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MANSONELLOSIS IN THE UPPER IMO RIVER BASIN, NIGERIA.

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ABSTRACT

The Upper Imo River Basin is endemic for mansonellosis due to *Mansonella perstans*. No case of *M. streptocerca* microfilaraemia was found in the studied population. The prevalence of *M. perstans* microfilariae in the area was 12.5%. Microfilaraemia was higher among older individuals and there was no significant difference in prevalence between sexes. The overall mf GMI among mf positives was 98 mf/ml (103 mf/ml for males and 92 mf/ml for females). There was no significant difference between the overall mf GMI in males and females (t-test; $p > 0.05$). It is generally believed that mansonellosis due to *M. perstans* does not cause any serious clinical sign or symptom, and consequently there was no examination for clinical manifestations related to this infection in the Upper Imo River Basin of the studied population.

KEYWORDS: Mansonellosis, Imo River, epidemiology

INTRODUCTION

Mansonellosis due to *Mansonella perstans* is widely distributed in Africa, the Caribbean and Central and South America (McMahon and Simonsen, 1996; Gelfaud and Wessels, 1964). Mansonellosis due to *M. streptocerca* is the only other species found in Africa but (mansonellosis due to *M. ozzardi* does not exist in Africa) (Duke *et al*, 1948). Of the two *Mansonella* species present in Africa, *M. perstans* is better distributed and better studied.

M. perstans is arguably the most widespread human filaria' infection in Nigeria. There is probably a high endemicity of mansonellosis in the coastal and mainland areas of Niger Delta. It is also the predominant filarial species in Calabar (Useh and Ejezie, 1995) from where it forms an epidemiological continuum with neighboring rainforest Cameroun, which is reported to have high prevalence of about 50% (Anderson *et al*., 1974). Similarly, high prevalences have been reported from studies in other parts of the Niger Delta area (Arene and Atu, 1986; Udonsi, 1986), and among the Igbo populations of Abia and Imo States (Anosike *et al.*, 1992).

M. perstans is generally non-pathogenic (McMahon and Simonsen, 1995). However this filarial species is increasingly being associated with clinical filariasis in some endemic areas. These include transient swellings resembling calabar swelling (Useh and Ejezie, 1995), pruritus, fever, pain in the bursae, abdominal crams especially in the liver regions, nodules in the conjunctiva, swelling of the eyelids and proptosis (Baird *et al*, 1988), ocular lesions (Owen and Hennessey, 1932) or general ocular involvement (Useh and Ejezie, 1995) and elephantoid scrotum (Arene and Atu, 1986; Onwuliri *et al.*, 1988). Microfilariae may cross the conjunctiva (Ashton and Cook, 1979), and have also been found in the hydrocele fluids (Wijeyaratne *at al.*, 1982). Other clinical manifestations reported to be associated with mansonellosis due to *M. perstans* include eosinophilia, joint pains and nervous exhaustion (Clarke *et al*, 1971); cardiac failure, pericarditis, enlarged liver and spleen (Gelfaud and Wessels, 1964); and inversion of the central nervous system (Duke *et al*, 1948). Also included are: febrile attack, and skin eruptions (Udonsi, 1986), swelling of the eyelids and conjuctival granulomas (Baird *et al.*, 1988), and histopathologic features in tissue sections (Baird *et al*, 1987). Generally, immigrants from non-endemic areas are more prone to disease manifestation than natives of the endemic areas. This apparent difference in the ability of *M. perstans* to illicit clinical manifestations from one area to another may be related to the possible existence of distinct *Culicoides*-parasite complexes (Anosike *et al.*, 1992). The possible contribution of *M. perstans* to chronic clinical filariasis needs to be reevaluated.

Mansonellosis due to *M. streptocerca* has a more limited distribution, especially in Central and West Africa. Furthermore, it differs from *M. perstans* infection in that both the adult worm and microfilariae inhabit the dermis, hence causing mostly dermal, clinical manifestations. Dermatitis due to *M. streptocerca* is characterized by pruritus, hypopigmented macules and papules, mostly over the thorax and shoulders. (Meyers *et al.*, 1972).

In the Upper Imo River Basin mansonellosis has not been studied. This study was aimed at ascertaining the prevalence and microfilarial intensity of *M. perstans and M. streptocerca* in the area. This report is part of a comprehensive study on the epidemiology of filariasis in the basin by the Danish Bilharziasis Laboratory and University of Port Harcourt Joint Project.

MATERIALS AND METHODS

The Study area

The Imo River Basin (IRB) is located in the south-eastern region of Nigeria, lying between latitudes 4.4° and 5.8° North, and longitudes 7.0° and 7.8° East. It traverses three States: Imo, Abia, and Rivers. From the derived savannah in the upper part it extents through the rainforest vegetation to the mangrove swamps at the Atlantic Ocean.

