# THE EFFECTS OF SEASON AND DISTANCE ON THE PREVALENCE AND INTENSITY RATES OF URINARY SCHISTOSOMIASIS IN AGULU-LAKE AREA OF ANAMBRA STATE, NIGERIA

**EKWUNIFE, Chinyelu Angela**
Department of Biology, P.M.B 1734, Nwafor Orizu College of Education Nsugbe, Anambra State, Nigeria

**ABSTRACT**

***A survey of the effects of season, and distance to water source on the prevalence and intensity rates of Schistosoma haematobium infection in Agulu community of Anambra State was conducted using the primary schools in the town, using parasitological screening approach. Prevalence was similar in both the dry and rainy season months. Seven out of the 15 Primary schools surveyed had pupils with infection. Prevalence in schools with infection ranged from 4.1- 55.2 % during the dry season to 3.3-55.6 % during the rainy season. Prevalence and geometric mean egg count were highest in the 10-14 years age group in all the schools and in both dry and rainy seasons. Geometric mean of egg count / 10ml urine (intensity) decreased from 22.5 egg/10 ml in dry season to 10.7 egg/10 ml in wet season. Prevalence rates and intensity showed significant decrease with increase in the distance from the village to the lake. The implications of these are discussed***.

**Keywords:** Urinary schistosomiasis, Season, Distance, Prevalence rate, Intensity, Geometric mean

## INTRODUCTION

Quantitative urine examination techniques have in recent years replaced qualitative procedures in community studies of schistosomiasis because of the useful information provided by quantization of egg output. This is because the sensitivity of the method could be tested and the results could be expressed in terms that allow comparism with other studies e.g. geometric mean. The usefulness of quantitative technique is now recognized by national control programmes, which have achieved significant reduction on prevalence from double to single figures in large areas. The epidemiology of S. haematobium in man has been described in term of age - specific prevalence and school children have often been studied. This is because they represent he age groups at greatest risk and with greatest intensity of infections, thus providing convenient baseline data for the whole population (Forsyth, 1969, Wilkins, 1977). Thus quantitative urine examination using school children could help to give useful information on the state of urinary schistosomiasis in Agulu town during both rainy and dry season conditions. This shall help in disease control and shall allow comparison with other studies on urinary schistosomiasis from different regions.

One of the important determinants of a household's choice of water source has been reported to be distance (Blum *et al* 1987). Jones (1973) found the distance beyond which people had negligible contact with lake Volta to be 5km. Appleton and Bruton (1979) also reported that only about 1/4 of the people who live within 5km of lake Sibaya (South Africa) probably depend on it or its adjacent ponds for water and so have frequent contact with these habitats. The remaining 3/4's they reported use streams or pans for domestic purposes although some of those people may have to use the lake or ponds during winter or dry years. There is a need for more studies of that kind to evaluate the relationship between distance to water sources in endemic areas and prevalence of schistosomiasis. Such are deemed to be of great value in planning disease control programmes. The paper reports a study of schistosomiasis infection in Agulu town of Anambra State, Nigeria, where a lake implicated in the transmission of the disease is situated.

## MATERIALS AND METHOD

**The Study Area:** Agulu town (Figure 1) was purposively selected for the study because of previous knowledge of the presence of *S. haematobium* infection in the town (Emejulu 1994, Emejulu *et al,* 1994). Agulu which is in Anaocha Local Government Area is located between latitude $6^o06^/$N and longitude $7^003^/$E. Coming from the South, the land is generally a steep dive towards the lake. It enjoys tropical type of climate.

