PREVALENCE OF *Schistosoma haematobium* AND ITS INTERMEDIATE HOSTS IN MAKURDI METROPOLIS

Abstract

Introduction: Urinary Schistosomiasis (US) is a chronic water-borne infection caused by digenetic trematode belonging to the genus *schistosoma*, it is generally caused by *Schistosoma haematobium*. *Bulinus globosus* is a species of a tropical freshwater snail that act as an intermediate host of *Schistosoma haematobium*. Aim: The study was aimed at ascertaining the prevalence of *Schistosoma haematobium* infection and to describe its intermediate hosts among school children in Makurdi. Methodology: Snails were collected by hand picking and scooping net methods. An epidemiological survey research on urinary Schistosomiasis was undertaken from September to November 2017 among students that volunteered in the selected schools within Makurdi metropolis. A total of 97 fresh water snails were collected and 200 urine samples involving pupils aged between 5 to 18 years were collected and analyzed for the eggs of *Schistosoma haematobium* by microscopy using Urine Syringe Filtration Technique (USFT). Statistical analysis was performed using SPSS 20. Chi-square test was used to determine significant difference between variables. Results: Out of the 97 species of fresh water snails that were caught 41 (42.3%) were *Bulinus* spp. Of the 200 urine samples analyzed, 49 (24.5%) were found to be infected with ova of *S. haematobium*. The infection was higher among males 30 (25.6%) than females 19 (22.9%) although the difference was not statistically significant ($\chi^2_{CAL}=0.19$, $\chi^2_{TAB}=3.84$). The prevalence of *Schistosoma haematobium* infection among school children in relation to age showed that ages 15-19 years had the highest prevalence 13 (38.2%) and ages 5-9 had the lowest prevalence 3 (8.5%).The statistical analysis also revealed that there is no significant difference (8.302) in *Schistosoma haematobium* infection among the four schools in the study area. The presence of many snail species especially the *Bulinus* spp and increased contact time with the *Schistosoma haematobium* infested freshwater habitat were thought to be responsible for the prevalence of the disease in the area. Finding of this study shows that urinary Schistosomiasis was found to have a low prevalence in the area studied and there is need to intensified integrated control measures to reduce or completely eradicate the disease.

Key words. ***Schistosoma haematobium*, Intermediate Hosts, Makurdi, Metropolis**

Introduction

Urinary Schistosomiasis also called Bilharzias is a parasitic disease caused by a digenetic blood fluke of the genus *Schistosoma* called *Schistosoma haematobium*. *Schistosoma haematobium* is the causative agent of urinary Schistosomiasis The disease is the second most prevalent neglected tropical diseases after hookworm and remains an important public health problem globally especially in the Sub-Saharan Africa [1]. *Schistosoma haematobium* infection is endemic in over 50 countries in Africa, [2] it was reported as the most devastating prevalent parasitic disease due to morbidity and mortality for developing countries in Africa [3].

School children of the age groups 5 to 15 often swim and fish in some of the water bodies around their school during breaks and vacations. Some of the pupils engage in fishing during vacation as seen in the study area. There have been reports on high prevalence of urinary schistosomiasis in Makurdi and its environs [4; 5], hence the need to study the prevalence of urinary schistosomiasis and its intermediate hosts in Makurdi. Previous studies had reported a high prevalence of urinary

schistosomiasis amongst children in two local government areas in Benue state (Buruku and Katsina-Ala) [4] with an overall prevalence of 41.5% among the 1,124 children examined. Another study carried out in Gboko, Benue State [4] reported 41% prevalence of *S. heamatobium*. While a study in Keffi [5] reported 30.5% prevalence of *S.haematobium* among school children in Keffi town Nassarawa state.

