# Co-Infection Of Malaria And Typhoid Fever In Ekwulumili Community Anambra State, Southeastern Nigeria.

Onyido A.E, Ifeadi C.P, Umeanaeto P.U., Irikannu K.C, Aribodor D.N, Ezeanya L.C, Ugha C.N, Obiechina, I.O

Department of Parasitology and Entomology, Nnamdi Azikiwe University, Awka

**Abstract:** A study of co-infection of typhoid and malaria fevers was carried out in Ekwulumili Community, Nnewi South, L.G.A., Anambra State, Nigeria, between May and July, 2012. Venous blood samples were collected from apparently healthy individuals who did not show any signs and symptoms of malaria and typhoid fevers. A total of 200 subjects comprising 52 (25%) males and 148(74%) females were examined. Field stained thick and thin blood films were used to detect malaria parasites in the samples. Typhoid fever was diagnosed from each blood sample using widal test kit. Of the 200 participants sampled, 40(20%) tested positive for malaria, 11 (5.5%) tested positive for typhoid fever and 10(5.0%) were co-infected with malaria and typhoid fevers. More females (5.41%) than the males (3.85%) were co-infected with typhoid and malaria fevers. There was no significant difference in the co-infection of malaria and typhoid fever between the genders ($P \geq 0.05$). The co-infection of malaria and typhoid fever was highest in the age group 41-50 years (8.82%) and absent in the age groups 61-70 and 71-80 years. Among the occupational groups, traders had the highest co-infection (9.90%) while no case of co-infection was observed among the teachers. There was no significant difference in the co-infection of malaria and typhoid fevers among the occupational groups ($P \geq 0.05$). Among the villages, the co-infection was highest at Umudim village (6.67%) and least at Urueze village (4.44%). There was no significant difference in the co-infection of malaria and typhoid fevers among the villages ($P \geq 0.05$). Improvement of sanitary conditions, personal hygiene and reduction in malaria vector and housefly breeding sites were suggested for reduction of the transmission of the diseases.

[Onyido A.E, Ifeadi C.P, Umeanaeto P.U., Irikannu K.C, Aribodor D.N, Ezeanya L.C, Ugha C.N, Obiechina, I.O. **Co-Infection Of Malaria And Typhoid Fever In Ekwulumili Community Anambra State, Southeastern Nigeria.** *N Y Sci J* 2014;7(7):18-27]. (ISSN: 1554-0200). http://www.sciencepub.net/newyork. 3

**Keywords :** Co-Infection, Malaria, Typhoid Fever, Ekwulumili Community Anambra State, Southeastern Nigeria

## Introduction

Malaria and typhoid fever are among the most endemic diseases in the tropics (Nsutebu *et al.,* 2001; Mbuh *et al.,* 2003). Both diseases are common in many countries of the world where the prevailing environmental conditions of warm humid climate, poor sanitary habits, poverty and ignorance exist. These two diseases have been associated with poverty and underdevelopment with significant morbidity and mortality (CDC, 2009).

Malaria is a life threatening disease caused by protozoan parasites of the genus *Plasmodium* that are transmitted through the bites of infected female *Anopheles* mosquitoes. Malaria remains the world's most important tropical parasitic disease with regards to mortality and morbidity (WHO, 2008). It is an important public health disease in both tropical and sub-tropical countries in Africa where it is mostly seasonal with its major incidence occurring in the rainy season (Eneanya, 1998). This disease causes widespread premature deaths, suffering, and financial hardships on poor households and holds back economic growth and improvement in living standards. Malaria has reduced the annual economic growth rate by 1.3% (Akapule, 2011).

In Nigeria, malaria is endemic and stable, being a major cause of morbidity and mortality (FMH, 2005). It results in 25% infant and 30% childhood mortality. It was ranked as the highest cause of death in 1978 and 1982 (Osisanya, 1985). More than 50% of the total population suffers from at least one episode of malaria each year and 90% of the total population is at risk of malaria. Beyond the impact on children and pregnant women, it affects the general population (RBM, 2005).

Typhoid fever, also known as enteric fever is an acute systemic infection caused by *Salmonella typhi*, a gram-negative bacterium (WHO, 2007). It is largely a disease of developing nations due to their poor standard of hygiene and unavailability of clean water. It is transmitted faeco-orally through contaminated food and water. Transmission by flies such as *Musca domestica* has also been reported (CDC, 2007). The most prominent feature of the infection is fever which gradually rises to a high plateau (Nnabuchi and Babalola, 2008). Globally, typhoid fever is an important cause of morbidity and mortality in many regions of the world with an estimated 12-33 million cases leading to 216,000 – 600,000 deaths annually (Pang *et al.*, 1995).

Co-infection of malaria and typhoid fever causes extra hardship to the health and economy of the victims. This study therefore sought to investigate the co-infection of typhoid fever and malaria in Ekwulumili Community, Nnewi South L.G.A, Anambra State, Nigeria. The specific objectives were to determine:

1. Malaria infections through examination of stained blood films under the microscope.
2. Typhoid infections using Chromatest Widal Agglutination kit.
3. Co-infections of malaria and typhoid through careful examination of the results and calculations.
4. The groups (age, sex, occupations and education) mostly affected.

## Materials and Methods

**Description of the Study Area.**

The study was carried out in Ekwulumili community in Nnewi South Local Government Area of Anambra State, Southeastern Nigeria. It is 35km (22miles) southeast of the commercial city of Onitsha. It shares boundaries in the north with Igbo-ukwu, in the south with Unubi and Ezinifite. The geographical coordinates for Ekwulumili are 5°.97`N latitude and 7°.02`E longitude.It lies at an elevation of 140m (159 ft) above sea level. The town is just 6 degrees north of the equator and lies in the rainforest belt. It has marked dry and wet seasons typical of the West African sub-region. It has a wet season with about 9 months of rainfall (April – November), and an annual rainfall range of 2000 – 3000mm. Dry season lasts from December – March. It has an average humidity of 70% throughout the year and a maximum average temperature range of 27-36$^{o}$C in the dry season and a minimum temperature range of 20-30$^{o}$C in wet season. Ekwulumili community is made up of four villages - Owellengwu (now renamed Owellechukwu), Isigwu, Urueze and Umudim. The town has many streams and springs like Nwangene, Nnobe, Ubiada, Iyiahaba, Mmili-ukolo, Iru-mmili, Njaba and so on. They have few bore holes in each village but most people still fetch water from the streams and springs. They have many fish ponds and agricultural farms in the community.