**Urine Collection and Analysis:** Parasitological screening of all the primary and attached preprimary school children in the 15 primary schools in the town was carried out between 1999 – 2000 in both dry and rainy seasons. Wide mouthed screw cap containers with numbers for identification were used to collect urine samples from each pupil in the different schools on visitation. Urine collection was made between 10.00 and 14.00h. This is the period of greatest egg out put (Stimmel and Scott, 1956, Bradley, 1963). This was done during the dry season months for 16 weeks (Nov.1999-Feb.2000) and repeated during the rainy season months for 16 weeks (May-August 2000). A simple centrifugal sedimentation procedure (5min at 5000rpm) of 10ml aliquot urine drawn from each specimen was used (Oliver and Uemura, 1973). *S. haematobium* ova in the sediment poured on a Macmaster slide were counted under X10 microscope eyepiece. Calculation of geometric mean egg count was done using the method in WHO (1987). Distance from the centre of each village to the lake, the crowflies was estimated and recorded.

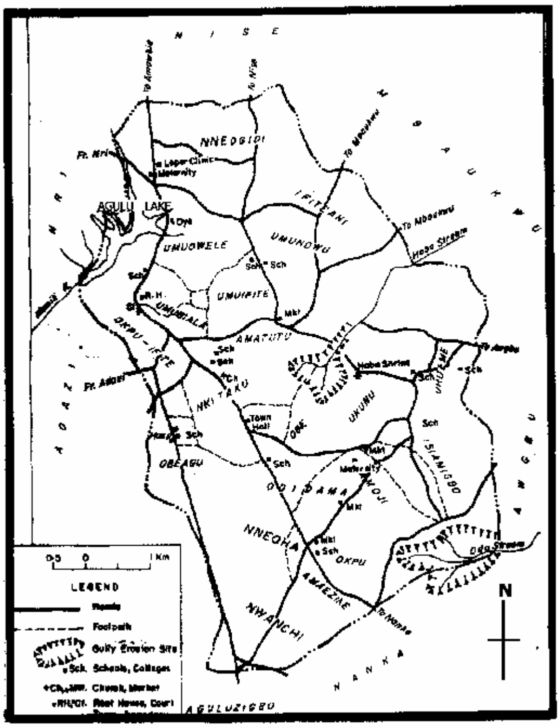


**Figure 1: Map of Agulu town**

**Data Analysis:** Dry season age group Infection Rate = Number people Infection among age group in affected school during the dry season/ Total Number of people in the age group X 100.
Rainy season age group Infection Rate = Number people Infection among age group in affected school during the rainy season / Total Number of people in the age group X 100.
Total infection for each season = Total of all infected in all school for that season / Total Number of people in all the school x 100. Age group GM = Geometric mean of all the infected individuals of an age group in all schools together.
Total GM = Geometric mean of all the infected individuals in all the schools together. In all the cases descriptive statistics was employed to ascertain the means and mean differences between season and distance ascertain using t-test.

## RESULTS

Seven schools out of fifteen had individuals that excreted *S. haematobium* ova during both the dry and rainy seasons (Table 1). The schools include Umuowelle Primary School, Umuifite Primary School, Umunowu Primary School, Nneogidi Primary School, Practicing Primary School, Ifiteani Primary School and Obeagu Primary School. For dry and rainy seasons, Umuowelle Primary School recorded the highest infection rates of 55.2% and 56.6% respectively followed by Ugwuaba Primary School with infection rates of 43.2% and 43.1% for both seasons. Obeagu Primary School recorded the lowest infection rates of 4.1% and 33.3% for the dry and rainy seasons respectively. Table 2 shows that in Umuowelle Primary School, infection rates of 29.4 %, 61.1 %, 70.1 % and 55.2 % were recorded for 0-4, 5-9, 10-14 and 15-19 age groups respectively during the dry season while infection rates of 34.1 %, 54.8 %, 73.3 % and 52.2 % respectively were recorded for same age groups during the rainy season. Infection rates for the other schools had similar patterns for both season. However, the geometric mean of egg count/10ml urine decreased during the rainy season for the different ages in the different schools. Umuowelle Primary School recorded the geometric mean (GM) of egg output of 11.2, 29.9, 48.4 and 28.5 during the dry season for the age groups 0-4, 5-9, 10-14, 15-19, respectively while during the rainy season the GM were 8.1, 20.2, 36.4 and 29.9 for same school and same age groups. Overall geometric mean of egg count/10ml urine decreased from 22.5 egg/10ml in dry season to 10.7 egg/10ml in wet season (Tables 2 and 3).

