# LENGTH-WEIGHT RELATIONSHIP AND CONDITION OF FRESHWATER SHRIMPS *Atya gabonensis* AND *Macrobrachium felicinium* FROM THE MU RIVER, MAKURDI, NIGERIA

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## ABSTRACT

***Length-weight parameters (a and b) of the equation: $W = aL^b$ were estimated for two freshwater shrimp species Atya gabonensis and Macrobrachium felicinium caught bimonthly from October 2001 to March 2002 using brush traps in the Mu river. The mean b values were 2.989 ± 0.328 and 3.003 ± 0.318 for A. gabonensis and M. felicinium respectively. The values did not differ significantly ($P < 0.05$) from 3, showing that their growths were isometric, M. felicinium where in better condition than A. gabonensis.***

**Key words**: Length-weight, Relationship, Condition factor, *Atya gabonensis*, *Macrobrachium felicinium*, Mu river

## INTRODUCTION

In fisheries research, length-weight relationships are important for the estimation of weight where only length data are available and as an index of the condition of the fish (Pauly, 1993 and Goncalves, *et al.,* 1997). King (1996a) noted that only a few estimates of species length-weight relationship parameters are available for Nigerian fishes. Of the 149 species of fish in Nigeria's inland and coastal waters compiled by king (1996a, 1996b) from various studies, none of the papers contained information on the length-weight relationship of fin-fishes (shrimps) from the inland waters. Freshwater shrimp constitute one of the most desirable candidates for freshwater aquaculture in different parts of the indo-pacific region. Knowledge of the biology of these species is important, since they are highly demanded in both Nigerian domestic and export markets. They are therefore culture candidate in our local fresh and brackish water ponds.

This study presents information on the size distribution, length-weight relationship and relative conditions of *A. gabonensis* and *M. felicinium* in the Mu river, Fiidi-Makurdi.

## MATERIALS AND METHODS

A total of one hundred and fifty (150) *A. gabonensis* and fifty five (55) *M. felicinium* were collected form two sampling sites in the Mu river between October 2001 and March 2002 using brush traps placed in water along the riverbank. Total length (cm) and body weight (g) were taken after draining water and blotting our excess water on the body (king, 1996b). For each species, the parameter a (proportionality constant) and b (exponent) of the LWR of the equation $W = aL^b$ were estimated using base 10 logarithm transformation of L - W data pairs and ordinary least - square linear regression (i.e. log transformed versions of $W = aL^b$) as Log W = log a + b – log L. The condition factor was calculated using Fulton's condition factor, $K = 100W/L^3$ (Carlender, 1969), were L = length (cm), W = weight (g) and 3 derived from exponential b of $W=aL^b$.

## RESULT AND DISCUSSION

The length of *A. gabonensis* ranged from 5.0 to 12.2 cm, with a mean value of 7.99 ± 2.12 cm and the weight ranged from 3.3 to 51.6 g with a mean value of 13.98 ± 10.36 g. The length of *M. felicinium* ranged from 3.1 to 8.2 cm with a mean value of 6.33 ± 1.003 cm while the weight ranged from 2.8 to 11.2 g with a mean value of 6.6 ± 1.67 g. The length-weight relationship *A. gabonensis* ranging from 5.0 to 12.2 cm was $W = 0.014L^{2.989}$. The corresponding relationship for *M. felicinium* ranging from 3.1 – 8.2 cm was $W = 0.0016L^{3.003}$. These values indicated isometric relationship with 98 % of the variation in body weight being accounted for by changes in length. The length – weight relationship obtained for *A. gabonensis* and *M. felicinium* revealed that the values of the slopes (b) for

favours the development of parasite in the mosquitoes.

The diagnosis of malaria is made with certainty on identification of the malaria parasite in blood films of patients together with other symptoms associated with the disease. Due to the large and increasing number of children in attendance at health – centres, clinics and out-patient department of hospitals in areas where the disease is endemic, it is not always possible to investigate every suspected case even where sufficient laboratory equipment, chemicals and staff are available. Thus diagnosis of clinical malaria is commonly made in children who are feverish without other overt childhood diseases, and chloroquine is often given as therapeutic measure (Azuike, 1993).

Prevalence surveys can give insights into the transmission patterns of diseases in any given area and act as useful tools for control purposes. In Ebonyi State, previous information on the prevalence of malaria parasitaemia among primary school children is lacking. This study was undertaken, therefore to determine the prevalence of malaria parasitaemia among primary school children in Ebonyi State, and as such provide baseline date for future malaria control programmes in the State.

