PACIFIC JOURNAL OF MEDICAL SCIENCES

{Formerly: Medical Sciences Bulletin}

ISSN: 2072 – 1625

Pac. J. Med. Sci. (PJMS)

www.pacjmedsci.com. Email: pacjmedsci@gmail.com.

PREVALENCE OF HUMAN EDIBLE CRABS INFECTED WITH *PARAGONIMUS UTEROBILATERALIS* METACERCARIAE IN SOUTHEASTERN NIGERIA

Emmanuel Chukwunenye Uttah

Department of Biological Sciences, Cross River University of Technology, Calabar, Nigeria.

Corresponding Author: Emmanuel Chukwunenye Uttah

Email address: drecuttah@yahoo.com.

Running title: Human edible crab metacercariae infection

PREVALENCE OF HUMAN EDIBLE CRABS INFECTED WITH *PARAGONIMUS UTEROBILATERALIS* METACERCARIAE IN SOUTHEASTERN NIGERIA

Emmanuel Chukwunenye Uttah

Department of Biological Sciences, Cross River University of Technology, Calabar, Nigeria.

Corresponding Author: Emmanuel Chukwunenye Uttah

Email address: drecuttah@yahoo.com.

Running title: Human edible crab metacercariae infection

ABSTRACT:

This study was aimed at determining the seasonalityof relative abundance of human edible crab, *Sudanautes*caught from their natural habitats, and those sold for human consumption in local markets in endemic areas of South-eastern Nigeria, to assess their infection rate with *P. uterobilateralis* metacercariae. Crabs were caught from their natural habitat as well as bought from the market over a period of 12 months; they were then and examined in the laboratory for infection with metacercariae. The prevalence of metacercarial infection of the crabs in both groups showed no seasonal variation but oscillated throughout the year. In all, 151 (6.9%) of the crabs caught were infected with *Paragonimus* metacercariae. The monthly percentage of total infected crabs exhibited seasonality as the relative abundance, being relatively higher in the dry season months; peaking in the month of September but lowest in January. The monthly percentage of total infected crabs was higher than the percentage of crabs caught in five months: June, September, November, February, and May. There is need for innovative measures to discourage the local population from eating improperly cooked crabs so as to curb the epidemiological dangers of eating infected crabs.

Key words: Paragonimiasis, edible crab, *Sudanautes*, metacercariae infection, Nigeria

(Submitted January 2013; Accepted March 2013)

INTRODUCTION:

Crabs belong to a group of animals known as decapod crustaceans. Many species of crabs constitute an important part of the local food chain in sub-Saharan Africa [1]. Some of these crab species are of immense epidemiological importance.

The species *Sudanautes* is the intermediate host of *Paragonimusuterobilateralis* in eastern Nigeria [2]. Eating of large amount of crabs has continued in parts of Eastern Nigeria decades after second outbreak of paragonimiasis in the area [3]. Paragonimiasis is acquired as a result of consumption of raw or improperly cooked or prickled freshwater crabs or crayfish harbouring infective metacercariae [4].

Paragonimiasis is a zoonotic infection of tropical and sub-tropical significance clustered around the intertropical zone. About 200 million persons are at risk of being infected, while 20 million are already infected, aggravating the public health and socio-economic indices in the endemic areas [5].

Past research activities have been more on the prevalence of infection and identification of endemic foci [2, 3, 6, 7], as well as on the identification of the intermediate host [2]. The crab-eating behaviour of an endemic population has been studied and observations indicated that the risk of paragonimiasis increased with the frequency of eating of *Sudanautes* [3], and the diagnostic overlap of paragonimiasis with tuberculosis [8]. However, information on the seasonal abundance of *Sudanautes* and its seasonal rate of infection with *P. uterobilateralis* metacercariae is scanty. This is an important missing link in paragonimiasis research since seasonal variation in crab populations and the level of crab infection are important epidemiological factors in paragonimiasis transmission [9]. Thus longitudinal studies to obtain data on these parameters are steps in the right direction. This study aimed to determine the seasonal relative abundance of *Sudanautes* in their natural habitats, and to assess the infection rates of *Sudanautes* with *P. uterobilateralis* metacercariae in relation to seasonality among those sold in local markets in an endemic area of southeastern Nigeria.