The prevalence and intensity rate among the schools in Agulu with respect to distance is shown in Table 4. Agulu lake is situated at the northwest of the town. The infection rate increased as one moved from south to north and from east to west. The number of positive cases of urinary schistosomiasis decreased as one moved away from the lake. Umuowelle Primary School which is closest to the lake (200m) had the highest prevalence rate of 55.2% followed by Umunifte Primary School at a distance of 300m which had a prevalence of 43.2%, while Obeagu Primary School which is up to 2km had the lowest prevalence 4.1%. Other schools which are at a distance of 2.5km or more had 0%. Correlation analysis confirm this to be significant (t=2.57, df=5) at 5% level. The intensity of infection also decreased as one moved away from the lake. Umuowelle Primary School nearest to the lake (200m) had 31.1 intensity while Obeagu Primary School which is about 2km from the lake had an intensity of 8.9. The decrease in intensity of infection with increase in distance from the lake is significantly correlated at 5% level (t=2.57,df=5).

## DISCUSSION

Generally, Prevalence and egg output go together. The most significant association was with age. Both egg output and prevalence rose rapidly in the early years to a peak level in the 10-14 yrs age

**Table 1: Prevalence rates of urinary schistosomiasis in primary schools (P/S) in Agulu by season**

| School | Village located | Dry season | | | Rainy season | | |
|---|---|---|---|---|---|---|---|
| | | No. Exam. | No. Infection | % Infection | No. Exam. | No. Infection | % Infection |
| Agunkwo P/S | Amaorji | 70 | 0 | 0 | 42 | 0 | 0 |
| Central ,, | Odidama, Obe | 200 | 0 | 0 | 192 | 0 | 0 |
| Chukwuka ,, | Uhueme,Ukunu | 241 | 0 | 0 | 243 | 0 | 0 |
| Community ,, | Umunowu | 219 | 76 | 34.7 | 216 | 74 | 34.3 |
| Ezeanyanwu ,, | Odidama, Okpu | 233 | 0 | 0 | 220 | 0 | 0 |
| Nwanchi ,, | Nwanchi,Nneoha Amaezike | 110 | 0 | 0 | 90 | 0 | 0 |
| Obe ,, | Obe | 233 | 0 | 219 | 0 | 0 | 0 |
| Obeagu ,, | Obeagu | 169 | 7 | 4.1 | 151 | 5 | 3.3 |
| Onike ,, | Okpu | 140 | 0 | 0 | 112 | 0 | 0 |
| Practicing ,, | Nkitaku, Umubiala, Okpuifite, Amatutu | 532 | 128 | 24.1 | 506 | 119 | 23.5 |
| Udoka ,, | Ukunu, Isimaigbo | 189 | 0 | 0 | 180 | 0 | 0 |
| Ugwuaba ,, | Umuifite | 185 | 80 | 43.2 | 174 | 75 | 43.1 |
| Umuowelle ,, | Umuowelle | 201 | 111 | 55.2 | 189 | 105 | 55.6 |
| Ifiteani ,, | Ifiteani | 141 | 33 | 23.4 | 101 | 22 | 21.9 |
| Nneogidi ,, | Nneogidi | 186 | 55 | 29.6 | 172 | 50 | 29.1 |
| Total | | 3029 | 450 | 16.2 | 2807 | 450 | 16.1 |