MATERIALS AND METHOD

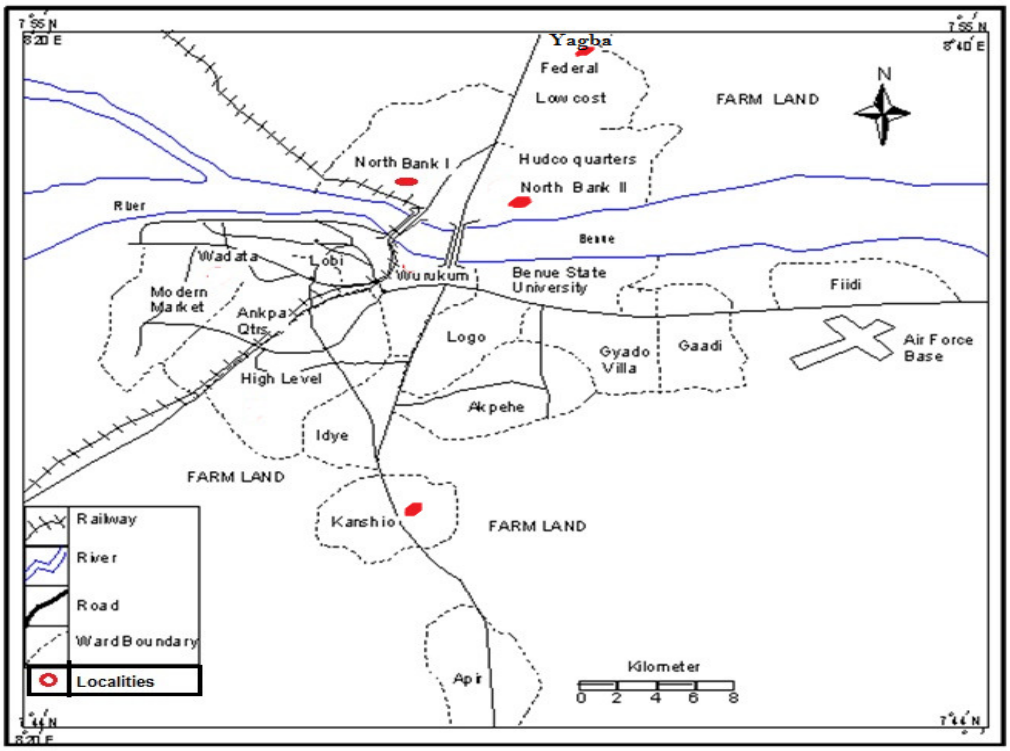

Figure. 1: Makurdi Township showing Sampled Sites (source;google maps)

Makurdi is the capital of Benue State of Nigeria. The city is located in central Nigeria along the Benue River and holds the base for the Nigerian Air force aircraft squadrons. Makurdi has an estimated population of 500,797 persons. The major ethnic groups inhabiting the city are the Tiv, Idoma, Igede and etulo. It holds the Benue State University and the Federal University of Agriculture. It is located on latitude 7.7306^{o}N and longitude 8.5561^{o}E along the banks of the Benue River which is a major tributary to the Niger River.

Sampling Site for urine collection

The consent of the management of four different schools within Makurdi Local Government Area were sort for through a letter of introduction from the Head of the Department of Biological Sciences, Benue State University and an Ethical approval from the Benue State Ministry of Health to allow urine samples to be collected from their students. Sampling within all four schools was based on random selection. The four schools include; Daddy Memorial Nursery and Primary School. Yagba, Josephine Nursery and Primary

School, North Bank, Holy Family Nursery and Primary School Kanshio and Local Government Education Authority Nursery and Primary School North Bank.

The sampling sites were water bodies that are at proximity to the schools sampled .Snails' samples were collected using the method of scooping nets and hand picking as described in Oguoma [6]. *Bulinus spp* snail the intermediate hosts of *S. haematobium* [7] were collected from fresh water habitat found in Makurdi, Benue state**.**

Sampling Materials

The following materials were used for the research: running water, a light microscope, a centrifuge, universal specimen bottles, slides, gloves, Polycarbonate membrane filter, detergent, 10ml syringe, laboratory coat, a record notebook, forceps, Questionnaires, scoop net, rain boots and collection tray.

Ethical clearance

Before the commencement of the study, a letter of introduction was obtained from the Head of Department, Biological Science, Benue State University, an official ethical clearance was obtained from the Benue State Ministry of Health. The letter was followed up by enlightenment to the authorities of the above-mentioned schools where these samples were collected.

Study Design

The study was conducted from September to November 2017. Sampling was completely randomized, as there was no restriction whatsoever as to age, class, or sex. The research was conducted on every student that volunteered. A total of 200 students of those who volunteered were sampled at random from the four different schools.

A questionnaire was used in the primary school as the pupils were interviewed to provide information such as age, sex, class, source of drinking water, bathing water and parental occupation.

Ten to fifteen milliliters (10- 15ml) to of Urine specimens were collected, using clean and sterile, wide-mouthed, screw-cap plastic containers according to WHO recommendation between the hours of 10 a.m. and 2 p.m to coincide with the period when excretion of *S. haematobium* eggs is highest [4].

The color of the urine samples were noted, some smoky brown, bloody, turbid and cloud appearance were observed. Each urine sample were poured into clean 10ml test tube and properly labeled.