Ekwulumili has a population of about 50,000 citizens. Most indigenes reside outside the town and do business in numerous cities across Nigeria and the rest of the world. They however, maintain homesteads and extended families in the town and visit the town regularly for short stays. The majority of Ekwulumili dwellers are traders and farmers. Few are engaged in civil service, teaching and other occupations (Ohimili, 2012).

**Ethical Considerations and Community Mobilization**

Advocacy visits to the traditional ruler of the community, HRH Igwe G.O. Umeanadu, Eze Onyeorulu I of Ekwulumili, his cabinet and the president of Ekwulumili Development Union (EDU) with an introductory letter from the Head of Department of Parasitology and Entomology which helped in obtaining both permission to carry out the research and cooperation of the people. Participants were mobilized through town criers and announcements in the churches, schools and market places. Informed consent of each adult participant was obtained before blood sample collection. Concent for screening of the children was obtained from their parents and teachers.

**Selection of the Study Participants**

The participants were drawn from the four villages of the community. They were assembled in the community civic centre and sampling technique was a non-probability method in which participants were attended to as they came.

**Collection of Bio-data of the Participants**

Biodata of the participants such as names, age, sex, village, educational and occupational status were obtained through interviews. The participants were apparently healthy people without any signs and symptoms of malaria and typhoid fever.

**Collection of Blood Samples**

3mls of venous blood of the participants were collected and put into an EDTA (Ethylene Diamine Tetra-acetic Acid) treated blood collection tube. Each participant's arm was tied with a turniquette, and the site for blood collection was wiped with a cotton swab soaked in methylated spirit to clean and sterilize the area. A 5ml syringe and a 21g needle were carefully used to puncture the vein and 3mls of blood were collected. A dry cotton swab was placed at the point of entrance of the needle into the vein and the needle was gently removed, covered with its cover and properly disposed into waste bin provided.

**Diagnosis of Malaria Parasites**

Diagnosis of malaria was by the microscopic examination of stained thick and thin blood films.

**Preparation of Thick Blood Films**

Three drops of the participant's blood were placed on a well-labeled grease-free microscopic slide. The blood was homogenously spread in a circular motion using the edge of a spreader slide to make an even smear. The smear was allowed to air dry and placed in a slide box away from flies, dust and heat.

**Preparation of Thin Blood Films**

A drop of the participant's blood was placed at the centre of a well-labeled grease-free microscopic slide. A smooth edged spreader slider was placed at an angle of about 45$^{o}$C with the horizontal slide in front of the drop of blood. The drop of blood was allowed to run along the edge of the spreader slider. The spreader was pushed gently but firmly along the horizontal slide to make a thin smear of the blood. Care was taken to ensure even contact of the spreader and the surface of the horizontal slide. The film was allowed to air dry, fixed by dipping in a container of absolute methyl alcohol for 2 seconds and later placed in a slide box away from flies, dust and heat

**Staining of the Blood Films**

Thick blood films were stained by holding the slide with the dried thick film facing downwards and dipped into Field's stain A for 5 seconds. The excess was drained off by touching a corner of the slide against the side of the container. The slide was washed gently in clean water for about 5 seconds. It was dipped into Field's stain B for 3 seconds, excess stain drained of, washed the slides in clean water, wiped the back of the slides clean with filter paper and placed in an upright position on a draining rack for the film to air dry. Using a pipette, each film was covered with diluted Fields stain B and an equal volume of Field's stain A was added immediately and mixed well using the pipette. The film was left to stain for one minute, washed off with clean water, and placed upright on a draining rack to air dry.

**Microscopic Examination of the Blood Films**

When the stained thin and thick films were completely dried, a drop of immersion oil was added on each slide and examined under the microscope using x 100 objective lens. The thick film was used to detect the presence of malaria parasites while the thin film was used to identify the species. The results were recorded against the names and number of the participants. The intensity of malaria was recorded using the plus sign thus: Mild infection (+) or 1-10 parasites per 100 high power fields, moderate infection (++) or 11-100 parasites per 100 high power fields and heavy infection (+++) or 1-10 parasites per high power field (Cheesbrough, 2006).

**Diagnosis of Typhoid Fever**

Typhoid fever infections were diagnosed using the participant's blood plasma and Widal test kits. The Widal kit contained reactants with attenuated typhoid antigen which reacted specifically with the body's antibody.

**Required Materials**

1. Febrile diagnostic test kit (chromaatest widal Agglutination Kit). This contained the O and H febrile antigens for paratyphi A-C and typhus D respectively.
2. White rectangular tile.
3. Blood plasma in a well-labeled test tube.
4. Pasteur's pipette.
5. Centrifuge

**Procedure**

Each blood sample of the participants in the EDTA-treated blood collection tube was emptied into a well-labeled test tube and centrifuged at 1000 r.p.m for 5 minutes to separate the serum from the red cells. The test tube containing the serum was placed in a test tube rack. On a white rectangular tile, a drop of each reactant in the following progression; paratyphi A, B, C and D of O antigen, was placed in the first row and a drop of each paratyphi A, B, C and typhus D of H antigen was placed in the second row. Using Pasteur's pipette, a drop of plasma was added to each reactant and mixed with a stirrer, making sure that the stirrer is dried with cotton wool after each stir. The tile was gently rocked with hands for two minutes and each spot was observed for agglutination.

**Recording of Observations**

An agglutination reaction in any of the reagents was an indication that *Salmonellae* were present. The degree of agglutination was recorded in titres as follows:

Scanty agglutination - - 1:40
Slight agglutination - - 1:80
Heavy agglutination - - 1:160
Very Heavy agglutination - 1:320
(Chessbrough, 2006)

**Statistical Analysis**

Data recorded from the study were analyzed statistically for significant differences in the prevalence of co-infection of malaria and typhoid with respect to villages, age, sex, educational and occupational status using analysis of variance (ANOVA) test at 5% level of significance.

