed by formol Ether concentration 32(55.2%), Katukatz recovered 28(48.3%), but could not recover any protozoan parasiteds. Stoll technique recovered 22(37.9%) parasites, and wet preparation detected the least number of parasites, 12(20.7%).

Table I and II showed the % prevalence of the individual parasites and the sensitivity of the techniques. *Ascari lumbricoides* showed the highest individual prevalence. An overall prevalence of 25% obtained in this study is low as compared to data from Ilorin 70.8% (Awogun) and Lagos 89.5%(Oyerinde et.al). This result is however constant with result from Abeokuta 25.6%(Okodua et.al. 2003), and from dhofor region with a prevalence of 25% too(Idris et.al 2001). None of the methods could single handedly detect all the cases observed in this study. None was applicable for trophozotes and cysts of protozoa and eggs or larvae of helminthes. It is therefore recommended that Brine Floatation technique should be added to the routine wet preparation in most African Laboratories, including the UCH, for greater accuracy (Ogbolu et.al. 2008). This low prevalence maybe due to public awareness, improvement on environmental sanitation and possibly prior chemotherapy.

Table 1, 2, 3

In addition sir, still on these intestinal parasites, we looked at helminthiasis among school children in Oshogbo. Human intestinal helminth parasites are worms that use the human body of the gut as their habitat. They are among the most common infections occurring throughout the developing world, especially the sub-Saharan Africa, where socio-economic factors, poor sanitation, malnutrition and ignorance encourage transmission of infections. Between 500m-1billion people are estimated to be infected worldwide (WHO 1987). Although helminthiasis is endemic in Nigeria, it is usually a neglected common parasitic disease of childhood. Surveillance for helminthiasis is therefore important in establishing endemicity and in the planning of control interventions. Osun state have many unsampled areas and those areas sampled have no definite data on factors that have influenced the prevalence of the disease.

Thus, a study of intestinal helminth parasites was carried out in three Primary Schools in Osogbo metropolis(Table I)between January-October 2007. Faecal samples from 479 pupils were examined using direct smear and formol ether concentration methods of which 365 (76.2%) were positive. Helminth parasites identified included *Ascaris lambricoides* (50.7%) hookworms(23%) *strongyloides stercoralis* (0.85%), *Trichuris trichiura*(0.42%) and *Schistosoma mansoni*(1.37%). Co-infections of *Ascaris lambricoides* and hookworm (3.34), *Ascaris* and *T. trichiuria* (0.21%), and *Ascaris* and *S.Mansoni*(0.63%)Table II Age group 5-10 had the highest age specific prevalence(Fig III) and also the arithmetic mean of egg count. None of the parasites was sex dependant.

Since both male and females harbored the parasites in varying degrees the infection rate was significantly higher in public schools than private ones. The prevalence of over 50% for *Ascaris limbricoides* in both sexes suggest that the problems of unhygienic practices and low standard of sanitation were not restricted to any group in the study sites. This is high by WHO standard. The debilitating effects of helminthiasis on school children are many, and they include kwashokor, emaciation, fatigue and mental dullness(12). These features were observed physically among none of the subjects. The need for concerted periodic education in healthy living habits, mass treatment of the students and improvement on the provision of portable water to the community.

Table I, II, III

Finally in this section, we looked into the level of contamination of soils in Ibadan. Soil transmitted helminthiasis infection are common chronic human infection worldwide(1.2) and this has been recognized as an important health problem, particularly in under developing countries(3.4). Children in developing countries become most important vulnerable swap to these infection since they usually play within the grounds (5). Feecal examination for intestinal parasites gives result that really do not directly indicate the extent at which people are at risk but simply demonstrate duly the point of prevalence. Therefore, soil contamination by parasites seems to be the most direct indication of risk (Uga et.al., 1997)

To determine the prevalence of soil transmitted helminthiasis in Ibadan, a total of 102 soil samples were collected from different sources, ranging from refuse dump, vegetable farm, school playground, abattoir, hospital, vicinity of homes, gutters and the road sides in five local government areas of the City. (Table 1)

