Advances in Science and Technology, Vol. 1, No. 1, January - March 2007, pp. 61-66

New Diagnostic Methods and the Use of Geographic Information System (GIS) in Small Scale Aquaculture for Sustainable Rural Development: The Nigerian Perspective

I. R. Keke[1], and D.C. Njoku[2]

[1]Fisheries and Hydrobiology Research Unit. Dept of Animal and Environmental Biology, Faculty of Science, Imo State University, Owerri. [2]Dept of Fisheries and Wildlife Management, Faculty of Agriculture, Imo State University, Owerri.

(Submitted: 24 November, 2006; Accepted: 16 March, 2007)

Abstract

The paper examines new problem diagnostic methods in aquaculture vis-à-vis the conventional method which has failed to achieve the desired small-scale rural aquaculture development objectives in Nigeria, including the promoting of food security, improving nutritional standard of the people, generating supplementary income, reducing rural unemployment and protecting the environment. The inability of the conventional problem diagnostic method to incorporate the rural fish farmer in policy formulation process on matters concerning him and his destiny is largely responsible being unable to determine the real needs and aspirations of the people when development projects are formulated. In this contest, new problem diagnostic methods are advocated, based on participatory aquaculture extension system (PAES). Instruments include the Agro- ecosystem analysis (AEA), Farmer Participatory Research (FPR), Participatory Action Research (PAR), Forming Systems Research (FSR), the Rapid Rural Appraisal (RRA) and the Participatory Rural Appraisal (PRA) techniques. Effective application of the new problem diagnostic instruments require effective method of assessing the aquaculture potentials in rural communities based on definite criteria. The paper favours the use of Geographic Information System (GIS) The application of GIS and the criteria for the assessment of rural aquaculture potentials using the GIS are discussed. Due consideration of small scale aquaculture in the unified agricultural extension system is recommended, based on the former participatory approach to problem diagnosis and resolution.

1.0 Introduction

"Aquaculture" generally covers a broad range of culture systems and practices, ranging from industrial scale intensive fish farming to small- scale fish farming enterprise as an integral part of rural development. The bulk of aquaculture production comes from small- scale farmers in rural areas (Mohnar *et al,* 1991). For many adopters of this kind of aquaculture (usually the small holder rural farmers), it is secondary activity. It may be integrated with other aspects of farming, such as crop and livestock production, with each aspect enhancing the benefits of the other. Infact the evolution of this manner of integrated farming system at rural farm level is an essential index of rural development. Small- scale rural aquaculture has a potential index of rural development. Small- scale rural aquaculture has a potential for enhancing food security (Williams, 1995). It also has an important role in a number of other areas as supplement to income, source of employment to low-income group, source of extra food, means of spreading farm risks, and as source of raw material (e.g. fish meal or bone meal) in livestock feed. These features of small –scale rural, aquaculture, according to FAO (1997) have made it a focus for development and assistance.

2.0 Problem Diagnosis in Small-Scale Rural Aquaculture New Developments.

The success or failure of aquaculture development activities can be determined in two ways as suggested by LightFoot *et al* (1992):

(i) Whether the activities succeed in the terms set by promoters of such activities and

(ii) Whether they make sense to the farmer.

Farmers own acceptance or rejection of the technology should ultimately be the most important criterion; this adoption and rejection are important indicators. There is the need to supplement these with a range of other indicators (FAO, 1997) both quantitatively and qualitatively. These include:

3.0 Results

Tables 1 and 2 summarise the findings in the studies.Out of the 50 samples obtained from the Plasmodium falciparum infected pregnant women, aged (20 – 44) years, 47 (94%) had normal aspartate aminotranferase (AST) levels. In the control group comprising another 50 pregnant women of the same age range, but without the infection, normal AST levels were observed in all the samples examined (100%). The mean (X_t) AST for the infected group was 15.05IU/L in contrast to 14.00 IU/L found in the control (X_c) group.

For alanine aminotransferase (ALT), there was no significant difference ($p>0.05$) between the mean (X_t) of the infected (11.07IU/L) and the mean (X_c) of the non-infected pregnant women (11.00IU/L) who made up the control.

