Riboflavin profile in Nigerians with *Schistosoma heamatobium* infection

[1]Nmorsi OPG, [2]Ukwandu NCD and [1]Isaac C

1. Tropical Research Unit, Department of Zoology, Ambrose Alli University, Ekpoma, Nigeria

2. Department of Medical Microbiology, Ambrose Alli University, Ekpoma, Nigeria

E-mail: nmorsiopg@yahoo.com

ABSTRACT: Riboflavin profile and the degree of infection were studied among 100 volunteers comprising 65 children and 35 adults with *Schistosoma haematobium* infection. Light infection of < 50 ova/10ml was reported among 35 volunteers while heavy infection of > 50 ova/10ml was observed in 65 patients. The infected participants had mean riboflavin (22.0 ± 4.5 nmol/L), flavin mononucleotide, FMN (16.44 ± 2.8 nmol/L), flavin adeno dinucleotide, FAD (63.07 ± 0.75 nmol/L) . The control subjects had higher mean riboflavin (108.8 ± 10.2 nmol/L), FMN (102.8 ± 3.5 nmol/L) and FAD (404.9 ± 8.7 nmol/L). These differences between the mean control and the infected volunteers for mean riboflavin, FMN and FAD were statistically significant (χ^2 = 68.45, P> 0.05; χ^2 = 72.63, P> 0.05; χ^2 = 288.58, P> 0.05). The relationship between egg counts, riboflavin, FMN and FAD was negatively correlated (r = -0.30, r = -0.41, r = -0.38) respectively. The mean riboflavin (19.0±4.6 nmol/L), FMN (14.7±1.65 nmol/L) and FAD (56.58±12.49 nmol/L) in children were lower than the 35 infected adults. These differences for riboflavin, FMN and FAD were not statistically significant (P<0.05; χ^2=0.47, P<0.05; χ^2=1.69, P< 0.05; χ^2=0.66) respectively. We deduce that the depressed riboflavin status among the *S. haematobium* infected volunteers than their control subjects implicated riboflavin and its metabolites in the pathogenesis of this parasite. There is the need to incorporate riboflavin in the management of urinary schistosomiasis. [Nature and Science. 2008;6(1):15-18]. ISSN: 1545-0740.

INTRODUCTION

Schistosomiasis remains an important parasitic infection in many tropical areas, especially Africa. Six hundred million people are thought to be at risk and 200 million are estimated to be infected (Chan *et al*., 1996). Recent analysis suggest that the morbidity due to schistosomiasis is grossly underestimated (King *et al*., 2005), resulting in an estimated 280,000 deaths annually in sub-Saharan Africa (Hoetez *et al.*, 2006). Nutritional status has been implicated as one of the factors associated with schistosomiasis morbidity (WHO, 1992).

Riboflavin is an essential nutrient in human nutrition has flavin mononucleotide (FMN) and flavin adeno dinucleotide, (FAD) as its precursor or metabolites. Ingested riboflavin enters the blood stream as FMN (Combs *et al.,* 1998), and inadequate riboflavin supply results in low circulating concentration (Capo-Chichi *et al.,* 2000). Circulating FAD also was reported to be decreased in malnutrition (Capo-Chichi *et al.,* 1999; Capo-Chichi *et al.,* 2000). Schistosomiasis and riboflavin deficiency have been associated with anaemia (Antony *et al*., 2006; Vanden Broek *et al*., 2000). However, the existence of an association between nutritional status and schistosomiasis is still not clear. Several studies have tried to correlate the nutritional status of the host with prevalence/intensity of infection (Coutinho 1976, 1980, Stephenson 1986, Coutinho *et al*., 1992, Ferreira *et al*., 1993, Continho *et al.,* 1997) or severity of clinical manifestations in schistosomiasis. However, conflicting results have been reported which could be due to differences in local, epidemiological features and in part, to different methodologies (Costa *et al*., 1988, Projetti *et al*., 1992).