Two different methods of concentration oval/cysts of parasites were used to analyse the samples, the zinc sulphate floatation technique, and concentrated glucose solution method. Result indicate that of the 102

samples collected, 57(55.9%) were positive for ova, cysts or larvae of one or more parasites. Hookworm was the most frequently encountered with a prevalence of 28(27.5), strongyloides stercoralis 15(14.7%) 20% Entamoeba histolytica 14(18.7%), Ascaris limbricoides 13(17.3%), and Trichuris trichiura 5(4.9%). The South East local government recorded the highest level of parasitic contamination 6(33.3%). Soils sampled from refuse dumps were the worst contaminated with 14 out of 18(77.8%). This study has revealed the high level of parasitic contaminant in the soils sampled in Ibadan, and is epideminological significant. The study is similar to previous studies (1) Dada and Belino, 1979; Ajayi and Duhlińska (1998) in Nigeria, and Van Ncekerk et al (1979) in South Africa. Eggs and ova of parasites can be transferred to vegetables, then on to the hands and transferred directly into the mouth, or ingested by eating raw vegetables, especially carrot in this environment, Intestinal parasites have been found to adhere to vegetables, fruits, fingers utensils and money (Crompton and savioli 1993).

Generally, diseases by intestinal parasites can be significantly reduced by the provision of pipe borne water, zero and near zero indecent open defecation, the use of vinegar (5% acetic acid in washing vegetables, avoidance of the use of night soil as garden fertilizer and general hygienic practices.

Tables 1, 2, 3

Mr. Vice-Chancellor Sir, we evaluated the prevalence of some lesser protozoan diseases, like Trichomoniasis (a sexually transmitted disease) in Osogbo, and toxoplasmosis in Lagos. Sexually transmitted infections are those passed from one person to another through sexual contact via vagina, anal or oral, and could be caused by bacteria, viruses, and or parasites. Trichomoniasis, caused by Trichomonas vaginalis, a Protozoan parasite is a very common sexually transmitted disease. Symptoms varies, being mild or rare, and most people are barely aware they are infected. The status of this disease prior to this study was unknown in Osogbo, as against information from Benin City (Okaka and Ogboe-Obanor,2006), Bauchi(Oyawoye et al,1995), Ekpoma (Nmorse and Daudu 1994), Harare(Manson and Forman 1980), and WashintonUSA(Hooton et al, 1990). This study was thus designed to provide base line data on the overall prevalence of Trichomoniasis in Olorunda local government area which includes Osogbo.

A total of 882 individuals made up of 794 (90.03%) females and 88(9.97%) males were examined in Osogbo, between January 2005 and March 2006 from various health centres for Trichomoniasis.

91 (10.3%) and 106 (12.02%) prevalence of Trichomonas vaginalis were reported with the wet mounts direct microscopy and modified oxoid culture medium method respectively. However, there was no stastically significant difference in prevalence ($p>0.05$). Infection rates were significantly higher ($p<0.05$) in females than in males. The clinical symptom of vaginal discharge (VD) recorded the highest prevalence (52.83%) which was statistically significant compared to other clinical signs in the study.

We recommend that due to the frequent role of asymptomatic men in spreading of trichomoniasis, control of this infection necessitates examination and, if necessary, treatment of male sex partners. Delay of sexual initiation, avoidance of sexual promiscuity and consistent and correct use of condoms could be effective ways of interrupting the transmission of these infections, most especially among our youths.

The mortality rate of Toxoplasmosis the second lesser protozoan disease is very low in adults, but it could cause devastating effects including eye blindness, neurological impairment to and mental retardation in congenitally infected children, Despite, the untold hardship caused by this parasite on the children of infected women, information on the seroprevalence of *Toxoplasma gondii* in Lagos is limited. 276 pregnant women attending antenatal clinic for the first time were screened for Toxoplasma antibodies using Enzyme immunoassay and structured questionnaire used to obtain information on risk factors associated with the infection

Out of the 276 women tested, 21 (7.6) and 90 (32.6) has toxoplasma IgM and Toxoplasma IgG respectively. Toxoplasma IgM was common in the first trimester (16.7) while Toxoplasma IgG was seen mostly in the third trimester (46.7). Seroprevalence of Toxoplasma IgM and IgG was seen to be significantly associated with parity ($p < 0.05$). Toxoplasma IgG were found to be significantly associated with age of the women. Histories of farming, still birth, eating or raw vegetables were associated with seroprevalence of Toxoplasma IgG. The results of this show that the seroprevalence rate is still low and there is need to include the testing of Toxoplasma as a part of the antenatal investigation done on pregnant women and to educate women about the risk factors that lead to Toxoplasma infection in order to reduce congenital malformations and death as a result of these infections. We recommend the testing of Toxoplasma as part of antenatal investigation, and education of pregnant women on the risk factors associated with Toxoplasma infection.