Studies in the Upper Imo River Basin were carried out in two neighbouring communities of Umuowaibu1and Ndiorji, which are located about 10 km northwest of Okigwe. The two communities are socio-culturally similar and are inhabited by the Igbo tribe. Familial settlement pattern was evident in the studied communities with houses arranged in clusters.

The area is hilly with characteristic undulating plains. There are 7 streams, and three rivers in the area. In addition to the Imo River the other water sources include Nkpoma Stream,

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Ngele Asaa Stream, Aluum Stream, Ngeleocha Stream, Kirika Stream, Mpiti Stream, and Ojomoko Stream, Ibu River, Ugbi River, and Nwangele River. There are also numerous pockets of natural, and man-made stagnant water pools at the banks of the rivers and streams, which are used by the villagers for processing cassava. They also serve as favourable breeding sites for mosquitoes. The villagers depend on the streams and rivers for most of their water needs. Activities normally carried out in the streams or rivers include fetching water for domestic uses, swimming, bathing and fishing. Fetched water is usually stored in drums or other plastic containers, clayey pots, and natural containers, which are normally kept under the rain tracks, most times without cover.

Farming is the main occupation. The soil consists predominantly of shale, which provides good agricultural land for intense farming activities for crops like yam, cassava, maize, groundnut, vegetables, cocoayam, three-leaf yam, banana, and pineapple. Domestic animals include livestock such as goats, sheep, chicken, and ducks; and pets such as dogs and cats. Fishing and petty trading are also popular among men and women, respectively.

According to meteorological report from the Imo State Meteorological Service, the annual rainfall for the area averaged 2840 mm per annum, with most of the rainfall in the months of June through October.

Preparations for the study

Local Government health authorities were contacted and their consent were obtained before the actual work began. The local traditional rulers and leaders of town development unions were consulted and briefed about the project. Their co-operation was sought in the mobilization of their people. Village assistants were recruited to assist in the project work in the various communities. All individuals of ages one year and above from the selected communities were included in the study population. These comprised natives, as well as non-natives who had resided there for at least one year. Natives who were working somewhere else were excluded from the survey. The targeted sample size was 1000 people.

Census and mapping

Mapping of the various study communities was carried out with the aid of the village assistants and some educated youths of the area. The approximate positions of houses, markets, religious places, major roads and some track roads, as well as water bodies in the communities were noted. General head count was conducted.

Blood sampling and examination for *M. perstans*

Day and night blood samples for parasitological examination were taken from every consenting person of one year and above. The day blood sampling took place between 0800 hours and 1600 hours. A clean microscope slide was labelled with the personal number. Using sterile lancet, 50□l of finger prick blood was taken from the left thumb and drawn into a blood pipette for thick smear preparation on the microscope slide. This was dried overnight and taken to the laboratory.

The night blood sampling took place between 2200 and 0200 hours. It alternated day and night-blood sampling were collected on alternate days. In each case, the village heads were asked to fix dates themselves. Information was passed to the villagers by their leaders during their weekly meetings, and reminders were given through the village town criers.

The thick blood smear method was the method of choice for examination of the night blood samples. From the left thumb, using sterile lancets and blood pipettes, 50□l of finger-prick blood was drawn and smeared onto clean, grease-free microscopic slides. These were left on slide trays to dry before being carefully arranged in slide racks for transportation to the laboratory in Port-Harcourt for staining and microscopic examination.

The slides with the day blood samples from the field were left to dry overnight whereas slides with night blood samples were left to dry until late afternoon of the day of sampling. They were then dehaemoglobinized by being placed in a running clean tap water for two minutes. Thereafter they were dried and fixed in methanol for a minute. All the day blood samples were then stained with haematoxylin while night blood samples were stained with Giemsa. The stained slides were examined under microscope using x40-x100 magnification of the objective. Identification was according to the keys in Learning Bench Aid No.3 (Tropical Health Technology).

Skin snipping for *M. streptocerca*

Two skin snips (one from the shoulder and the other from the buttocks) for parasitological examination were taken from each individual during day time using a Walser Corneo-Scleral punch. The biopsies were placed in micro-titre plates containing 0.2ml of 0.85% saline solution. The Corneo-Scleral punch was sterilized, after use on each individual, by respectively dipping it into five serial dilutions (50%, 60%, 70%, 80%, 90%) of alcohol. When completed, each plate was covered with cellophane tape and taken to the laboratory where they were kept for about 24 hours at room temperature (Pedersen and Kolstrup, 1986). The fixing and staining procedures have been explained elsewhere (Uttah *et al.*, In press).