**Results**

A total of 200 persons, 52(26.0%) males and 148 (74.0%) females, were examined for malaria and typhoid fever infections in Ekwulumili community (table 1). Of this number, 135 (67.5%) were from Urueze village, 31(15.5%) from Umudim village, 4 (2.0%) from Owellechukwu village and 30(15%) *from Isigwu* village. An equal number of males and the females were from Owellechukwu village while more females than the males were from the other villages.

The participants were aged between 1 and 80 years. Between 6(3.0%) and 37(18.5%) participants from different age groups took part in the study. More males than the females were from the age groups 1-10years and 71-80years, while more females than the males were from the other age groups.

Among the occupational groups, 55(27.5%) were traders, 43(21.5%) were farmers, 9(4.5%) were teachers, 39(19.5%) were applicants and 54(27.0%) were students. All the teachers were females. More females than the males were from the other occupational groups.

Among the educational groups, 18(9.0%) had non-formal education, 99(49.5%) had primary education, 72(36.0%) received secondary education and 11(5.5%) received tertiary education. More females than the males were from all the educational groups.

The prevalence of malaria among the participants is shown in table 2. *Plasmodium falciparum* was the only malaria parasite identified in this study. Of the

200 individuals examined, 40(20.0%) were positive for malaria among whom 14(35.0%) were males and 26(65.0%) were females. There was no significant difference in malaria prevalence among the gender groups (P≥0.05). Urueze village had the highest malaria prevalence of 32(23.7%) while Umudim had the least 3(9.67%). There was no case of malaria infection in Owellechukwu village. There was no significant difference in malaria prevalence among villages (P≥0.05). More males 2(25.5%) than the females 1(4.16%) were positive in Umudim village while in Urueze and Isigwu villages, more females than the males tested positive for malaria.

Among the age groups, 1-10 years had the highest malaria prevalence rate of 6(66.69%) while 41-50 years had the least malaria prevalence rate of 3(8.82%). There was no case of malaria in the age group 71-80 years. There was a significant difference in malaria prevalence among the age groups (P≤0.05). More males 4(80.0%) than the females 2(50.0%) were malaria positive in age-group 1-10 years while more females than the males were positive in other age groups.

Among the occupational groups, the students had the highest malaria prevalence 18(33.33%) while the applicants had the least 4(10.26%). There was no case of malaria amongst the teachers. There was no significant difference in malaria prevalence in the occupational groups (P>0.05). More females than the males were positive for malaria in the other occupational groups.

Among the educational groups, the primary education group had the highest malaria prevalence 21(21.21%) while those with non-formal education had the least 3(16.67%). No case of malaria was observed among the tertiary education group. There was no significant difference in malaria prevalence among the educational groups (P>0.05). More males than the females were positive for malaria among the primary and secondary education groups. Only females 3(20.0%) were positive with malaria among the non-formal education group.

The prevalence of typhoid fever among the study participants is shown in table 3. Of the 200 participants examined, 11(5.5%) tested positive for typhoid fever among whom, 2(18.18%) were males and 9 (81.82%) females. Statistically, there was a significant difference in typhoid fever prevalence among the genders (P≤0.05).

Isigwu village had the highest typhoid fever prevalence 2(6.67%), while Urueze village had the least 7(5.19%). There was no case of typhoid fever in Owellechukwu village. There was no significant difference in typhoid fever prevalence among the villages (P>0.05). More males 2(5.88%) than the females 5(4.95%) were typhoid fever positive in Urueze village. More females than the males were positive in Umudim and Isigwu villages.

Among the age groups, the age group 21-30 years had the highest prevalence of typhoid fever, 2(16.67%) while the age group 51-60 years had the least prevalence 1(2.78%). There was no case of typhoid fever in the age groups 61-70 and 71-80 years. The difference in typhoid fever prevalence among the age groups was not significant (P>0.05). Only the females were infected in the age groups from 21-30 years. More males 1(8.33%) than the females 1(4.0%) were positive for typhoid fever in the age group 11-20 years. Only one male was infected in the age group 1-10 years.

Among the occupational groups, traders had the highest prevalence of typhoid fever 5(9.09%) while farmers had the least 1(2.32%) There was no case of typhoid fever amongst the teachers. Although typhoid fever was slightly higher among the traders than other occupational groups, there was no significant difference in typhoid fever prevalence among the occupational groups (P>0.05). More males 2(10.52%) than the females 1(2.86%), were positive for typhoid fever among the students.

Among the educational groups, the secondary education group had the highest typhoid fever prevalence of 6(8.33%) while the primary education group had the least 5(5.05%). There was no case of typhoid fever among the non-formal and tertiary education groups. Typhoid fever prevalence was not significantly different among the primary and secondary education groups (P>0.05). More females than the males were positive for typhoid fever among primary and secondary education groups.

Of the 200 participants examined for co-infection of malaria and typhoid fever (table 4), 10(5.0%) were co-infected with typhoid and malaria fevers among whom were 2(20.0%) males and 8(80.0%) females. There was a significant difference in the co-infection of malaria and typhoid fever among the genders (P<0.05). Isigwu village had the highest prevalence of typhoid malaria co-infection 2(6.67%) while Urueze village had the least 6(4.4%). No case of co-infection was recorded in Owellechukwu village. There was no significant difference in co-infection of malaria and typhoid fevers among the villages (P>0.05). More males 2(20.0%) than the females 4(3.96%) were positive for the co-infection in Urueze village. An equal number of males and females, 1(8.33%) each, was co-infected in Umudim village while only females were co-infected in Isigwu village.

The age group 1-10 years had the highest co-infection 1(11.11%), while the age group 51-60 years had the least 1(2.32%). There was no case of the co-infection in the age groups 61-70 and 71-80 years. There was no significant difference in the co-infection among the age groups. More males 1(8.33%) than the females 1(4.0%) was co-infected in age group 11-20 years. Only females were co-infected in the age groups 21-30 years to age group 51-60 years.