The mean ALP level of the infected group was slightly higher than that of the control group (X_t) = (102.66 as against (X_c) = 94.60 IU/L), giving a marginal increase of 8.52%. Similarly, 17 (34%) of the infected group had abnormal ALP in contrast to 11(20%) of the non-infected (control) group with abnormal ALP. The abnormal level of ALP may not be as a result of the Plasmodium falciparum infection, since it was also observed in the control group. Generally, a low mean parasite (Plasmodium falciparum) count (8.7) was observed in the study. This may be related to acute Plasmodium falciparum infection. There was no definite relationship between malaria parasite count and the age group of the subjects. Similarly, the serum enzyme levels were not dependent on malaria parasite count and the age group of the subjects. Similarly, the serum enzyme levels were not dependent on the age group of the infected group.

Table 1: Mean serum enzyme concentration for non-*Plasmodium Falciparum* infected pregnant women

Age group	AST	ALT	ALP
20-24	15.63	14.63	103.25
25-29	9.81	7.44	69.38
30-34	14.50	12.33	60.38
35-39	12.73	9.27	127.82
40-44	17.00	11.28	111.71
$X_c \cong$	14.00	11.00	94.60

Table 2: Mean serum enzyme concentration for *Plasmodium Falciparum* infected pregnant women

Age group	AST	ALT	ALP	Mean parasite counts
20-24	14.92 (10.4)*	13.00(9.62)	76.05(9.6)	9.9
25 – 29	16.93 (8.62)	10.00 (10.42)	126.88 (10.38)	9.8
30 – 34	17.48 (7.0)	14.40 (9.00)	93.70 (9.2)	8.4
35-39	14.60 (6.8)	10.80 (6.80)	129.50 (6.8)	6.8
40 – 44	11.83 (8.0)	7.17 (9.00)	87.17 (9.0)	8.7
$X_t \cong$	15.05 (8.15)	11.07 (9.00)	102.66 (9.00)	8.7
Ref. ranges	0-41 IU/L	0 – 45 IU/L	30-115 IU/L	

* values in parentheses show parasite counts for each study.

4.0 Discussions and Conclusion

The presence of the *Plasmodium falciparum* infection in the pregnant woman did not cause any appreciable change in the serum levels of aspartate anninotransferase (AST), alanine anninotransferase (ALT) and alkaline phosphatase (ALP). (Table2).

Ozegbe (2001) reported transient increases in the serum levels of AST and ALT, in pregnancy. Based on the Murrey et. al. (2000) reference ranges, 47 out of the 50 infected pregnant women had normal AST (X_t=15.03 IU/L). When compared with the mean value of the non-infected pregnant women (X_c=14.00 IU/L), there seemed to be a transient (7.14%) elevation over the control (Tables 1 and 2). There was no distinct relationship between the age groups and the AST levels. The parasite counts neither correlated with the age groups nor with the enzyme concentrations.

Although Thomasson (1979),and Daas and Shah (2000), reported a slight increase in the serum levels of AST and ALT in pregnancy associated with viral infection, no increases in ALTwere observed the present study. I Indeed for ALT, there was no difference between the means of the infected (X_t = 11.07 IU/L) and the non-infected (X_c = 11.00IU/L) pregnant women (n =50). All the patients in the control and test groups exhibited normal ranges of ALT, indicating that liver function was not compromised in any way as a result of the parasite infection. Similarly, the parasite count did not relate with the age or serum enzyme levels in a definite pattern.

A transient (8.52%) increase during pregnancy in the case of ALP was observed (Tables 1 & 2). Out of the 50 patients studied, 17 (34%) showed abnormal ALP values, while 33 (66%) of them fell within the acceptable reference range. However, a similar pattern was also observed for the non-infected control group, where 11 (20%) of the 50 non-infected pregnant women showed abnormal ALP levels; and 39 (80%) of them had normal ranges. Owing to the fact that the same pattern of results were seen both in the test and control groups, the phenomenon may not be associated with the *Plasmodium falciparum* parasite infection. As was the case with AST and ALT, there was no definite relationship with the malaria parasite counts and the age group of the subjects.

In all, the possible explanation may be that the degree of parasitaemia associated with the pregnant women did not trigger the release of AST, ALT or ALP to appreciable serum levels. This may be so because the low burden of parasitaemia in the present study possibly did not affect liver function. Besides, these marker enzymes are predominantly hepatic rather than erythrocytic: the erythrocytes are known to bear the burden of *Plasmodium falciparum* infection. The parasites are also haboured by the liver during the non-erythrocytic stages of chronic infection. The degree of parasitemia did not give rise to this phenomenon. It is therefore concluded that the *P. falciparum* infection did not affect liver function.