MATERIALS AND METHODS:

The study area

The study was carried out in Oyigbo, a sprawling community in the suburb of Port Harcourt, Rivers State, Nigeria. Oyigbo is urban in nature;it constituted predominantly of non-indigenes, and could be described as assimilated into the larger Port Harcourt city. The community lies on the bank of Imo River, and therefore a considerable proportion of the population live off the freshwater resources from the river [3]. Generally, the population

consists of subsistent farmers, fishermen, artisans, traders, river-food processors, and significantly few white collar workers [3]. Imo River traverses three states mainly in rainforest Nigeria. The states are Imo, Abia, and Rivers states. The Oyigbo area is in the Lower Imo Basin. Here, crabs are caught both for subsistence and for commercial purposes and sold locally and in nearby towns where they are regarded as delicacy either to complement for meat and fish as sources of protein or to serve as alternative altogether. Crabs are now being used as partial substitute for fishmeal fed to fish being raised in fishponds [10].

Collection of crabs

In order to compare results, the basket traps and nets methods of Udonsi [2] were adopted with little modification. Nets were spread to cover Crab holes as much as possible and then the crabs were chased from their hiding places upstream by disturbing the surroundings. Baskets were placed where the crabs were most appropriate for the same purpose. Emerging crabs were trapped in the baskets or nets. Sampling was carried out comprehensively at various sampling points for two consecutive days every four weeks. The crabs were kept in sealed containers in iced packs and transported to the laboratory.

Sampling of crabs sold in the market

Sudanautes being sold in the market in the study areas were bought fresh during sampling days and preserved in iced packs and transported to the laboratory for examination.

Laboratory examination of crabs

The haemocoel contents of the individual crabs were examined in the laboratory using dissection microscope. The haemocoel was examined completely for encysted microcercouscercariae of *P. uterobilateralis* [2]. The number of cercariae per individual crab was noted. High magnification (x100) in Compound microscope was used for confirmation.

Data analysis:

Monthly percentage of total infected crabs (MPTI) was calculated as follows:

MPTI = (Number of infected crabs in a month x 100), divided by, total number of infected crabs collected in the entire 12 months.

Prevalence was calculated as follows:

Prevalence = (total number of infected crabs x 100), divided by, total number of crabs collected in the entire 12 months.

RESULTS:

Monthly Abundance of crabs and seasonal variation

A total of 2190 crabs were caught during the study. The abundance of crabs was highest in the months of June through September. Overall, the relative abundance of crabs peaked in August and was least in the month of January. It was significantly higher in the rainy

season months (May to October) than in the dry season months (November to April; χ^2-test: $p < 0.05$). The monthly abundance of crabs was more in the months of sustained heavier rainfall (see Table 1). The monthly variation in temperature was minimal throughout the year; hence the monthly temperature values recorded were comparable in both the rainy and dry seasons.

Table1: Monthly abundance of crabs in relation to monthly rainfall and monthly temperature in southeastern Nigeria

Month	Abundance	Rainfall (mm)	Temperature (°C)
June	238	440	26.5
July	289	380	25.6
August	343	530	26.0
September	277	540	25.8
October	168	400	24.4
November	146	47	24.1
December	124	9	24.4
January	59	8	25.9
February	81	30	28.5
March	124	100	27.0
April	168	204	28.8
May	173	310	26.5

Infection rates between crabs caught from their natural habitats and those being sold in the market.

The prevalence of cercarial infection of crabs showed no seasonal variation but oscillated throughout the year in both crabs caught from their natural habitats and those being sold in the market. For the former category of crabs, the highest monthly prevalence was 7.5% in February; while the lowest was 3.8% in the month of July (see Table 2). For those sold in the market, the highest monthly prevalence of cercarial infection was 7.2% in the month of May and least (4.1%) in December and July.

Table 2: Comparison of monthly prevalence of crab infected with *Paragonimus* metacercariae between crabs caught in their natural habitats and those sold in the market in Southeastern Nigeria

Month	Percentage of total caught from the natural habitat (%)	Percentage of total sold in the market
June	5.7	5.2
July	3.8	4.1
August	4.9	5.2
September	6.6	5.8
October	5.9	5.8
November	5.2	5.8
December	3.9	4.1
January	5.9	4.2
February	7.5	5.8
March	5.0	5.5
April	5.3	6.2
May	6.3	7.2

Seasonality of percentage of crabs caught and percentage of infected crabs

In all, 151 (6.9%) of the crabs caught were infected with *Paragonimus* metacercariae. The monthly percentage of total infected crabs exhibited seasonality as did the relative abundance. As shown in Table 3, the monthly percentage of total infected crabs was relatively higher in the wet season months (June to September); peaked in September, but lowest in dry season month of January.