**Table 1: Biodata Of The Participants**

| Biodata Villages | Number Examined | Number Of Males (%) | Number Of Females (%) |
|---|---|---|---|
| Urueze | 135 (67.5%) | 34 (25.2%) | 101 (74.8%) |
| Umudim | 31(15.5%) | 7 (22.58%) | 24 (77.42%) |
| Owellechukwu | 4 (2%) | 2 (50%) | 2 (50%) |
| Isigwu | 30 (15%) | 9 (30%) | 21 (70%) |
| Total | 200 | 52 (26%) | 148 (74%) |
| **Age** | | | |
| 1-10 | 9 (4.5%) | 5 (55.55%) | 4 (44.44%) |
| 11-20 | 37 (18.5%) | 12 (32.43%) | 25 (67.57%) |
| 21-30 | 12 (6%) | 4 (33.33%) | 8 (66.67%) |
| 31-40 | 31 (15.5%) | 3 (9.68%) | 28 (90.32%) |
| 41-50 | 34 (17%) | 5 (14.71%) | 29 (85.29%) |
| 51-60 | 36 (18%) | 7 (19.44%) | 29 (80.56%) |
| 61-70 | 35 (17.5%) | 12 (34.29%) | 23 (65.71%) |
| 71-80 | 6 (3%) | 4 (66.67%) | 2 (33.33%) |
| Total | 200 | 52 (26%) | 148 (74%) |
| **Occupation** | | | |
| Traders | 55 (27.5%) | 12 (21.81%) | 43 (78.18%) |
| Farmers | 43 (21.5%) | 10 (23.6%) | 33 (76.74%) |
| Teachers | 9 (4.5%) | - | 9 (100%) |
| Applicants | 39 (19.5%) | 11 (28.21%) | 28 (71.79%) |
| Students | 54 (27%) | 19 (35.19%) | 35 (64.81%) |
| Total | 200 | 52 (26%) | 148 (74%) |
| **Education** | | | |
| Non-formal | 18 (9%) | 3 (16.67%) | 15 (83.33%) |
| Primary | 99 (49.5%) | 27 (27.27%) | 72 (72.72%) |
| Secondary | 72 (36%) | 20 (27.78%) | 52 (72.22%) |
| Tertiary<br>Total | 11 (5.5%)<br>200 | 2 (18.18%)<br>52(26%) | 9 (81.82%)<br>148(74%) |
| Total | 200 | 52 (26%) | 148 (74%) |

**Table 2: Prevalence Of Malaria Among The Participants From Ekwulumili C0mmunity**

| Biodata Villages | Number Examined (%) | Number Positive (%) | Males Examined (%) | Males Positive (%) | Females Examined (%) | Females Positive (%) |
|---|---|---|---|---|---|---|
| Urueze | 135 (67.5%) | 32(23.7%) | 34(25.2%) | 9(26.47%) | 101(74.8%) | 23(22.77%) |
| Umudim | 31(15.5%) | 3(9.67%) | 7(22.58%) | 2(28.57%) | 24(77.42%) | 1(4.16%) |
| Owellechukwu | 4 (2.0%) | - | 2(50.0%) | - | 2(50.0%) | - |
| Isigwu | 30 (15%) | 5(16.67%) | 9(30.0%) | 2(22.22%) | 21(70.0%) | 3(14.28%) |
| Total | 200 | 10 (5.0%) | 52(26.0%) | 2(3.85%) | 148(74.0%) | 8(5.41%) |
| **Age** | | | | | | |
| 1-10 | 9 (4.5%) | 6(66.67%) | 5(55.55%) | 4(80.0%) | 4(44.44%) | 2(50%) |
| 11-20 | 37 (18.5%) | 12(32.43%) | 12(32.43%) | 4(33.33%) | 25(67.57%) | 8(32.0%) |
| 21-30 | 12 (6.0%) | 3(25.0%) | 4 (33.33%) | 1(25.0%) | 8(66.67%) | 2(25.0%) |
| 31-40 | 31 (15.5%) | 6(19.35%) | 3(9.68%) | - | 28(90.32%) | 6(21.43%) |
| 41-50 | 34 (17.0%) | 3 (8.82%) | 5(14.71%) | 1(20%) | 29(80.56%) | 2(6.8%) |
| 61-70 | 35 (17.5%) | 6(14.63%) | 12(34.29%) | 3(25%) | 23(65.71%) | 3(13.04%) |
| 71-80 | 6 (3.0%) | - | 4(66.67%) | - | 2(33.33%) | - |
| Total | 200 | 40(20%) | 52(26.0%) | 13(25.0%) | 148(74.0%) | 27(16.24)% |
| **Occupation** | | | | | | |
| Traders | 55 (27.5%) | 11(20.0%) | 12(21.81%) | 2(16.67%) | 43(78.18%) | 9(20.63%)9 |
| Farmers | 43 (21.5%) | 7(16.28%) | 10(23.26%) | 2(20.0%) | 33(76.74%) | 5(15.15%) |
| Teachers | 9 (4.5%) | - | - | - | 9(100%) | - |
| Applicants | 39 (19.5%) | 4(10.26%) | 11(28.21%) | 1(9.09%) | 28(71.79%) | 3(10.71%) |
| Students | 54 (27.0%) | 18(33.33%) | 52(26.0%) | 8(42.11%) | 148(74.0%) | 10(28.57%) |
| **Education** | | | | | | |
| Non-formal | 18 (9.0%) | 3(16.67%) | 3(16.67%) | - | 15(83.33%) | 3(20.0%) |
| Primary | 99 (49.5%) | 21(21.21%) | 27(27.27%) | 9(33.33%) | 72(72.72%) | 12(16.67%) |
| Secondary<br>Tertiary<br>Total | 72 (36.0%)<br>11(5.5%)<br>200 | 16(22.22%)<br>-<br>40(20%) | 20(27.78%)<br>2(18.18%)<br>52(26.0%) | 5(25.0%)<br>-<br>13(25.0%) | 52(72.22%)<br>9(81.82%)<br>148(74.0%) | 11(21.15%)<br>-<br>27(18.24%) |