References

Cheesbrough, M. 1998, Medical Laboratory Manual for Tropical Countries. 3rd Ed. Part 1. Cambridge Union Press. Cambridge: pp239-2511, 312-283.

Conchilo, J., Pilneborg, J., Peters, P. 2002, Liver enzyme elevation induced by hyperemesis gravidarum: Aetiology, diagnosis and treament. Neth. J. Medicine, Z, **2**, 417-423.

Dass, E., Shah, K. 2000, Liver blood enzymes. Indian J. Expt. Biol. **38**, 1138-1142.

Laifei, S., Stiller, R., Siddigui, D., Danston, G., 2001, Ursodeoxy – cholic acid for the treatment of intrahepatic cholestasis in pregnancy. Journal of maternal-fetal and Neonatal Medicine, **10**(2), 131-135.

King, E. J.and King, P. R. N.1954, Estimation of plasma phosphatase by determination of hydrolyzed phenol with amino-antipyrene. J. Chem. Path., **7**, 322-326.

Mishra, S.K. and Mohanty, S. 2003, Problems in management of severe malaria. The Internet journal of Tropical medicine. **1**(1), 1-11.

Montogomery, R., Dryer, R., Conway, T., Spector, A. 1990, Biochemistry, A law oriented Approach 5th Ed, Mosby, Missouri .pp104-132.

Murray, R.K., Granner, D.K., Mayer, P.A., Rodwell, V.W., 2000, Harpers Biochemistry, 25th ed. McGraw Hill. New York. pp 83, 242-245, 869

Obi, E., Orisakwe, O., Asomugha, A., Udemezue, O., Orish, V., 2004, The hepatoxic effect of halfantrnic in guinea pigs. Indian J. Pharmacol **36**(5), 303-305.

References

Andreae, M.O., Chapuis, A., Cros, B., Fontan, J., Helas, G., Justice, C., Kaufman, Y.J., Minga, A. and Nganga, D. 1992, "Ozone and Aitken nuclei over equatorial Africa: Airborne observations during DECAFE 88," Journal of Geophysical Research, **97**, 6137-6148.

Barnes, J.E. and Hofmann D.J. 1997, "Lidar measurements of stratospheric aerosol over Mauna Loa Observatory," Geophysical Research Letters, **24**, 1923-1926.

Chineke, T.C., Rizi, V., Masci, F., DiCarlo, P. and Iarlori M. 2000, "1979-1999 satellite total ozone column measurements over West Africa," Annali di Geofisica, **43**, 537-544.

Cros, B., Delmas, R., Nganga, D., Clairac, B. and Fontan J. 1988, "Seasonal trends of ozone in Equatorial Africa: Experimental evidence of photochemical formation," Journal of Geophysical Research, **93**, 8355-8366.

Ferry, G.V., Pueschel, R.F., Strawa, A.W., Kondo, Y., Howard, S.D., Verma, S., Mahoney, M.J., Bui, T.P., Hannan, J.R. and Fuelberg H.E. 1999, "Effects of aircraft on aerosol abundance in the upper troposphere," Geophysical Research Letters, **26**, 2399-2402.

Fioletov, V.E., Kerr, J.B., Hare, E.W., Labow, G.J. and McPeters R.D. 1999, "An assessment of the world ground-based total ozone network performance from the comparison with satellite data" Journal of Geophysical Research, **104**, 1737-1747.

Fishman, J. and Larsen J.C. 1987, "The distribution of total ozone and stratospheric ozone in the tropics: Implications for the distribution of tropospheric ozone," Journal of Geophysical Research, **92**, 6627-6634.

Fishman, J. and Watson C.E. 1990, "Distribution of tropospheric ozone determined from satellite data," Journal of Geophysical Research, **95**, 3599-3617.

Kalicharran, S., Diab, R.D. and Sokolic F. 1993, "Trends in total ozone over South African stations between 1979-1991," Geophysical Research Letters, **20**, 2877-2880.

Kundu, N. and Jain M. 1993, "Total ozone trends over low latitude Indian stations," Geophysical Research Letters, **20**, 2881-2883.

Press, W.H., Teukolsky, S.A., Vetterling, W.T. and Flannery B.P. 1992, Numerical recipes in FORTRAN: the art of scientific computing (Cambridge: University Press).