MOSQUITO CONTROL

Mr. Vice-Chancellor Sir, mosquitoes transmits various disease pathogens and therefore a reduction of mosquito population will positively impact on the diseases transmitted. Vegetation and plant foliage routinely provide mosquitoes with safe, sheltered resting sites and also sources of food. Adult male and female mosquitoes must regularly consume carbohydrates for a variety of activities (Foster 1995), and they ingest sugars or plant origin (Schlein and Muller, 1995, Burkell 1999). Thus, the use of insecticides to treat plant foliage provides a means of adult mosquito control breed on their need to ingest sugar meals and to rest, which can result in increased exposure duration based on their natural behavior. Recent studies have focused on evaluating the toxicity of different insecticides on foliage against various species of mosquitoes (Xue et al, 2006; Xue, 2008). Pyrethroids are the most common insecticides being used for adult mosquito control because of their short persistent in the environment, high level of potency against a wide range of arthropods, low application rates, and low toxicity to most vertebrates. It is therefore essential to evaluate the capabilities of the various forms of pyrethroids commercially available. This study was to investigate application of pyrethroids (permethrin, d-phenothrin and resmethrin) to vegetation to evaluate residual efficacy on treated leaves by laboratory bioassay, and also correlate the bioassay results with residual content of insecticides in leaves as determined by gas chromatography/mass spectrometry (GC/MS).

All treatments produced 100% mortality (24h) of mosquitoes in test cages placed within the vegetation. At 48 h and 1 wk post treatment, insecticide treatment resulted in 70 -100% reduction of adult mosquitoes caught by Centers for Disease Control and Prevention traps baited with 1-octen-3-ol. Insecticides residues in excised leaves from both treated and control areas of the study sites were evaluated against adult female *Culex quiquefasciatus* by laboratory bioassay. Permethrin produced 90% mortality up to 1 week post-application. Both d-phenothrin and resmethrin produced nearly this level of mortality for a much shorter duration of < 48 h post application, with residual effects dropping thereafter. Average insecticide concentrations in leaves were quantified by gas chromatography/ mass spectroscopy, and some correlation was observed between chemical

biological results. This study, has demonstrated and confirmed, that treatment of leaves with a water-based permethrin product, provides efficacy against *Cx. Quinquemaculatus* For >1wk application. Rather than limiting barrier treatments to the use of pyrethroids only, the use of several different classes of insecticides with short-to medium-term residual effects, in intermittent rotation, may decrease the ease of development of insecticidal resistance by mosquitoes. This is the first report we are aware of for d-phenothrin and resmethrin. The application of insecticides to plants/vegetation as barrier sprays, when used in conjunction with other controlled measures may become an integral part of a broad management scheme for mosquito control. Within an area, the most appropriate time to use barrier treatment must be determined. Also, adequate care must be taken to avoid a situation where mosquitoes develop resistance to specific insecticides from prolonged or repeated exposure. The bioassay method or procedure used in this study which examines the time of death at a single insecticide dose, rather than mortality at a series of doses is easier and more economical to use than WHO 1992 method of bioassay, as already adopted by Ocampo et al (2000) and is hereby recommended for use in routine surveillance.

Mr. Vice-Chancellor, looking inwards, we decided at least to look into the population dynamics of mosquito larvae in waste tires in Ago-Iwoye, Nigeria. Mosquitoes inhabit almost all water containing vessels ranging from household water storage containers, to waster cans, and discard tires, thereby causing various serious health hazards and possibly outbreaks. Mosquitoes are vectors of diseases like malaria, yellow fever and wart wile virus. Discarded tires are microhabitat for larvae of multiple species of mosquito. Between August to October 2011, 15 locations containing discarded tyres were samples fortnightly for mosquito larvae which were bred in the laboratory to the fourth instar, and then identified using the fractional keys of Prtt and Stojanvicj (1967). Results revealed the Genus composition of five mosquitos. *Aedes* sp had the highest population of 54.5%, followed by *Culex* sp 23.4%, *Anopheles* 10.1%, *Toxorhynchitis* 6.4% and *Othopodomyia* 5.5%. Public education initiative should be high for all those who keep containers that could hold water for mosquito breeding. Both *Aedes* and *Anopheles* species, very high in the study portends the dangers of yellow fever and increased malaria.