We therefore investigate riboflavin and flavin nucleotides concentration and the degree of schistosomiasis in our locality for which information is previously lacking. This present communication correlates riboflavin and flavin nucleotides status of infected volunteers and intensity of infection.

MATERIALS AND METHODS

This study was carried out in Ihieve-Ogben; a rural community in Owan East local government area of Edo State. It is located at Latitude 6ºN and longitude 6ºE. Ihieve-Ogben is located within the guinea savanna region of the State. Agriculture especially farming and hunting are their predominant activities while a few of them, mostly women, are traders. The village has a stream which the inhabitants use as their source of water and recreational activities. There are about 1,000 inhabitants in this community.

The investigation commenced with a community mobilization campaign at Ihieve-Ogben. This involved educating them on the significance of the study as well as seeking their consent. Ethical permission was obtained from the State Ministry of Health, Benin City, Nigeria.

The Ova found in the urine of the 100 participates with schistosomiasis were quantified and classified as light infection <50 ova/10ml and heavy infection >50 ova/10ml according to WHO standards (WHO, 1983). Thirty control volunteers were without the *S. haematobium* eggs in their urine. Malaria, intestinal parasites, HIV and other overt febrile illness were ruled out in these volunteers using standard procedures and kits. The plasma riboflavin, FMN and FAD were determined by a high performance liquid chromatography (Traunmüller et al 2003).

The data obtained in this study were subjected to statistical analysis namely correlation and chi-square tests using Microsoft Excel statistical package.

RESULTS

Riboflavin, the flavin neuclotides profile and intensities of infection are presented in table 1. Light infection of < 50 ova/10ml was reported among 35 volunteers while heavy infection of > 50 ova/10ml was observed in 65 patients. The mean infected participants had mean riboflavin (22.0 ± 4.5 nmol/L), flavin mononucleotide, FMN (16.44 ± 2.8 nmol/L), flavin adeno dinucleotide, FAD (63.07 ± 0.75 nmol/L) . The control subjects had higher mean riboflavin (108.8 ± 10.2nmol/L), FMN (102.8 ± 3.5 nmol/L) and FAD (404.9 ± 8.7 nmol/L). These differences between the mean control and the infected volunteers for mean riboflavin, FMN and FAD were statistically significant (χ^2 = 68.45, P> 0.05; χ^2 = 72.63, P> 0.05; χ^2 = 288.58, P> 0.05). The relationship between egg counts, riboflavin, FMN and FAD was negatively correlated (r = -0.30, r = -0.41, r = -0.38) respectively.

Table 2 shows riboflavin and flavin nucleotides status of infected children and adults. Sixty five children were infected with *S. haematobium* for which their mean riboflavin (19.0±4.6 nmol/L), FMN (14.7±1.65 nmol/L) and FAD (56.58±12.49 nmol/L) was lower than the 35 infected adults. These differences for riboflavin, FMN and FAD were not statistically significant (P<0.05; χ^2=0.47, P<0.05; χ^2=1.69, P< 0.05; χ^2=0.66) respectively.

Table 1: Riboflavin and flavin nucleotides profile and intensity of infection

Intensity of infection	No Infected		Riboflavin (nmol/L)	FMN (nmol/L)	FAD (nmol/L)
	Children	Adult			
Light Infection <50 ova/10ml	15	20	27.0±6.27	17.0±1.69	66.1±0.81
Heavy Infection >50 ova/10ml	50	15	17.0±2.1	15.87±0.47	60.04±0.81
Mean			22.0±4.5	16.44±0.28	63.07± 0.75

Table 2: Riboflavin and flavin nucleotides status of infected children and adults

	No infected	Riboflavin (nmol/L)	FMN (nmol/L)	FAD (nmol/L)
Children	65	19.0±4.6	14.7±1.65	56.58±12.49
Adult	35	25.5±7.5	18.08±1.36	69.50±6.37
Mean	-	22.25±5.5	16.39±1.4	63.07± 4.0
Control	30	108.8±10.2	102.8±3.5	404.9±8.7