Chemical Examination of the urine was carried out on sample using commercially prepared test-strip (Combi 10 urine test-strip) noting the various parameter Glucose, Protein, Blood, Urobilinogen, Nitrite, Bilirubin pH etc.

Comment [WU1]: ????????? I remember saying to fill these gaps… What are the other parameters on the Combi 10?

Polycarbonate membrane filters (Millipore Comp.) of 13 mm diameter and 12-14 µm pore size were used for filtration of *Schistosoma haematobium* eggs from urine [8]. The filters were removed at the laboratory from filter holders using a blunt-ended forceps and transferred to a microscope slide, face upwards and stained with methylene blue [8].

The entire filter was systematically examined for eggs of *Schistosoma haematobium*. The number of eggs in the preparation was counted and recorded.

1-50 eggs per 10ml of urine were considered as light infection, 51-200 eggs per 10ml of urine as moderate infection and above 200 eggs per 10ml of urine as heavy infection [8; 9].

On examination of the samples using the microscope, the parasite, *Schistosoma haematobium*, was identified by the presence of its ova or egg. The eggs or ova of *S. haematobium* have a characteristic terminal spine, are large, oval in shape and pale yellow-brown in color. In most cases the presence of the ova in urine is associated with the presence of pus cells and red blood cells (RBCs) [8].

The data were analyzed using the chi-square test with a P-value of 0.05. The chi-square test was used to determine if the observed frequency of occurrence of any value conformed to the expected frequency of that value. All data were entered into an Excel spreadsheet, checked for errors and analyzed using SPSS for windows (version 15.0, SPSS Inc, Chicago, USA). Simple percentages were used to calculate the prevalence of infection amongst the students sampled. Pearson Chi-square was used to analyze prevalence of urinary schistosomiasis and to assess the associations between the demographic characteristics of the study subjects and the findings of the test samples.

Result

Two hundred (200) urine samples of subjects from across four different schools within Makurdi LGA were collected and examined for ova of *S. haematobium*, 117 male and 83 female school children were involved as indicated in Table 1 below.

An overall prevalence of 49 (24.5%) school children tested positive to *S. haematobium* infection. males recorded a higher prevalence of 30 (25.6%) than females 19 (22.9%) Table 3 below.

Table 1 shows the different prevalence of the infection in different areas within Makurdi LGA. Daddy Memorial Nursery and Primary School and Holy Family Nursery and Primary School, Kanshio showed a prevalence of 15.1% and 20.5% to the infection respectively. LGEA Nursery and Primary School show the highest prevalence of 37.9% and Josephine international school north bank shows the lowest prevalence of 10.3%. Upon chi-square analysis of the data in table 1, the results revealed there was a significant difference in the prevalence recorded in the different schools (χ^2_{CAL}=13.77, χ^2_{TAB}=7.81 and df = 3). Table 2 shows the Abundance of fresh water snails in the different fresh water bodies areas located close to the various schools that were samples for schistosoma infection within Makurdi LGA. A total of 97 fresh water snails were sampled. The dam close to Daddy Memorial Nursery And Primary School had a total of 22(22.6%) snails while that of Holy Family Nusery And Primary School,Kanshio had a total of 21(21.6%). Local Government Education Authority (L.G.E.A) Nursery And Primary School had the highest number of 36(37.1%) and Josephine International School North Bank shows the lowest number of 18(18.5%). Table 3 shows the prevalence of *S. haematobium* infection in relation to sex distribution. More males than females volunteered for the study; males tested positive to the infection with a prevalence of 25.6% while females with a prevalence of 22.9% Upon chi-square analysis of the data in Table the results revealed there was no significant difference between the prevalence of both sexes (χ^2_{CAL}=0.19, χ^2_{TAB}=3.84 and d.f = 1).

Table 4 shows the age distribution of the prevalence of the infection. School children between the ages 15-19 are most infected with a prevalence of 38.2%, with children between the ages 5-9 recording the lowest prevalence of 8.5%. The study reveals that school children within all ages are infected with the parasite. Upon chi-square analysis of the data in Table 4, the results revealed there was no significant difference between the prevalence of the different age groups amongst the school children (χ^2_{CAL}=8.302, χ^2_{TAB}=5.99 and d.f = 2).

Table 1: Prevalence of *S. haematobium* Infection among School Children In Makurdi LGA.

School	No. examined	No. infected (%)
Holy family Nursery & primary school Kanshio	**39**	**8(20.5)**
LGEA Primary school North Bank.	**79**	**30(37.9)**
Daddy Memorial Primary School North Bank.	**53**	**8(15.1)**
Josephine international school North Bank	**29**	**3(10.3)**
TOTAL	**200**	**49(24.5)**

(χ^2_{CAL}=13.77, df = 3).