Mr. Vice-Chancellor sir, malaria, which is endemic in Nigeria is the most important disease in the world today. The World Health Organisation is determined to eliminate this disease in specific areas, especially Africa and thus eradicate same disease from the world with a deadline of 2030. All current control measures against malaria in Nigeria added together cannot achieve this feat. We have to change our strategy. Worldwide, specific measures aimed at the vector of pathogenic diseases have always been successful. Therefore, I strongly advocate integrated vector management or mosquito management to be the major trust for malaria control in Nigeria. For the disease Malaria to be established, three dancers must be present, i.e. Man, Parasite and Mosquito. The strongest arm of the triad is the parasite, since it has to undergo development in both man and mosquito, while man is that arm that suffers mostly from the presence of the parasite in his tissues. The mosquito however, and though the weakest link, enjoys life when sucking man's blood which is necessary to mature her eggs, and when transmitting sporozoides to man for further development in the liver and blood. Attachment of merozoide to red blood cells leads to destruction of RBC, debilitating disease and death. Of all the aetiological agents of malaria, *Plasmodium falciparum*, is the master executioner because it attacks red blood cells of all ages. A man having malaria is in a dance, either for life, and if care is not taken, with proper treatment, for death. A program of mosquito destruction will impact positively on the more than 11 pathogens transmitted by mosquitoes.

The global strategy, by the WHO (2018) is to eliminate Malaria from the world and gave a time frame for its actualization fixed between 2016 – 2030. Malaria, caused by Protozoan Parasite Plasmodium sp, and transmitted by Female Anopheles mosquito is the most important infectious disease in the world. Why is this so? This is because of the burden of disease on humanity.

YEAR	MORBIDITY(M)	NO OF COUNTRIES	MORTALITY
2010	200	106	655,000
2016	216	94	411,000
2017	219	87	435,000

WORLD'S BURDEN OF MALARIA

Approximately, 70% of the world's malaria burden is concentrated in 11 countries, 10 on the African continent, plus India.

Burden in Nigeria.

- Including - 25% of world's burden
- 60% of hospital visits
- 30% of hospital admission
- About 15% of school absentism

BURDEN IN AFRICA

- 92% of world's cases
- 93% of world's death
- <5 children accounted for
- 61% of all deaths worldwide

Thus Nigeria is a high burden country.

The Global Technical Strategy calculated \$6.6b per year as from 2020, in order to achieve elimination and eradication worldwide

Major/Current control methods in Nigeria.

- ITN – Insecticide Treated Nets
- IPTp - Intermittent Preventive Treatment in Pregnancy
- IRS - Indoor Residual Spraying
- CM- ACT with RDT testing: Case Management with Rapid Diagnostic Test.

The current status for each if these control methods are :

ITN - 35 – 45% Uptake

IPTp- Very adequate, except if the pregnant female does not attend any maternity Centre or hospital.

IRS- < 2% it rarely took off.

Case Management- ACT is drug of choice by regulation.

All of these methods will definitely not eliminate or eradicate Malaria in Nigeria. What then should we do?

My advocacy on this started with the publication of an article titled **“Beyond Fighting malaria with drugs and treated Nets”** on 29th October, 2009 (Punch News Paper). The initiative to write was from experience obtained from Anastasia Mosquito Control District. (AMCD), St Augustine Florida (2006 – 2007) while on Sabbatical Leave. I also presented a paper “Beyond fighting malaria with drugs and treated Nets: Advocacy for total integrated vector management” at the International Conference on Parasitology, 2015 in Philadelphia, USA.

Highlights

- Malaria burden is high in Africa especially Nigeria
- 86% of the 247 million with clinical malaria is from Africa.
- Man, mosquito and parasite are the critical factors in the epidemiology.
- Case study- Florida. 64 of 67 countries have Mosquito Control agencies, established by law, with funding principally by mileage fees on all properties in the county.
- Main mandate is to kill mosquitoes by scientific strategy of using several means in an integrated fashion - surveillance source reduction, chemical control, biological control interagency cooperation.
- The Brazil experience: 14,000 people died within 8months after accidental introduction of *Anopheles gambiae*.

A mosquito destruction law already exist, signed on April 25, 1945 by the Southern Protectorate. This law was reenacted by the Western Region in 1945, CAP 79, and Oyo State in 1979, CAP 75. This law called for the destruction of mosquitoes with a legal notice for the appointment of Sanitary Inspectors.

- Funding to be participatory, with a feeling of ownership by all residents in the Local Government Area. My proposal for funding is as follows:
1. Based on the population of Nigeria as 201m (UNPF, 2019), and the fact that 70m Nigerians are contributing to Pension Fund, we can source for a dollar a month from 100m people on regular pay to subscribe to a Mosquito Responsibility tax or Mosquito Malaria Tax, on a monthly basis. \$ 1=N350.