**Table 2: Infection rate (%) and geometric mean (GM) egg count during dry and rainy season in the endemic villages among age groups**

| School | Dry season | | | | | | | | Rainy season | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 – 4 | | 5 – 9 | | 10 – 14 | | 5 – 19 | | 0 – 4 | | 5 – 9 | | 10 – 14 | | 5 – 19 | |
| | % | GM | % | GM | % | GM | % | GM | % | GM | % | GM | % | GM | % | GM |
| 1. | 29.4 | 11.2 | 61.1 | 29.9 | 70.1 | 48.4 | 55.2 | 28.5 | 34.1 | 8.0 | 54.8 | 20.2 | 73.3 | 36.4 | 52.2 | 24.9 |
| 2 | 0 | 0 | 33.8 | 19.4 | 51.2 | 39.9 | 42.4 | 24.5 | 0 | 0 | 36.5 | 14.0 | 52.5 | 30.3 | 32.3 | 20.2 |
| 3 | 10.0 | 11.5 | 32.4 | 16.9 | 50.0 | 36.7 | 27.5 | 23.5 | 16.7 | 8.2 | 30.0 | 12.4 | 48.7 | 22.5 | 27.5 | 15.5 |
| 4 | 0 | 0 | 22.9 | 14.7 | 47.1 | 31.5 | 18.8 | 20.2 | 0 | 0 | 19.1 | 11.2 | 47.0 | 24.2 | 20.0 | 13.7 |
| 5 | 0.7 | 5.0 | 24.1 | 10.7 | 41.3 | 28.0 | 32.0 | 20.0 | 0 | 0 | 22.4 | 8.2 | 41.6 | 21.7 | 31.9 | 12.9 |
| 6 | 0 | 0 | 14.3 | 14.7 | 33.3 | 19.4 | 22.2 | 11.0 | 0 | 0 | 13.3 | 11.0 | 33.3 | 5.2 | 14.3 | 7.0 |
| 7 | 0 | 0 | 1.9 | 8.3 | 8.9 | 14.8 | 5.3 | 14.0 | 0 | 0 | 4.2 | 8.0 | 5.9 | 12.2 | 0 | 0 |

*1. Umuowelle Primary School 2. Ugwuaba Primary School 3. Community Primary School 4.Nneogidi Primary School 5. Practicing Primary School 6. Ifiteani Primary School 7. Obeagu Primary School*

group and then declined. The infection rates among the various age groups in the different schools were close for both dry and wet season. This could be due to the long life span of the worm (3 – 5 years), (Wilkins *et al* 1984, Fulford *et al* 1995), thus same infected individuals remain infected during both seasons. However, the Geometric mean of egg output declined remarkably in the rainy season. Though the people remain infected in the rainy season, the low egg count during that period could be due to a break in the transmission of disease during the wet season occasioned by non visit/reduced contact with transmission sites at such times since rain water can be collected from the home. This would reduce re-infection as well as accumulated worm load. Further, some worms may have died in the infected individuals and because there would be a reduction in rate of contact with the transmission site, re-infection would not occur. Thus Blum *et al* (1987) in the study of the effects of distance and season on the use of boreholes in northeastern Imo State, Nigeria reported that in wet season when the availability of water sources was much greater, rain water was the main sources of 64% of households since it was collected directly at home. In contrast however, McCullough and Bradley (1973) showed that egg output was stable in individuals for long period of time. But then, their study was conducted in Tanzania during the dry season months of 3 different years. The egg out put in their study population could have dropped during wet season and risen again during the dry season as a result

**Table 3: Total seasonal infection rate and GM by age**

| Age group | Dry season Infection rate (%) | Dry season GM | Rainy season Infection rate (%) | Rainy season GM |
|---|---|---|---|---|
| **0 – 4** | 6.4 | 6.7 | 8.3 | 2.3 |
| **5 – 9** | 26.7 | 16.8 | 26.2 | 10.1 |
| **10 – 14** | 44.0 | 31.2 | 44.5 | 21.2 |
| **15 – 19** | 30.9 | 20.3 | 28.0 | 12.3 |
| **Total** | 30.0 | 22.5 | 29.6 | 10.7 |