The proportion of infected crabs obtained in some months (in relation to total infected crabs obtained in 12 months) was higher than the proportion of crabs caught in those months (in relation to total infected crabs caught in 12 months). The months were June, September, October, January, February, and May. This difference was more marked in September.

Table 3: Seasonality of monthly percentages of total crabs and monthly percentages of total infected crabs in Southeastern Nigeria

Month	Percentage of crabs caught	Percentage of infected crabs
June	11.2	11.6
July	13.4	12.4
August	15.8	14.0
September	13.2	15.8
October	7.8	8.4
November	6.2	5.8
December	5.8	4.1
January	2.3	2.5
February	3.1	4.1
March	5.5	5.0
April	7.8	7.4
May	8.0	9.1

DISCUSSION:

The relative abundance of *S. africanus* in this study indicates that it is common in south-eastern Nigeria. Crabs generally are common and abundant in marine and freshwater bodies in West Africa [1]. The crabs are commonly harvested with crab pots, gill/set nets, and traps by local fishermen from streams, ponds, reservoirs and rivers for subsistence and commercial purposes [11]. In parts of southeastern Nigeria, there is frequent eating of *Sudanonautesafricanus*, the West African freshwater crab belonging to family Potamonautidae, with over 88 species, and is present in all the streams and river systems across Africa [12].

Data obtained in this present study confirms the seasonal variation in crab relative abundance in southeastern Nigeria as already reported by others [9, 13-16]. The seasonal effects on crab abundance are caused by variations in climatic factors such as rainfall and temperature [9]. Crab reproduction period is seasonal and is reported to coincide with the onset of rainfall [11]. However, there were no significant variations in the average monthly temperature observed throughout the yearin this study. This is expected as the study area is

close to the equator known to have minimal temperature variations. The minimal temperature variations may not have impacted significantly on the observed monthly relative abundance in this study. Elsewhere, crabs were more abundant and caught during the summer season, while lower abundance was recorded during the winter season for the same species [9, 17]. Epidemiologically six months (June, September, October, January, February, and May) were particularly striking in that the monthly percentage of total infected crabs in these months was higher than the percentage of crabs caught. This could suggest possible higher transmission indices in these months. This means that the transmission of paragonimiasis in South-eastern Nigeria is not seasonal.

The epidemiological parameters recorded from crabs caught in their natural habitats showed high infection rate. Massive eating of crabs in the area is driven mostly by the level of education and therefore could be attributed to level of awareness of the epidemiological implications of such eating behavior. Better awareness leads to better and proper preparation of the crab before eating [3]. On the other hand, better level of education most times could translate to better economic wellbeing, which means being in a better position to afford meat rather than relying on cheaper alternatives such as crab-eating [3].

Behavioural change must be a prominent part of any successful control strategies in South-eastern Nigeria. However, provision of alternative sustainable and inexpensive solutions to cause behavioral change has also been a restraint for many control programs [18]. Human behaviour plays a fundamental role in the epidemiology of parasitic infections such as paragonimiasis, both its emergence and spread.Human behavior is further complicated by the impacts of cultural, religious, ethnic, age and gender related variables. To have a desirable outcome in paragonimiasis control in the area, behavioural change must be directed to either curb crab-eating out-rightly or to properly cook them before eating. Secondly, there must be an alternative plan to encourage massive breeding and provision of infection-free crabs on a commercial scale for committed eaters. The crab species *S. africanus*is reported to have high fecundity, producing many eggs per individual, which is an indication that they are viable for farm production, and can be bred in captivity [11]. Selective breeding for rapid growth can be engineered to obtain more attractive and delicious specimens that will compete favourably with their naturally occurring counterparts.

CONCLUSION:

There is a high metacercariae infection rate among crabs in South-eastern Nigeria. There is need for innovative measures to discourage the local population from eating improperly cooked crabs.

ACKNOWLEDGEMENT:

The author appreciates the Chiefs of Oyigbo community and all the individuals that participated in the study. The contributions of my field and laboratory assistants are hereby acknowledged.