For a year \$12 = N4, 200 /person /year

N4, 200 x 100,000,000 = N420b.

Divided by 774 LG = N542, 635,658/year

~ N45, 219,638/month/LG

Activities of each LG will include Surveillance, Source reduction, Biological control, Chemical control, and Inter-agency Cooperation, and operational research.

2. All elected, appointed officials into political office must show responsible leadership in this scheme. Thus 20% of all their allowances should be checked off to the Mosquito Fund. They will also pay their one dollar/month from their Salaries.
3. For the first two years of this integrated mosquito control initiative, a minimum of 1% of all corporate bodies turnover or profit should be for Mosquito control, especially for physical structures and equipment to kick start the program

4. All properties (buildings) will pay ₦ 100/=~~₦~~ 200 for private residential and public/commercial respectively.

A re-enacted law, prepared by legal luminaries and midwived by the Association of Local Government of Nigeria(ALGON) must be in place to cover the whole country. Such a law will be the first by the people as different or distinct from top to bottom laws we are used to. When all these are in place, Nigeria would have fulfilled the high burden; high impact slogan of the world's efforts to get rid of malaria.

Generally, the country will need a strong political will to do this, as government will allow such laws and be bound by the law. Also the program will generate employment for young graduates i.e. between 15-30 of such cadre of people for appointment in each LGA (Local Government Area).

In conclusion, Mr. Vice-Chancellor Sir, I like to ask a question. Can a man be a parasite? I have always wondered if there exists a relationship between parasitism and corruption. The former is an association with a host which could be one of mutual benefit, (mutualism), when one benefits with no harm to the other (commensalism) and when one gains at the expense of the other (symbiosis). The latter, corruption is the use of position of authority for personal gain or illicit or undeserved benefit. To my mind therefore, corruption is akin or synonymous to parasitism of the symbiosis type. I stand to be corrected. Equally too, I will apologize if proven wrong. Thus, to me, any corrupt person is a PARASITE or HYPERPARASITE or SUPERPARASITE, depending on the quantum of the parasitism, largely because of the quest for acquisition fueled by greed. Examples are too numerous to mention. How do you explain the disappearance of a budgeted sum of \$16m meant for purchase of ITN for children less than 5 years and pregnant women (Punch 2019)? Kudos to the famous first lady who wanted a few of those nets for the use of her village people. Of course, she was not given, and probably because the nets were not bought in the first place, and of course, what was not available could not be distributed. Thanks to parasites *in situ*. This scenario plays out in virtually all facets of life in our dear country, with no exception at all. The first lady actually opined that \$16m was enough to fumigate the whole country to kill mosquitoes. The amount of money is not important, but the recognition that fumigating the whole country would kill mosquitoes.

If we do not kill corruption in Nigeria, and indeed the whole of Africa, corruption will kill us. This logic also plays out with respect to malaria.

A combination of malaria control methods without the constant, consistent and conscientiously executed destruction of mosquitoes will never lead to elimination nor to eradication. It is therefore up to us to either dance in the forest of life by killing mosquitoes before malaria kills us, or to dance to death by depending on measures that scratches the problem on the surface. At 59, going 60, our dear country Nigeria has come a long way, despite serious challenges in health, education, food production and security, and electricity. All these areas are grossly deficient in meeting our aspirations and desires. However, all hopes are not, and should not be lost. We need to have all hands on deck, galvanized by determined and purpose driven leaders. We have achieved little, but still have much more to be done.

God bless Nigeria.

Finally, in this inaugural lecture, I have highlighted some, definitely not all of the researches conducted on livestock ticks of cattle and also several parasites causing debilitating diseases in man. We cannot afford to

dance to death, simply because most parasitic diseases are both preventable and curable. As inhabitants of mother earth, I choose to dance for life; what about you?

Recommendations

1. It is recommended that the infection and treatment method, as was done for *Theilaria parva* for east coast fever be repeated for all the other protozoan parasite causing diseases like Babesiosis, Anaplasmosis and Erlichiosis, etc, for profitable livestock production.
2. A national emergency should be declared for malaria, and all efforts for eradication/elimination should be targeted towards the 2030 deadline. To this end, governments political will is paramount and this is demonstrated by the adoption of integrated vector management (mosquito destruction) as the major thrust. Mosquito agencies must be domiciled in every local government area, and are autonomous.
3. Schistosomiasis (flat unsegmented worms) is preventable by the provision of portable water round the clock and elimination of the snail intermediate host. Helminthic (round and flat segmented worms) infections could be controlled by the elimination of the intermediate hosts, if necessary and regular deworming of school age children in every local government area.