Data analysis

The Epi-Info version 6.0 was used in the entering of data from the parasitological and clinical surveys, and SPSS for Windows (1995 version) was used for data analysis. The geometric mean intensity (GMI) of microfilaraemia was calculated as antilog ($\sum$log $(x+1)/n$), with x being the number of mf per ml of blood in microfilaraemic individuals and n the number of microfilaraemic individuals examined.

RESULTS

Microfilaraemia in relation to age and sex

Mansonella perstans

The results from the survey for *M. perstans* microfilaraemia are based on blood specimens collected both in the day and in the night, from every examined individual. The mf prevalence in relation to age and sex is presented in Figure 1. The mf Geometric Mean Intensity (GMI) in relation to age and sex is presented in Figure 2. Only individuals who were examined both during the day and at night were included in the analysis. Excluded from these analyses were 14 persons from whom blood specimens were collected only during daytime.

Of all examined, 12.5% (12.9% for males and 12.1% for females) were mf positive for *M. perstans* (Table1). Microfilaraemia appeared early in life, with the youngest mf positive boy and the youngest mf positive girl being 3 years of age for both. The mf prevalence was slightly higher in the adults (≥ 20 years) than in the two youngest age groups (χ^2-test; $p > 0.001$). There was no significant difference in the prevalence of both sexes and in the different age groups (χ^2-test, $p > 0.05$ for all tests).

Of the blood samples from the day survey, 10.8% were mf positive (11.4% for males and 10.2% for females). The Mf prevalence was slightly lower in the night blood samples, for which 10.1% (10.9% for males, and 9.1% for females) were mf positive. Of those who were examined both during the day and at night, 8.1% (9.0% for males, and 7.3% for females) were mf

positive both in the day and at night; 2.5% (2.0% of the males and 2.9% of the females) were mf positive in the day but mf negative at night, while 1.8% (1.6% of the males and 1.9% of the females) were mf positive at night but mf negative during the day.

The overall mf GMI among mf positives was 98 mf/ml (103 mf/ml for males, and 92 mf/ml for females). There was no significant difference between the overall mf Geometric Mean Intensity of both sexes (t-test; $p > 0.05$). The GMI in the oldest females was peculiarly high, but the sample size was small.

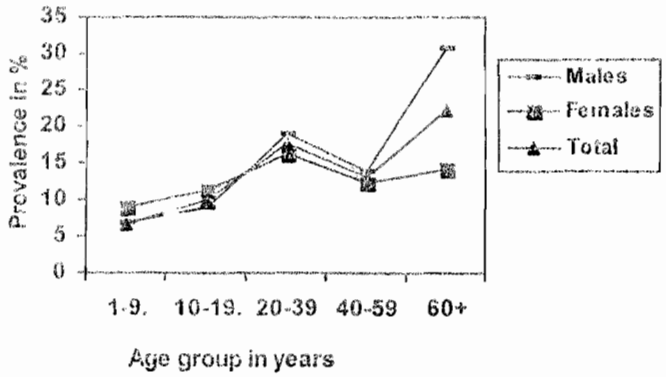

Figure 1 The prevalence of *M. perstans* microfilaraemia in relation to age and sex in the Upper Imo River Basin study population.

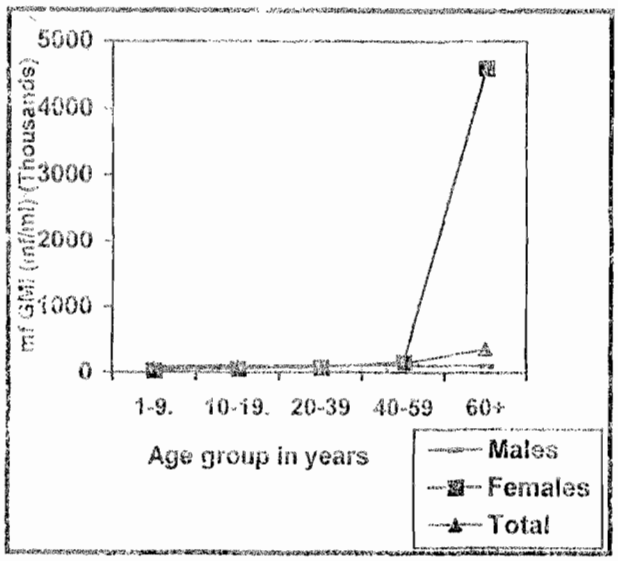

Figure 2: The mf GMI of *M. perstans* in relation to age and sex in the Upper Imo River Basin study population.

Result of Skin-snipping for M. streptocerca
The biopsies were all negative.