## MATERIALS AND METHODS

**Study Area**: The study was carried out in Ebonyi State (Figure 1). This is one of the thirty-six States of Nigeria. It is in the South - eastern part of the country and is made up of thirteen Local Government Areas which are Abakaliki, Ebonyi, Izzi, Ishielu, Ezza North, Ezza South , Ikwo, Ohaukwu, Onicha, Ohaozara, Ivo, Afikpo North and Afikpo South local government areas. It has a population of about 1.8 million and a total land area of about 5935 $km^2$ which gives a population density of over 300 persons per square kilometer (Anon, 1997).

The state is located between latitudes $7^0 30^1$ East and $8^0\ 30^1$ East and longitudes $5^0 40^1$ North and $6^0\ 45^1$ North within the rain forest zone of Nigeria characterized by high rainfall, run-off volumes and relative humidity. The annual rainfall is over 1600 mm while the mean daily rainfall is over 150 mm. The mean daily maximum and minimum temperatures are $32^0$C and $25^0$C respectively (Anon, 1997)

The fertile and rich soils of Ebonyi State encourage large scale agriculture. Available statistics indicate that agriculture provides productive employment to over 85 % of Ebonyians (Anon, 1997). This makes agriculture

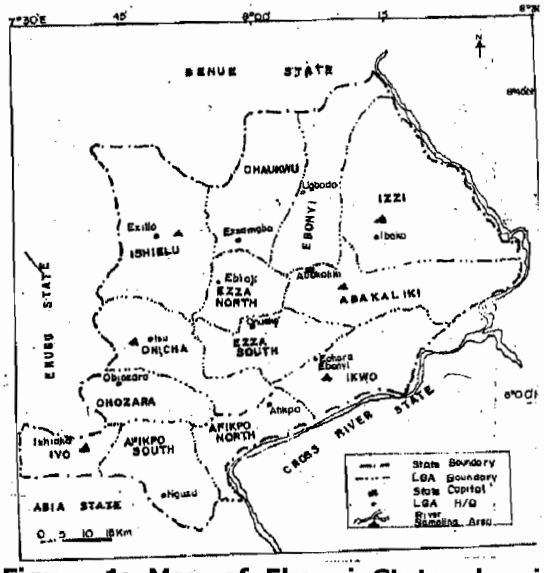


**Figure 1: Map of Ebonyi State showing sampled areas**

the mainstay of the state's economy. In fact Ebonyi state is regarded as one of the food basket states of the federation (Anon, 1997).

There are primary health centres in all the local Government Areas, some comprehensive health centres operated under the supervision of medical doctors and free mobile health clinic. There is a Federal Medical Centre and a State's University Teaching Hospital in the state capital. There are also strong believes in the use of traditional medicine in many rural areas of the state.

**Selection of Schools:** Three senatorial zones of the state: (Ebonyi South, Ebonyi North and Ebonyi central) were selected for study. In each senatorial zone of the State, Local Government Areas that make up the zone were listed and two out of them were selected using simple random sampling. The six Local Government Areas selected were Onicha and Ivo from Ebonyi South, Ikwo and Ishielu from Ebonyi Central and Abakaliki and Izzi from Ebonyi North Senatorial zone. Primary schools in each of the selected Local Government Area were listed and four schools were selected from each Local Government Area using random sampling technique. In the random sampling for Local Government Areas and schools, table of random numbers was used.

**Blood Sample Collection and Analysis**: From each of the twenty-four schools selected, 50 pupils were sampled using lottery method of sampling. In this method, papers written "yes" and "no" were folded neatly and displayed to the pupils to pick. The lottery papers were

usually counted for the expected number of "Yes" donors in each school. Those that picked yes were separated from those that picked "No". At the end of this exercise, the age, sex, weight and height of the pupils that picked yes were recorded. A total of 1,200 pupils aged between 5-16 years were sampled.

Venous blood was collected from each pupil using disposable needles and syringes. Thick and thin blood films were smeared on the slides for malaria parasite (mp) and species identification. For mp, the smears were stained with Giemsa stain while those for species identification were stained with Leishman's stain. Slides were examined under the binocular light microscope using x 100 objective oil - immersion. The presence of malaria parasites, the degree of infection and the species of parasite were identified. (Shute and Maryon, 1966).

The intensity of parasitaemia was measured per microscopic field. Up to 5 microscopic fields were examined and the number of parasites per field counted. The average number of parasites per five microscopic fields was then taken.