ACKNOWLEDGMENTS

Mr. Vice Chancellor Sir, kindly permit me to do this with respect to groups that I belong to. To God be the glory for all He has done in my life. Who am I to say or talk of any achievement but by God's grace? Thank you Father, for the past, the present, and surely for the future. Take all the glory, the adoration and the praises, and all my worship, because they all belongs to you.

MY PARENTS

My parents, Sir Augustine Popoola and Lady Theresa Adeyemi Amoo, of blessed memory, deserves special mention. They gave us, the children, everything they had. In their different ways, they taught us about life, ethics, and the attributes of love, honesty, discipline, hardwork and friendliness. Our parents were rich in goodness, and they passed on at ten years interval of each other, and I thank God for enabling us to take good care of them at their last moments. May they continue to rest in the bosom of the Lord, Amen .

MY TEACHERS

Teachers are trained minds, and are in the business of impacting knowledge to others, for their good and for the good of others in the community. I appreciate and salute all my teachers at the primary, secondary and tertiary levels, both living and the dead. My special recognition goes to Prof Ogunlesi, the first African Professor of Medicine at the University College Hospital, who, after reading my article on malaria control, came looking for me. I gained and also learnt so much from our discussion of more than 3 hours, and I wondered the kind of energy he must have had as a young doctor, if he was that strong and cerebral at 86. This was in 2009. May you continue to live long sir. My teachers at the Veterinary Faculty, University of Ibadan, were vibrant, intelligent, hardworking young men and women, who were readily accessible and very friendly. For me, these characteristics were all I needed in making up my mind on what to do after graduation. Four years after, I became a full member of same Faculty. Special mention must be made of Prof Oladipo Oduye, who brought me into research and supervised my Master's dissertation. He has been my Father figure up till

now. We will celebrate many more years of your birthdays. How I wish that Prof Olusegun Dipeolu were to be alive today. May your soul rest in peace Sir. He supervised my PhD in Tick bionomics, inculcated in me, a culture of hard work, both in the field and the laboratory, and he encouraged me to be prolific in writing as he was. He was my boss in Nigeria as well as in Kenya, at the International Centre for Insect Physiology and Ecology (ICIPE), the appointment which could not have been without his input. He nurtured me well, and brought me up like a son, which I actually was anyway.

These other Professors, had, at one time or the other, done or said or helped me one way or the other. Profs Akinboade, Majaro, Ojo, Adetosoye, Ogunrinade, Aire, Osuagwu, and Oladosu. Thanks to you all.

Finally, among teachers, I would like to acknowledge a Prof Lawson, then of the UCH, who refused us admission to study medicine on flimsy excuses which bothered on our appearances. Little did he know that he was pushing us to our areas of fulfillment. Thank you too.

FAMILY

Uncles and Aunties to me, are like shock absorbers, and they were always there for me as fall back options. Unknown to them, I was visiting them on rotation anytime and all the time I was broke. None of them ever turned me back empty handed. May God continue to bless and keep you, and shine His face of mercy towards you, Amen. My Uncles are Mr Fidelis Amoo, Mr Akinbola Akintola, and Mr Akinsola Akintola. My Aunties are Chief Mrs Lanre Abimbola, wife of Prof Wande Abimbola, the AWISE of the world; and Chief Mrs Mosun Adegbola, wife of Late Mr A Adegbola, retired Permanent Secretary, Oyo State.

SIBLINGS

MRS AJIBOLA PALMER, MR PATRICK ADEGBOLA AMOO (UK), AND MARCELINA ADENIKE ABIDOYE (US)
MY SOCIAL GROUPS

The AMITY GROUP consisted initially of young, upwardly mobile men in various fields of endeavours. We all went through life as it came, and now grandfatherism has knocked our doors. Thank you for being here.

ROTARY CLUB OF IBADAN

Rotary International is a world wide humanitarian organisation established for doing good, and that of Ibadan is an affiliate. Rotary stands for the truth, fairness, goodwill and friendship, and benefits to all concerned. I am honoured with your presence, thank you.

IRC(1902)

Ibadan Recreation Club (1902) is a meeting place for physical exercise, relaxation, business, and friendship. The club is another home away from home. Thank you for coming.

SILVER KNIGHTS CLUB

Established about thirty years ago by five friends, who sought for a platform to share and condense ideas about family issues. Our wives are called Damsels. It is primarily a family club. I appreciate your presence.