**Table 3: Prevalence Of Typhoid Fever Among The Participants From Ekwulumili Community**

| Biodata Villages | Number Examined (%) | Number Positive (%) | Males Examined (%) | Males Positive (%) | Females Examined (%) | Females Positive (%) |
|---|---|---|---|---|---|---|
| Urueze | 135 (67.5%) | 7 (5.19%) | 34(25.2%) | 2(5.88%) | 101(74.8%) | 5(4.95%) |
| Umudim | 31(15.5%) | 2 (6.45%) | 7(22.58%) | - | 24(77.42%) | 2(8.33%) |
| Owellechukwu | 4 (2%) | - | 2(50.0%) | - | 2(50.0%) | - |
| Isigwu | 30 (15%) | 2 (6.67%) | 9(30.0%) | - | 21(70.0%) | 2(9.52%) |
| Total | 200 | 11 (5.5%) | 52(26.0%) | 2(3.85%) | 148(74.0%) | 9(6.08%) |
| **Age** | | | | | | |
| 1-10 | 9 (4.5%) | 1 (11.11%) | 5(55.55%) | 1(20.0%) | 4(44.44%) | - |
| 11-20 | 37 (18.5%) | 2 (5.41%) | 12(32.43%) | 1(8.33%) | 25(67.57%) | 1(4.0%) |
| 21-30 | 12 (6%) | 2 (16.67%) | 4 (33.33%) | - | 8(66.67%) | 2(25.0%) |
| 31-40 | 31 (15.5%) | 2 (6.45%) | 3(9.68%) | - | 28(90.32%) | 2(7.14%) |
| 41-50 | 34 (17%) | 3 (8.82%) | 5(14.71%) | - | 29(80.56%) | 1(3.45%) |
| 61-70 | 35 (17.5%) | - | 12(34.29%) | - | 23(65.71%) | - |
| 71-80 | 6 (3.0%) | - | 4(66.67%) | - | 2(33.33%) | - |
| Total | 200 | 11 (5.5%) | 52(26.0%) | 2(3.85%) | 148(74.0%) | 9(6.08%) |
| **Occupation** | | | | | | |
| Traders | 55 (27.5%) | 5 (9.09%) | 12(21.81%) | - | 43(78.18%) | 5(11.63%) |
| Farmers | 43 (21.5%) | 1(2.32%) | 10(23.26%) | - | 33(76.74%) | 1(3.03%) |
| Teachers | 9 (4.5%) | - | - | - | 9(100%) | - |
| Applicants | 39 (19.5%) | 2(5.13%) | 11(28.21%) | - | 28(71.79%) | 2(7.14%) |
| Students | 54 (27.0%) | 3(5.55%) | 52(26.0%) | 2(3.85%) | 148(74.0%) | 9(6.08%) |
| **Education** | | | | | | |
| Non-formal | 18 (9.0%) | - | 3(16.67%) | - | 15(83.33%) | - |
| Primary | 99 (49.5%) | 5(5.05%) | 27(27.27%) | 1(3.70%) | 72(72.72%) | 4(5.55%) |
| Secondary | 72 (36.0%) | 6(8.33%) | 20(27.78%) | - | 9(81.82%) | - |
| Total | 200 | 11(5.5%) | 52(26.0%) | 2(3.85%) | 148(74.0%) | 9(6.05%) |

**Table 4: Co-Infection Of Malaria And Typhoid Fever Amongst The Participants From Ekwulumili Community**

| Biodata Villages | Number Examined (%) | Number Positive (%) | Number Examined (%) | Males Positive (%) | Number Examined (%) | Females Positive (%) |
|---|---|---|---|---|---|---|
| Urueze | 135 (67.5%) | 6 (4.44%) | 37(25.2%) | 2(20.0%) | 101(74.8%) | 4(3.96%) |
| Umudim | 31(15.5%) | 2 (6.45%) | 7(22.58%) | 1(8.33%) | 24(77.42%) | 2(8.33%) |
| Owellechukwu | 4 (2.0%) | - | 2(50.0%) | - | 2(50.0%) | - |
| Isigwu | 30 (15%) | 2 (6.67%) | 9(30.0%) | - | 21(70.0%) | 2(9.52%) |
| Total | 200 | 10 (5.0%) | 52(26.0%) | 2(3.85%) | 148(74.0%) | 8(5.41%) |
| **Age** | | | | | | |
| 1-10 | 9 (4.5%) | 1 (11.11%) | 5(55.55%) | 1(20.0%) | 4(44.44%) | - |
| 11-20 | 37 (18.5%) | 2 (5.41%) | 12(32.43%) | 1(8.33%) | 25(67.57%) | 1(4.0%) |
| 21-30 | 12 (6%) | 1 (8.33%) | 4 (33.33%) | - | 8(66.67%) | 1(12.5%) |
| 31-40 | 31 (15.5%) | 2 (6.45%) | 3(9.68%) | - | 28(90.32%) | 2(7.14%) |
| 41-50 | 34 (17%) | 3 (8.82%) | 5(14.71%) | - | 29(85.29%) | 3(10.34%) |
| 51-60 | 36(18%) | 1(2.78%) | 7(19.44%) | | 29(80.56%) | - |
| 61-70 | 35 (17.5%) | - | 12(34.29%) | - | 23(65.71%) | - |
| Total | 200 | 10 (5.0%) | 52(26.0%) | 2(3.83%) | 148(74.0%) | 8(5.41%) |
| **Occupation** | | | | | | |
| Traders | 55 (27.5%) | 5 (9.09%) | 12(21.81%) | - | 43(78.18%) | 5(11.63%) |
| Farmers | 43 (21.5%) | 1(2.33%) | 10(23.26%) | - | 33(76.74%) | 1(3.03%) |
| Teachers | 9 (4.5%) | - | - | - | 9(100%) | - |
| Applicants | 39 (19.5%) | 1(2.32%) | 11(28.21%) | - | 28(71.79%) | 2(3.57%) |
| Students | 54 (27.0%) | 3(2.56%) | 19(35.19%) | 2(10.52%) | 35(64.81%) | 1(2.86%) |
| Total | 200 | 10 (5.0%) | 52(26.0%) | 2(3.85%) | 148(74.0%) | 8(5.41%) |
| **Education** | | | | | | |
| Non-formal | 18 (9.0%) | - | 3(16.67%) | - | 15(83.33%) | - |
| Primary | 99 (49.5%) | 5(5.05%) | 27(27.27%) | 1(3.70%) | 72(72.72%) | 4(5.55%) |
| Secondary | 72 (36.0%) | 5(6.94%) | 20(27.78%) | 1(5%) | 52(72.22%) | 4(7.69%) |
| Tertiary | 11(5.5%) | - | 2(18.18%) | - | 9(81.82%) | - |
| Total | 200 | 10 (5.0%) | 52(26.0%) | 2(3.85%) | 148(74.0%) | 8(5.41%) |

Among the occupational groups, traders had the highest co-infection rate 5(9.09%) while the applicants had the least 1(2.32%). There was no significant difference in the co-infection among the occupational groups (P>0.05). More males 2(10.52%) than the females 1(2.86%) were positive for the co-infection among the students. Co-infection was not observed from males among the traders, farmers and applicants.