DISCUSSION

We reported depressed levels of riboflavin and flavin nucleotides in participants infected with schistosomiasis than the control subjects. Similar report on riboflavin deficiency in schistosomiasis had been documented earlier (Coutinho *et al.,* 1997, Rohner *et al.,* 2007). Of pathological importance is the negative correlation between the intensities of infection and the concentration of the riboflavin and its metabolites. Similar correlation between the nutritional status and prevalence/intensity had been reported earlier (Coutinho, 1976, 1980, Stephenson, 1986, Ferreira *et al.,* 1993). These observations and the lower

concentration of this micronutrient in the infected participants with heavy intensity of infection demonstrate the effects of *S. haematobium* on the riboflavin pool of the infected Nigerian. These implicate this micronutrient in the disease pathogenesis and the morbidity of urinary schistosomiasis in this locality. Since (Kawanaka *et al.,* 1983) documented a link between *Schistosoma* eggs survival and vitamin uptake, we deduce that riboflavin could be one of the essential vitamins required for the survival of *S. haematobium* eggs, which probably explains the low levels of riboflavin and flavin nucleotides in the infected volunteers.

Our result shows higher FAD in the control participants than the infected volunteers. The relatively higher FAD in the control volunteers than the infected participants reflects the impact of *S. haematobium* on the riboflavin pools in these Nigerians. This observation supports the earlier report of (Asahi *et al.,* 1984) who documented that the extracts of *Schistosoma* eggs exhibit hemolytic activity. Also this hemolysis has been documented to cause the release of flavin metabolites such as FAD and FMN from the intracellular compactment into plasma and mobilization of riboflavin from tissues into the circulation during febrile illness (Bamji *et al*., 1987). Our data which revealed three times the concentration of FAD to the riboflavin among the *S. haematobium* infected volunteer further supports the effect of haemolysis of this parasites in our investigated infected host.

In conclusion, we deduce that the depressed riboflavin status in the infected participants than their control counterparts implicates riboflavin and its metabolites; FAD and FMN in the pathogenesis of urinary schistosomiasis. This strongly supports our recommendation for the inclusion of nutrition program especially aimed at checking riboflavin deficiency in the management of this parasitic infection in the face of low socioeconomic and nutritional status which abounds in developed nations like Nigeria where urinary schistosomiasis still occur in endemic proportion.

Corresponding author,
OPG Nmorsi
Tropical Research Unit, Department of Zoology,
Ambrose Alli University,
Ekpoma, Nigeria
E-mail: nmorsiopg@yahoo.com

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REFERENCES

1. Antony, A., Nicholas J. S. L., Lysney B., Ursuline, N., Alan, F. and Simon, B. (2006). Schistosoma mansoni in pregnancy and association with aneamia in northwest Tanzania. *Transactions Royal Soc Trop Med Hyg.100(1)*: 59-63.
2. Asahi H., Moribayasin A., Sendo, F and Kobayakawa, T. (1984). Hemolytic factors in *Schistosoma japonicum* eggs. *Infect Immun. 46(2):* 514-518.
3. Bamji MS, Bhaskaram P, Jacob CM, (1987). Urinary riboflavin excretion and erythrocyte glutathione reductase activity in preschool children suffering from upper respiratory infections and measles. *Ann Nutr Metab, 31*: 191-6
4. Capo-chichi, C. D., Guéant, J, L. E., Feilet, F., Namour, F. and Vidailhet, M. (2000). Analysis of riboflavin cofactor levels in plasma by high-performance liquid chromatography. *J Chromatogr B,* 739: 219-224.
5. Capo-chichi, C. D., Guéant, J, L. E, Bennani, N, L. E, Vidailhet, C. and Vadailhet, M. (1999). Riboflavin and riboflavin-derived cofactors in adolescent girls with anorexia nervosa. *Am J Clin Nutr* 71: 978-986.
6. Chan, M.S., Guyatt, H.L., Bundy, D. A. P., Medley, G. F. (1996). Dynamic models of schistosomiasis morbidity. *Am J Trop Med Hyg 55*: 52-62.
7. Combs, G. F. (1998). *Riboflavin. The vitamins*, 2nd ed. San Diego: Academic Press, 295-310.
8. Costa MFF, Leite MIC, Rocha RS, Magalhães MHA, Katz N (1988). Anthropometric measures in relation to schistosomiasis mansoni and socio-economic variables. *Int J Epidemiol 17*: 880-886.
9. Coutinho EM, Freitas, LPCG, Abath, FGC (1992). The influence of the Regional Basic Diet from Northeast Brasil on health and nutritional conditions of mice infected with Schistosoma mansoni. *Rev Soc Bras Med Trop 25*: 13-20.