DISCUSSION

The prevalence of microfilaraemia among those screened twice for (both day and night) microfilaraemia was 12.5%. The closeness in level of microfilaraemia observed in the separate day and night screening exercises is expected, as *M. perstans* is not periodic. The prevalence of *M. perstans* in the Upper Imo River basin is close to that reported by Udonsi (1988) in the Igwun River Basin, but lower than the figure reported by Anosike *et al.* (1992) in some selected areas of Imo and Abia States. It is also lower than the findings made by Arene and Atu, (1986). Udonsi (1986) also reported a high *M. perstans* microfilaraemia prevalence in the Niger Delta area. That the prevalence of *M. perstans* microfilaraemia was as high in this survey, which took place months after ivermectin distribution in the area, perhaps indicates either that the pre-survey prevalence was even higher than the survey prevalence or that ivermectin had no microfilaricidal impact on *M. perstans*. This requires further research. However the latter suggestion is supported by the findings of McMahon and Simonsen (1996) that neither DEC nor ivermectin has an effect on *M. perstans* infections. Mansonellosis is of higher endemicity in the Imo River Basin than in southwestern Nigeria (Ngu and Folami, 1965); Ejezie, 1981). Moderate prevalence rates have been reported in the savannah areas of northern Nigeria (Wijeyaratne *et al.*, 1982; Anosike, 1988; Onwuliri, 1990; Ufomadu *et al.*, 1991). There seems to be a gradual increase in prevalence of mansonellosis from the northern to the southern parts of Nigeria (Sofoluwe *et al.*, 1978). This difference in the prevalence of *M. perstans* from one bioclimatic zone to another may be related to the ecological factors, which govern the breeding of the arthropod vector (Anosike *et al.*, 1992). The incidence of *M. perstans* correlated with rainfall in the Upper Volta region of West Africa (Pfister, 1952, cited by Sasa, 1976). The study revealed a high prevalence in the southern region with greatest rainfall and decreased prevalence in the northern parts with lowest rainfall. This does not explain the low prevalence of *M. perstans* in southwestern Nigeria, although it may indicate according to Anosike *et al.* (1992) that, high rainfall may be important in the breeding of the vector, *Culicoides*. This has earlier been posited by Sharp (1928). Prevalence may be higher in the urban areas than rural areas (Anosike *et al.*, 1992).

The prevalence of *M. perstans* microfilaraemia in this study was significantly higher among adults (≥ 20 years) than among children. Similar findings were made by Udonsi (1986) in Igwun River Basin, and Anosike *et al.* (1992) in selected areas of Imo and Abia States and by Anosike and Onwuliri (1994) and Ogunba (1977) in the northern and western regions of Nigeria respectively. Similarly, in the Bori community of the Nigerian Niger Delta area, prevalence of microfilaraemia increased with age (Arene and Atu, 1986). This may be related to their greater exposure mostly due to their occupations and daily engagements. As reported for bancroftian filariasis and onchocerciasis in this area, there was no significant difference in the prevalence of both sexes. This is in agreement with the findings of Useh and Ejezie (1995) in Calabar; and Akogun (1991) in northern Nigeria. Wijeyaratne *et al.* (1982) reported that sex-related differences in microfilarial prevalence were more pronounced for *W. bancrofti* than for *M. perstans* in the Malumfashi district. On the contrary, Anosike *et al.* (1992), and Arene and Atu (1986) reported a significantly higher prevalence of microfilaraemia in males than in females in Imo and Abia States and Bori Community respectively. Gender-

Only two women were positive in this age group but they had the highest individual intensities (4,940 and 4,290 mf/ml) of the entire population.

The overall GMI for mf positives from the day survey was 158 mf/ml (155 mf/ml for males and 162 mf/ml for females). The overall GMI among positives from the night survey was 145 mf/ml (141 mf/ml for males and 151 mf/ml for females), however this difference was not statistically significant (t-test; $p > 0.05$).

related occupational exposures, which vary from one locality to another, may be responsible for these differences. Bori, for example, is a fishing community with fishing being dominated by men, which exposes them to a higher risk of infection and subsequently a higher prevalence.

Blood sampled during the day gave slightly more mf positives than blood sampled during the night. This difference is not due to periodicity, but due to lower sensitivity when thick smears are used (Gubler *et al*, 1973; Akogun, 1991).

There was no significant sex-related or age-related difference between mf intensities in the Upper Imo River Basin. Incidentally the two women in the oldest age group with positive microfilaraemia had the highest mf intensities in the study population, giving a false impression. There seemed to be a relatively lower microfilaraemia intensity among women of reproductive age as has been reported for *W. bancrofti* in northern Nigeria and elsewhere (Kazura, 1987; Brabin, 1990; Anosike and Onwuliri *et al.*, 1994).

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