Among the educational groups, prevalence of co-infection was highest in the secondary education group 5(6.94%) and least among primary education group 5(5.05%). There was no case of co-infection among the non-formal and tertiary education groups. Prevalence of co-infection of malaria and typhoid fever was not statistically significant among the primary and secondary education groups (P>0.05). More females than the males had co-infection of malaria and typhoid fever among the educational groups.

**Discussion**

The study participants were from the four villages of the community and belonged to different age groups, sex, educational and occupational groups. Although the various groups were not equally represented, the cooperation and participation of the people in the study indicated that they were properly informed of the studies. Unequal representation of the groups may be as a result of personal interests and as such only those who were interested participated. Few participants had no formal education. This shows that about 80% of the participants were literate enough to understand and interpret instructions. In an epidemiological assessment of dental disorders among the residents of Ugbo-Odogwu community, a suburb of Enugu metropolis, Onyido *et al,* (2006) showed that 62.5% of the study population had primary education and were considered literate enough to benefit from any co-ordinated community directed health education and counseling.

More females than the males participated in the study. According to Ohimili (2012), most indigenes of Ekwulumili especially the males, do business in numerous cities across Nigeria and the rest of the world. However, these men maintain homesteads and extended families in the town and visit the town regularly for short stays.

*P. falciparum* was the only malaria parasite identified from the study. Ezedinachi *et al*, (1991) observed that malaria caused by *P. falciparum* remains a major cause of human mortality. Of the 200 individuals examined, 40(20.0%) were positive for malaria among whom 14(35.05%) were males and 26(65.0%) were females. The malaria prevalence in the community could be regarded to be moderately low when compared with other studies. It is lower than that of Aribodor *et al,* (2003) and Onyido *el al*, (2010) who reported 76% and 62% prevalence in Azia and Umudioka communities in Anambra state respectively. It is also lower than 46.0% observed at Nnewi (Umeaneto *et al* 2006), 64.0% among Nnamdi Azikiwe Students at Awka(Ezugbo-Nkwobi *et al,* 2011 ),53.90% at Abagana (Ugha *et al* 2013).The result is also lower than 58.2% at Ogbunike (Onyido *et al* 2011).The present lower prevalence of malaria in the community could be attributed to government malaria intervention programme of distribution and use of Long Lasting Insecticidal Treated Nets (LLINs) in the Rural communities of Anambra State. These LLINs are known to reduce malaria cases by 50% and decrease mortality in children by 15-30%,where coverage rates are high (Aribodor *et al* 2011)

Urueze village had the highest malaria prevalence 32(23.7%) while Umudim village had the least 3(9.67%). There was no case of malaria infection in Owellechukwu village. This could probably be due to many streams in Urueze and Umudim villages, thus increasing the availability of water and possible breeding sites for the vectors of malaria parasites while Owellechukwu village had no streams, rivers or springs and has a sloppy terrain. Earlier, Onyido *et al* (2009a&b) pointed out that the prevalence, intensity and regularity of malaria differ from location to location depending on factors like rainfall patterns, availability of vectors breeding places and proximity of human dwelling places to vector breeding sites among others. Among the age groups, malaria prevalence was recorded in all the age groups except in age group, 71-80 years. The age group 11-20 years had the highest malaria prevalence rate 12(32.45%) while 41-50 years had the least 3(8.82%). The age group 11-20 years is made up of students and adolescents who exhibit carefree lifestyle with no knowledge of the implications the bites received from the vectors of this disease; hence they expose themselves to these vectors while sleeping (Eneanya, 1998). The low prevalence among the age groups 41-50 years could be attributed to active immune response against these parasites and their careful habit in protecting themselves from the bites of the malaria vectors. Chandler and Reads, (1961) noted that in hyperendemic localities of *P. falciparum*, primary infections are seldom seen among adults but common in very young children and visitors.

Malaria was recorded in all the occupational groups except among the teachers. The Students had the highest malaria prevalence 8(33.33%) while the applicants had the least 4(10.26%). Obiekezie *et al*,( 2010) observed that school children under 18 years are not protected and that their immune system may not be competent as those of the adults.

Among the educational groups, the primary education group had the highest malaria prevalence 21(21.21%) while those with non-formal education had the least 3(16.67%). There was no case of malaria among the tertiary education group. It could be that those with tertiary education have proper knowledge about the mode of infection of malaria and typhoid and also the ways to prevent and control these diseases, as a result of their educational exposure, they take care of themselves properly as pointed out by Brieger *et al*, (1996).

Of the 200 individuals, 11(5.5%) tested positive for typhoid fever, among whom 2(18.18%) were males and 9(81.82%) were females. The total prevalence of typhoid fever in this study population is slightly higher then that of Salihu *et al,* (2008) who recorded 4.5% prevalence in Sokoto metropolis of Nigeria but lower than that of Okonkwo *et al*, (2010) who reported 80.1% prevalence in patients in Abeokuta, south western, Nigeria and that of Obiekezie *et al*; (2010) who reported a prevalence of 20.0% among the students of the university of Uyo,Cross River State of Nigeria.

Isigwu village had the highest typhoid fever prevalence of 2(6.67%) while Urueze village had the least prevalence 7(5.19%). Isigwu village has no natural stream or spring except very few boreholes. Talabi (1994) have shown that typhoid incidence is higher in dry areas where water supply is lowest and people congregate at few available sources. This could lead to contamination of available water sources and spread of infection through drinking of the contaminated water.