10. Coutinho, EM (1980). Estado nutricional e esquistossomose. *Rev Soc Bras Med Trop 13*: 91-96.
11. Continho, EM, Abath FGC, Barbosa CS, Dominges ALC, Melo, MCV, Montenegro SML, Lucena MAF, Romani SAM, Souza WVS, Coutinho AD (1997). Factors involved in Schistosoma mansoni infection in rural areas of northeast Brazil. *Mem Inst Oswaldo Cruz 95(5)*: 707-715.
12. Ferreira HS, Coutinho EM, Teodósio NR, Cavalcanti CL, Samico MJ (1993). Intestinal protein absorption in malnourished mice with acute schistosomiasis mansoni. *Mem Inst Oswaldo Cruz 88:* 581-587.
13. Hoetez PJ, Molyneux DH, Fenwick A, Ottessen E, Ehrlich Sachs S et al (2006). Incorporating a rapid-impact package from neglected tropical diseases with programs for HIV/AIDS, tuberculosis, and malaria. A comprehensive pro-poor health policy and strategy for the developing world. *PLos Med 3:* el02. doi: 10. 1371/journal pubmed. 0030102.
14. Kawanaka M, Hayashi S, Ohtomo H (1983). Nutritional requirements of Schistosoma japonicum eggs. *J. Parasitol*. *96(5):* 857-861.
15. King C.H., Dickman, K., Tisch, D. J. (2005). Reassessment of the cost of chronic helmintic infection. A meta-analysis of disability in endemic schistosomiais. *Lancet 365*: 1561-1569.
16. Proietti FA, Paulino UHM, Chiari CA, Proietti ABFC, Antunes CMF (1992). Epidemiology of *Schistosoma mansoni* infection in a low-endemic area in Brazil: clinical and nutritional characteristics. *Rev Inst Med Trop São Paulo 34:* 409-419
17. Rohner F, Zimmermann MB, Wegmueller R, Tschannen AB and Hurrell RF (2007). Mild riboflavin deficiency is highly prevalent in school-age children does not increase risk for anaemia in Cote d'Ivoire. *British J Nutr. 97*: 970 – 976.
18. Stephenson LUS (1986). Schistosomiasis and human nutrition, p. 1-21. Cornell International Nutrition Monograph series n° 16, New York.
19. Traunmüller F, Ramharter M, Lagler H, et al 2003. Normal riboflavin status in malaria patients in Gabon. *Am J Trop Med Hyg, 68(2)*: 182-5.
20. Vanden Broek NR, Letsky EA (2000). Etiology of anaemia in pregnancy in South Malawi. *Am J Clin Nutr 72(Suppl.):* 247-256.
21. WHO (1983). Urine filtration technique of Schistosoma haematobium infection. WHO PDP/83.4.
22. WHO (1992). Epidemiological modeling for schistosomiasis control. Medical Report Series, 830.