**Statistical Analysis:** The data were analyzed statistically using chi- square ($x^2$) test.

## RESULTS

A total of 1,200 primary school children aged between 5 to 16 years were examined for malaria parasite. Out of this number, 481 (40. 08 %) were infected. The malaria parasite isolated was *Plasmodium falciparum.*

**Malaria Parasitaemia in Primary Schools:** The highest prevalence rate of 52 % was recorded in Central School, Okue in Ivo L.G.A and Eketube Enyigba Community School, Abakaliki L. G. A. These two schools are located in the rural villages of the state. These were followed by Central School, Ntezi and Ndibulofia Ominyi Community School, Izzi with 50 % prevalence rates. Other values recorded were Agalegu Amachi Community School in Abakaliki with 48 %, Ataragu Amagu community Primary School, Ivo, with 46 % etc. The least infection rate of 22% was recorded in Community Central School Amanator Isu in Onicha L.G.A (Table 1)

**Gender, Age and Malaria Parasitaemia in Ebonyi State:** The highest prevalence of 231 (47.05 %) was recorded in children between 5 - 7 years. This was followed by 179 (39.08 %) recorded in the age class 8 - 10 years. The least prevalence of 3 (17.65 %) was recorded in 14 - 16 years class. A chi- square test carried on the data to know if the infection was age dependent was statistically significant ($P < 0.05$). It can be observed from Table 2 that malaria parasitaemia was higher in children of younger age groups than in those of older age groups. Table 2 also highlights the prevalence of malaria parasitaemia due to sex. Out of 591 males and 609 females examined, 243 males and 238 females were infected. This difference in infection according to sex was not statistically significant ($P > 0.05$). In the male and female, the highest prevalence was recorded in the 5-7 years age class, while the least prevalence was recorded in the 14-16 years age class. The parasitaemia in both sexes followed a similar pattern.

**Intensity of Infections:** The intensity in each age group is shown in table 3. In all the age groups sampled, children under the age class 8 - 10 years had the highest intensity of 11.59. Those under the age class 5 - 7 had 11.56 while the least intensity of infection was recorded in the age class 14 - 16 years.

## DISCUSSION

The parasite rate of 40.08 % in this study was quite high, indicating a high degree of malaria parasitaemia among primary school children in Ebonyi State. The species of malaria parasite was *Plasmodium falciparum.* The malaria infection in the state is severe because *Plasmodium falciparum* causes complicated form of malaria especially in young children.

Several studies have shown high parasite rates among primary school children in Nigeria. Salako *et al,* (1990) reported a parasite rate of 74 % in Nigeria while Ademowo *et al,* (1995) reported a lower percentage of 27 % among school children from a rural village in Western Nigeria. Furthermore,. Adeyemo *et al,* (1999) recorded a parasitaemic rate of 80 % among primary school children in malaria endemic village of Erunmu in South- West Nigeria. The endemicity is high in rural than urban communities of Ebonyi State. For instance, the highest parasitaemic rate of 52 % was recorded in two rural schools of Okue and Eketube. This result suggests that the rural environment offers adequate conditions for breeding of mosquitoes. The socio–economic status of parents in rural communities also helps in the transmission of malaria.

**Table 1: School by school malaria parasitaemic rates among primary school children in Ebonyi State**

| LGA | School | Number Examined | Number Infected | Infection Rate (%) |
|---|---|---|---|---|
| Ivo | Iyioji Comm. Pri. School, Akaeze. | 50 | 19 | 38 |
| " | Ndiobasi Comm. Pri. School, Ishiagu. | 50 | 21 | 42 |
| " | Central School, Okue. | " | 26 | 52 |
| " | Ataragu Amagu Comm. Pri. School. | " | 23 | 46 |
| Abakaliki | Eketube Enyigba Comm. School. | " | 26 | 52 |
| " | Agalegu Amachi Comm. School. | " | 24 | 48 |
| " | EBSU Staff Pri. Sch., Abakaliki | " | 18 | 36 |
| " | Ezikwo Rd Pri. School, Azuiyiokwu. | " | 18 | 36 |
| 1zzi | Ndibuolfia Ominyi Comm. School, Izza | " | 25 | 59 |
| " | Ezzainymagu Comm. School Ndubia | " | 21 | 42 |
| " | Agbaja Central School, Izzi | " | 20 | 40 |
| " | Onuenyim Comm. School, Izzi | " | 17 | 34 |
| Ikwo | Comm. Pri. Sch. Agubia Ikwo | " | 14 | 28 |
| " | Urban Pri. Sch. Ndufu Echara | " | 13 | 26 |
| " | Comm. Cent. Sch. Echialike Ikwo | " | 22 | 44 |
| " | Comm. Pri. Sch. Ndiagu Amagu | " | 22 | 44 |
| Ishielu | Comm. Pri. Sch. Ezillo | " | 19 | 38 |
| " | Central School, Ntezi | " | 25 | 50 |
| " | Central School Umuhuali | " | 20 | 40 |
| " | Comm. Cent. Sch. Ohofia Agba | " | 22 | 44 |
| Onicha | Amokpara Comm. School, Oshiri | " | 22 | 44 |
| " | Amanator Onicha Comm. Pri. Sch. | " | 20 | 40 |
| " | Comm. Cent. Sch. Anamnator Isu. | " | 11 | 22 |
| " | Isuachara pri. School, Isu | " | 13 | 36 |
| **Total** | | **1,200** | **481** | **40.08** |