Among the age groups, those within the age group of 21-30 years had the highest prevalence of typhoid fever 2(16.67%) while those in 51-60 years had the least 1(2.78%). There was no case of typhoid fever among the age group 61-70 and 71-80 years. Obiekezie *et al;* (2010) observed that the higher prevalence of typhoid and malaria in lower age groups could be as a result of low levels of both cell moderated and humoral immunity among the young age group. The age group 21-30 years are constantly outside the home, working and they buy food from food vendors and drink any water available. This could be the cause of the high prevalence of typhoid fever among this age group. Traders had the highest prevalence of typhoid fever 5(9.09%) while farmers had the least 1(2.32%) among the occupational groups. This is probably because the traders are exposed to all sorts of food and sachet water from the food vendors. Crump *et al*, (2004) showed that exposure to polluted drinking water, close proximity to human waste and refuse dumps, low standards of food preparation, and ignorance contribute to occurrence, prevalence and transmission of typhoid. Among the education groups secondary education group had the highest prevalence of 6(8.33%) while the primary education had the lowest 5(5.05%). There was no case of typhoid fever among the non-formal and tertiary education groups. This could be because people with non-formal education are mostly old people who ate home-cooked lunch all the time and do not purchase food or sachet water from food vendors. The tertiary education group have the knowledge about the typhoid fever and protect themselves from infection (Brieger *et al*; 1996).

Of the 200 participants examined for the co-infection of malaria and typhoid fever, 10(5.0%) tested positive among whom were 2(20.0%) males and 8(80.0%) females. The co-infection rate is lower than that of Agwu *et al*., (2008) who reported 20% prevalence of malaria and typhoid fever co-infection at Ekpoma, Edo State, Nigeria. The higher co-infection rate amongst women agrees with the work of Agwu *et al*, (2008) who observed that most female farmers and traders spend their time in the farms and markets where they may have no other sources of drinking water and have to purchase sachet water.

Isigwu village had the highest co-infection rate 2(6.67%) while Urueze village had the least 6(4.44%). No case of con-infection was recorded in Owellechukwu village. This is because there are many streams in Umudim and Urueze villages which are breeding sites for malaria mosquitoes but Owellechukwu has no streams. Although Isigwu village has no streams, this work was done almost at the peak of rainy season. Salaraj (2008) has observed that typhoid fever often peaks in the month of July to September in tropical areas and often coincides with the rainy season when sanitation and hygiene is often at its lowest ebb.

The age group 1-10 years had the highest co-infection rate 1(11-11%) while the age group 51-60 years had the least 1(2.78%). There was no case of co-infection recorded among the age groups 61-70 years and 71-80 years. This could be as a result of lower levels of both cell mediated and humoral immunity to malaria and typhoid fever among the younger age groups (Obiekezie, 2007).

Traders had the highest co-infection rate 5(9.09%) while thee applicants had the least 1(2.32%). This is probably because the traders are exposed to different sources of food and water in the market that are sometimes contaminated with *Samonella typhi*. Exposure to polluted drinking water, close proximity to human wastes and refuse dumps, low standards of food preparation, indiscriminate defecation and ignorance contribute to the occurrence, prevalence and transmission of the disease (Crump *et al*., 2004).

Co-infection of malaria and typhoid fever was observed among primary and secondary education groups and none among the tertiary and non-formal education groups. Although education helps in protecting one self against diseases, the level of education among primary and secondary education groups is still low since most of them still believe that Africans are resistant to infectious diseases and therefore consume food or water available to them irrespective of hygienic standards. More so, most people in this educational group are low income citizens. Irepepolu *et al*., (2008) pointed out that in Nigeria, a higher percentage of the population is poor, live under socio-economically poor conditions and the incidence of typhoid fever is high, hence malaria and typhoid fevers are diseases of poor and ignorant (CDC 2009)

Concomitant infection of typhoid and malaria is very dangerous as most malaria cases are not properly managed and most cases treated as malaria were infact typhoid cases, as the two diseases present common symptoms (Kremsner *et al.*, 1995).

It is therefore suggested that regular screening for malaria and concomitant bacteraemia be carried out in rural communities so as to improve diagnosis and treatment of malaria and typhoid cases. Control of typhoid fever and malaria could be achieved through source reduction of breeding sites for mosquito vectors, prevention of contamination of food and water sources with *S. typhi* through proper environmental sanitation and sewage disposal and also treatment of infected persons. The Government of the day should help rural communities in provision of piped-borne water to the communities, maintenance of appropriate food hygiene through health education, provision of appropriate sewage disposal and health facilities. Communities should also help themselves by keeping their streams clean and free from contamination with faeces and urine, boiling of household drinking water, environmental sanitation and personal hygiene. National Agency for Food and Drugs Administration Control (NAFDAC) should look into sachet water sold in our rural villages to ensure their safety as drinking water.

**References**

1. Agwu, E., Ihongbe, J.C., Okogun, G.R.A. and Inyang, N.J. (2008). High incidence of co-infection with malaria and typhoid in febrile HIV infected and Aids patients in Ekpoma, Edo State, Nigeria. *Brazillian Journal of Microbiology*, 40:329-332.
2. Akapule, A.S. (2011. Malaria bites into economic development. http://www.ghananewsagency.org/shealth/r227413/health/malaria-bites-into-economic-development/ Accessed on 1-5-2012.
3. Aribodor, D.N., Njoku, O.O., Eneanya, C.I., Onyali, I.O. (2003). Studies on the prevalence of malaria and management practices of Azia community, Ihiala L.G.A, Anambra State, Nigeria. *Nigeria Journal of Parasitology* 24:33-38.
4. Brieger, W.R., Onyido, A.E., sexton, J.D., O.J.(1996). Monitoring community response to malaria control using insecticide-impregnated bed nets, curtains and residual spray at Nsukka, Nigeria, *Health Education Research Theory and Practice*. *Vol*. 11 No 2pp 133-145.
5. CDC-Centre for Disease Control and Prevention (2007). Malaria: Life cycle of *Plasmodium* species. http://www.cdcgov/malaria/plasmodium species.html/ Accessed on 1-5-2012.
6. CDC-Centre for Disease Control and Prevention (2009). Typhoid fever. http://www.cdc.gov/ncidod/dbmd/diseaseinfo/typhoidfever_g.html/ Accessed on 1-5-2012.
7. Chandler, A.C., and Read, C.P.(1961). Introduction to parasitology with reference to the parasites of man, 10th edition. *John Wiley and sons Inc. New York, London, Sydney*. Pp 822.
8. Cheesbrough, M. (2005). Test for Malaria Parasites. Laboratory Practices in Tropical Countries. Second edition, part 1. *Cambridge University PRESS UK*. Pp 191.
9. Eneanya, C.I. (1998). Seasonal variation in malaria episodes among residents of Udi, a semi-urban community in southeast Nigeria. *Nigerian Journal of Parasitology* 19(1): 39-43.
10. Ezedinachi, E.N.U., Ejekie, G.C., Usanga, A.E., Gemade, E.T., Ikpa, N.W., and Abariba, A.A.A. (1991). Malaria and its treatment in Nigeria. *Acta Tropical* 48, 17-24.
11. FMH-Federal Ministry of Health (2000). Malaria situation Analysis. *A Publication of the Federal Ministry of Health, Abuja, Nigeria*: p. 23.
12. FMH-Federal Ministry of Health (2001). Strategic plan for rolling back malaria in Nigeria/Abuja, *Publication of the Federal Ministry of Health*. P. 37.
13. FMH-Federal Ministry of Health (2005). National Treatment Guidelines. *A publication of the Federal Ministry of Health, Abuja, Nigeria:* p.47.
14. Irepepolu, O.H., Entonu, P.R., and Agwale, S.M. (2008). A review of the disease burden, impact and prevention of typhoid fever in Nigeria. *West African Journal of Medicine* (3); 127-133.
15. Kremsner, P.G., Radloff, P., Metzger, W., Wilding E., Mordumuller, B., Phillips, J., Bienxle, U., and Graniger, W. (1995). Quinine plus chlindamycin improves chemotherapy of