**Table 4: The relationship between prevalence and intensity rates and distance of schools from Agulu lake**

| Geogra-phical location | Villages | Distance to lake (m and km) | School they attend | % Prevalence | Intensity (GM) |
|---|---|---|---|---|---|
| **West** | Umuowelle | ≤200m | Umuowelle P/S | 55.2 | 31 |
| **West** | Umunifite | .3km(300m) | Ugwuaba ,, | 43.2 | 20.9 |
| **North** | Umunowu | .45km(450m) | Community ,, | 34.7 | 20.0 |
| **North** | Nneogidi | .70km(700m) | Nneogidi ,, | 29.6 | 16.9 |
| **West** | Umubiala | 500m | Practicing ,, | | |
| **West** | Amatutu | 700m | Practicing ,, | | |
| **West** | Okpuifite | 1km(.93km) | Practicing ,, | 24.1 | 14.7 |
| **West** | Nkitaku | 1.5km | Practicing ,, | | |
| **North** | Ifiteani | 1.2km | Ifiteani ,, | 23.4 | 11.6 |
| **South** | Obeagu | 2km | Obeagu ,, | 4.1 | 8.9 |
| **South** | Obe | 2.5km | Obe & Central , | 0 | 0 |
| **South** | Odidama | 2.7km | Central ,, | 0 | 0 |
| **East** | Ukunu | 2.9km | Udoka | 0 | 0 |
| **East** | Isiamaigbo | 3.0km | Chukwuka ,, | 0 | 0 |
| **East** | Amaorji | 3.2km | Agunkwo ,, | 0 | 0 |
| **East** | Uhueme | 3.4km | Agunkwo ,, | 0 | 0 |
| **South** | Nneoha | 3.7km | Ezeanyanwu ,, | 0 | 0 |
| **South** | Okpu | 4.0km | Ezeanyanwu ,, | 0 | 0 |
| **South** | Amaezike | 4.2km | Onike ,, | 0 | 0 |
| **South** | Nwanchi | 4,5km | Nwanchi ,, | 0 | 0 |

of re-infection. The high Geometric mean egg output recorded by Scott *et al* (1982) in lake Volta Ghana could also be as a result of dry season, only one small water contact site was recognized at Agulu lake during the rainy season. Usual sites on the different arms were over grown by weeds and were very bushy and lacked human activity during the rainy season.

Prevalence and intensity of infections showed a significance decrease with increasing distance to the lake, which is the focus infection. This finding is a pointer to the important role of distance from focus of infection in the prevalence of schistosomiasis in a location, which is portrayed by the fact that children who lived at a considerable distance from the lake had no infection. It is also an indication of the relationship between distance of water bodies from communities and the extent of usage of each water body by the communities, pointing to the fact that communities rely on water sources which are close to their location. Since frequency of contact with focus of infection diminishes with increase in distance, prevalence of water borne disease such as schistosomiasis would be expected to decline with increase in distance from such foci of infection. Similarly, since the population relies on harvested rain water during the rainy season, the number of new cases or re-infected individuals would be expected to drop during the rainy season. The findings of the present study conform to these expectations, and lend support to the observation by Emejulu (1994) that most households use water sources which are very close to them and that very few use sources up to 2km away from home. Distance determines the time spent in collecting water and so affects travel times. Saving of time for other chores could be one of the reasons why the villagers resort to nearest water source. In this study however, few people, who live at a distance of 1.2 km to 2 km or more were found to be infected. This is probably because Agulu lake inspite of its distance from some villages holds sufficient attraction for children from such villages, and such children from far distance would still visit it for recreational purposes. Further, high temperatures in tropical Africa especially in the afternoon compel inhabitant of such tropical areas to look for a place to cool off and the people find such a place of comfort in the lake.

The seasonal decrease on geometric mean egg output of individuals is very important in the context of control measures for the disease. Since people do not go to the lake during the rainy season, mass treatment of villagers around the schools identified with *S. haematobium* during the rainy season would be beneficial in curtailing incidence of schistosomiasis. Such an approach will have the effect of reducing the parasite load of infected numbers of the affected communities and thus reducing the chances of re-infecting the snails in the water during the dry season. It is also possible that some infected snails would die during the lengthy period of the rainy season because Bayne and Loker (1987) reported that infection significantly reduced snail host survival a happenstance that would further weaken the transmission cycle and make the control measure more effective.

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