**Table 2: Sex and age – related malaria parasitaemia among primary school children in Ebonyi State**

| Age Class (Years) | Male | | Female | | Total No Exam. In each class | Total Number & (%) infected in each class |
|---|---|---|---|---|---|---|
| | Number Examined | No & (%) infected | Number Examined | No & (%) infected | | |
| **5-7** | 248 | 117(47.18) | 243 | 114(46.91) | 491 | 231(47.05) |
| **8-10** | 223 | 88(39.46) | 235 | 91.(38.72) | 458 | 179 (39.08) |
| **11-13** | 115 | 37 (32.07) | 119 | 31(26.05) | 234 | 68 (29.06) |
| **14-16** | 5 | 1 (20) | 12 | 2 (16.67) | 17 | 3 (17.65) |
| **Total** | **591** | **243 (41.12)** | **609** | **238 (39.08)** | **1200** | **481 (40.08)** |

**Table 3: Age-related intensity of parasitaemia**

| Age class (years) | Number of Parasites | Number of pupils infected | Intensity |
|---|---|---|---|
| **5-7** | 2670 | 231 | 11.56 |
| **8-10** | 2075 | 179 | 11.59 |
| **11-13** | 760 | 68 | 11.18 |
| **14-16** | 30 | 3 | 10.00 |
| **Total** | **5535** | **481** | **11.51** |

Most of these parents cannot afford screening of their homes, insecticides and treated bed nets for mosquito control. Illiteracy and ethnic beliefs among the rural dwellers have further encouraged the transmission of malaria parasites. In some cases, the infected children are not fully treated with the correct doses of antimalaria drugs. Among the age groups sampled, children between the 5 - 7 years age group had the highest rate of parasitaemia and thus vulnerable to malaria attacks due to the fact that their immunity to malaria parasite had not been fully developed.

Angyo *et al*, (1996) in a similar study at Jos Nigeria reported a parasite rate of 70. 5 % among children of the same age group. In this study, children of 8-10 years age group had parasitaemic rate of 39.08 %, those of 11- 13 years age class had 29.06 % while those of 14 -16 years age class had 17.65 % parasitaemic rates indicating that the parasitaemic rate decreases with increasing age. Older children are therefore less susceptible to malaria attack because they seem to have developed their own active immunity against malaria parasite (Angyo, *et al.* 1996).

Immunity has important effects on the transmission of the disease by reducing the level of parasitaemia after infective bites and increasing ten folds the rate of clearance of parasitaemia (Ademowo, 1995). With repeated infections in areas of intense transmission, the level at which parasitaemia stabilizes falls and the threshold for symptoms rises. Consequently, parasitaemia becomes asymptomatic and the risks of unrestrained parasitic multiplication to lethal

burdens decline (Ademowo, 1995). Numerically, more males than females were infected despite the fact that more females than males were examined in the present study. This is comparable to the report of Okeahialam *et al,* (1972) and Uzoegwu and Onwurah (2003) for children and adults respectively. However, in this present study, the difference in males and females infected with malaria parasite was not statistically significant and therefore infection was not dependent on sex.

The intensity of parasitaemia was high. The fact that children with such parasite densities were healthy and able to go to school means that malaria is well tolerated in Ebonyi state just as in many other parts of the sub- Saharan Africa. This is in consonance with the report of Ogunrin, (2001) who noted that children in endemic areas might tolerate very high levels of parasitaemia without severe symptoms.

**Conclusion:** Efforts must be put up to undertake a massive attack on the parasite and its vectors in the state because it is evident that malaria parasitaemia is widespread among younger children. If the situation is not checked, more children will be vulnerable to malaria attack and soon most of the debilitating effects of malaria will surface. Therefore concrete steps should be taken quickly to avert an epidemic of malaria especially among children of school going age. Apart from chemotherapeutic control of malaria in the state, health education focusing on malaria control should be intensified both at school and at the community level to ginger up community participatory activities aimed at sustainable malaria control.

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