REFERENCES:

1. Bello-Olusoji O, Oyekanmi, AM, Afunmiso, OM, and Ozorewor. OM. Length-weight relationship and stomach content of Portunid crabs, *Callinectespallidus*(de Rochebrune, 1883) from the Gulf of Guinea. *Bowen J. Agric*. 2006, 3(1): 65–72.
2. Udonsi, JK. Endemic Paragonimus infection in Upper Igwun Basin, Nigeria: a preliminary report on a renewed outbreak. Annals of Tropical Medicine and Parasitology, 1987, 81: 57- 62.
3. Uttah, EC. Paragonimiasis and renewed crab-eating behavior in six communities from two ethno-cultural clusters in Southeastern Nigeria. *ISRN Infectious Diseases*, 2013, vol. 2013, Article ID 569485, 5 pages. doi:10.5402/2013/569485.
4. Aka, N, Adoubryn, K, Rondelaud, and Dreyfuss, G. Human paragonimiasis in Africa, *Annals of Afr Med*, 2008, 7 (4): 153 – 162
5. Toscano, C, Yu, SH, Nunn, P, Mott, KE. Paragonimiasis and tuberculosis, diagnostic confusion: a review of the literature. *Trop Dis Bull* 1995, 92: 1-26.
6. Nwokolo, C.Outbreak of paragonimiasis in Eastern Nigeria." *Lancet*, 1972, 1(7740): 32–33.
7. Arene, FO, Ibanga, E, and Asor, JE. Epidemiology of paragonimiasis in Cross River basin, Nigeria: prevalence and intensity of infection due to Paragonimus uterobilateralis in Yakurr local government area. Public Health, 1998, 112(2):119-122.
8. Lane, MA, Barsanti, MC, Santos, MY, Lubner, SJ, and Weil, GJ. Human Paragonimiasis in North America following Ingestion of Raw Crayfish. *Clin Infect Dis*, 2009, 49:e55–61.
9. Hosseini M, VazirizadeA, Parsa Y, and Mansori A. Sex Ratio, Size Distribution and Seasonal Abundance of Blue Swimming Crab. *World ApplScs J* 2012, 17 (7): 919-925.
10. Idoniboye-Obu TLE, Irere AL, and Ayinla AO. Utilizing crab meal as a partial substitute for fish meal In the diet of *ClariasGariepinus* (Burchell 1822). *Afri J of ApplZool Environ Biol*,2006, 8:119-125.
11. Bello Olusoji OA, Anifowose OJ, and Sodamola MY. Length-Weight Relationships, Condition Factor and Fecundity of the West Africa

Freshwater Crab, *Sudanonautesafricanus*(Milne-Edwards 1883), in Western Nigeria. *West AfrJ ApplEcol,* 2009. 16: 65-74.

12. Cumberlidge N. Modification of the freshwater crabs of West Africa. Family Potamonautidae. IRD. pp. 1–382. 1999.
13. DittelAI, and Epifanio CE. Seasonal and tidal abundance of crab larvae in a tropical mangrove system, Gulf of Nicoya, Costa Rica". *Marine Ecology Progress Series*. 1990, 65: 25-34.
14. MaynouF, and Cartes JE. Community structure of bathyal decapod crustaceans off south-west Balearic Islands (western Mediterranean): seasonality and regional patterns in zonation. *Journal of the Marine Biological Association of the United Kingdom* 2000, 80: 789e798.
15. Leung SF, and Leung KF. Hong Kong's penaeid prawns: a decade long record of change in community composition. In: Morton, B. (Ed.), Perspectives on Marine Environmental Change in Hong Kong and Southern China, 1977e2001. Hong Kong University Press, Hong Kong, pp. 616e653. 2003.
16. Ganmanee M, Narita T, Sekiguchi H. Long-terminvestigation of spatiotemporal variations in faunal composition and species richness of megabenthos in Ise Bay, central Japan. Journal of Oceanography 66, 1071e1083. 2004.
17. Robertson WD, and Kruger A. Size at maturity, mating and spawning in the Portunid crab *Scylla serrata*(Forskål) in Natal, South Africa. *Estuarine, Coastal and Shelf Science*, 39: 185-200. 1994.
18. Azim SF, Dojki SS, and Ahmad MA. Role of Human Behaviour and Parasitic Diseases". *Infect Dis J Pakistan* 2008, 17(4): 128-134.