severe malaria in children. *Antimicrobial agent and chemotherapy*. 39, 40-45.
16. Mbuh, F.A., Gialadima, M. and Ogbadu, L. (2003). Rate of co-infection with malaria parasites and *Salmonella typhi* in Zaria, Kaduna state: *Annals of African Medicine*. 2:64-67.
17. Nsutebu, F.F., Ndumbe, P.M. and Koulla, S. (2001). The occurrence of typhoid fever in Cameroon; over diagnosis due to misuse of the widal test. *Trans. R. Sec. Trop. Med. Hyg*. 96:64-67.
18. Obiekezie, S.O. (2007). Basic immunology, 2nd edition. *Academic and scientific research institute publishers, Nigeria.* Pp 1-19.
19. Obiekezie, S.O., Asamudo, N.U., and Akpan, M. (2010). Concomitant bacteraemia in malaria parasitaemia among the students of University of Uyo, Southsouth Nigeria. *Nigerian Journal of Microbiology*. Vol. 24(1) 2231-2234.
20. Ohimili, J. (2012). Ekwulumili Community. www.ekwulumili.com. Accessed on 10-5-2012.
21. Okonkwo, I.O., Soleye, F.A., Adeyi, A.O. and Abubakar, M.I. (2010). Prevalence of *Salmonella typhi* among patients in Abeoukuta,south-western Nigeria. *British Journal of Pharmacology and Toxicology*. 1(1): 6-14.
22. Onyido, A.E., Mama, N.J., Ikpeze, O.O., and Ononiwwu, C.E. (2006). Dental disorders among the residents of Ugbo-Odogwu escarpment,Udi Hills, Eastern Nigeria. *Animal Research International* 3(3): 534-538.
23. Onyido, A.E., Ezike, V.I., Nwosu, E.O., Ozumba, N.A., Ikpeze, O.O., Obiukwu, M.O. and Amadi, E.S. (2009a). Crepsular man-biting mosquitoes of a tropical Zoological garden in Enugu South Eastern Nigeria. *Internet Journal of Parasitic diseases* 4(1):1-9.
24. Onyido, A.E., Ezike, V.I., Ozumba, N.A., Nwankwo, A.C.N. and Nwosu, E.O. (2009b). Breeding of *Aedes albopictus* Skuse (Diptera: Culicidae) in water holding containers around residential houses in Enugu South eastern Nigeria. *Nigerian Journal of Parasitology* 30(1):9-12.
25. Onyido, A.E., Agbata, V.O., Umeanaeto, P.U., Obiukwu, M.O. and Amadi, E.S. (2010). Malaria burden and Vector abundance in a sub-urban community in the rainforest zone of Nigeria. *Nigerian Journal of Microbiology*. 24(1): 2224-2230.
26. Onyido, A.E., Agbata, V.O., Umeanaeto, P.U., and Obiukwu, M.O. (2011). Ecology of malaria vectors in a rainforest sub urban community of Nigeria. *African Research Review*. 5(2): 293-105.
27. Pang, T.Z., Bhutta, A., Finbry, B.B., and Altwegg, M. (1995). Typhoid fever and other Salmonellosis: a continuing challenge. *Trends Microbiology* 3:253-5.
28. RBM-Roll Back Malaria (2005). Global Strategic Plan: Roll Back Malaria 2005-2015. Geneva: Roll back malaria partnership. World Health Organization (WHO), Switzerland. Pp. 23-24.
29. Salihu, M.D., Oboegbulem, S.I., Manga, B.S. and Gulumbe, M.L. (2008). Bacteriological analysis of cases diagnosed as Enteric fever in Sokoto, Nigeria. *Continental Journal of Microbiology*. 2:1-4.
30. Salaraj. I. (2009). Typhoid fever and control measures. www.p:tt.edu/usuper 7/23011-24001/23121. Ppt. Accessed on 1-5-2012
31. Talabi H.A.I. (1994). Medical aspects of typhoid. *The Nigerian post graduate Medical Journal*. 1(2): 14-16.
32. Umeanaeto, P.U., Ekejindu, I.M. and Ifeanyichukwu, M.O. (2006). Prevalence and intensity of malaria in blood donor at Nnamdi Azikiwe University Teaching Hospital (NAUTH). Nnewi, Anambra state, Nigeria. *Nigerian Journal of Pasrasitology*. ISSN 1117 – 4145. VOL. 27, pp. 11-15.
33. WHO-World Health Organization (1994). Quinghaosu Drugs. A New Generation of Anti-malaria. Geneva: WHO/TDR News 36:7.
34. WHO-World Health Organization (2008). Economic cost of malaria. Roll back malaria program report. http://who.malarialroll-back-malaria/accessed on 1-5-2012.

6/13/2014