Table 2: Abundance of Freshwater Snails in the Different Water Bodies Areas Located Close to the Various Schools

School	Type of Fresh Water Snail				
	Melanoides spp	*Bulinus globolus*	*Bulinus forskali*	*Bulinus succiniodes*	other types
Holy family nursery & primary school. Kanshio.	3	4	3	2	9
LGEA primary school North Bank.	15	7	2	4	8
Daddy memorial primary School,North Bank.	5	11	2	0	4
Josephine Int'l School North Bank	4	3	3	0	8
TOTAL	27	25	10	6	29

Table 3: Sex Distribution of *S. haematobium* among School Children Examined

Sex	No. examined	No. infected (%)
Male	**117**	**30(25.6)**
Female	**83**	**19(22.9)**
Total	**200**	**49(24.5)**

(χ^2_{CAL}=0.19 and d.f = 1)

Table 4: Age distribution of *S. haematobium* infection among school children in Makurdi LGA.

Age	No. examined	No. infected (%)
5-9	**35**	**3(8.5)**
10-14	**131**	**33(25.2)**
15-19	**34**	**13(38.2)**
Total	**200**	**49(24.5)**

(χ^2_{CAL}=8.302, d.f = 2)

Some plants were found to be associated with some fresh water snails (intermediate host of *S. haematobium*) as they were attached to the roots and leaves of these plants. These plants included the following.

1. Water lilly (Nymphaea lotus)
   Scientific classification
   Kingdom : Plantae
   Clade: Angiosperms
   Order : Nymphaeales
   Family : Nymphaeaceae
   Genus : Nymphaea
2. Bind weed (Convovulus arvensis)
   Other names include; field bindweed,europoean bindweed.
   Scientific classification
   Kingdom : Plantae
   Clade: Angiosperms
   Clade: Eudicots

Clade: Asterids
Order : Solanales
Family : Convolvulaceae
Genus : Convolvulus
Species: *C. arvensis*

3.Creeping Jenny (Lysimachia nummularia)

Other names include;

Money wort,herb two pence and two penny thot.

Scientific classification
Kingdom : Plantae
(unranked): Angiosperms
(unranked): Eudicots
(unranked): Asterids
Order : Ericales
Family : Primulaceae
Genus : Lysimachia
Species: *L. nummularia*

Table 5 : Plants found in fresh water bodies at the various locations

Location	No. examined	No. of fresh water snails	Species of plant
Kanshio	**39**	**21**	**Water lilly and Bind weed**
North Bank.	**108**	**54**	**Water lilly, Bind weed, Creeping Jenny**
Yagba	**53**	**22**	**Water lilly and Bind weed**
TOTAL	**200**	**97**	

Discussion.

This work revealed a total prevalence of 49 (24.5%) for *S. haematobium* infection. This means only 49 school children out of the 200 respondents were infected by *S. haematobium* at Makurdi LGA. This is higher to reports with an overall prevalence rate of 17.8% [10], also earlier study recorded a prevalence rate of 15.7% [9] and a prevalence rate of 17% of the infection within Gboko town [5]. This could be attributed to contact with water contaminated with the cercariae of the parasite. The low prevalence observed in Josephine international

school North Bank as compared to the three other schools. This could be due to the fact that Josephine international school is a private school and is mostly attended by middle class persons and a greater percentage of her students′ source their bathing and drinking water from boreholes which correlates with less contact with contaminated water. LGEA primary school north Bank on the other hand has a greater number of her students depending on well and stream water and is located in the rural region of Makurdi LGA. The school is a public school and it′s attended by pupils whose parents are low class.

The sex distribution of *S. haematobium* infection among school children in makurdi LGA showed a higher prevalence rate in males 30(25.6%) than in females 19(22.9%), this is similar to a previous [11] on the prevalence of the infection. Prevalence of urinary schistosomiasis is known to be generally higher among males than females [2; 4; 10 and12] this difference in prevalence is however statistically not significant. The prevalence of *S. haematobium* infection in relation to age indicates that the prevalence is highest in the age group 15-19 and lowest in the age group 5-9. The difference in prevalence is however not significant .This is similar to reports previous studies [3; 5; 13 and 14] on the prevalence of the infection in different study areas in Nigeria. The low prevalence recorded within the 5-9 age groups may be due to less exposure to epidemiologic factors that predispose school children to the infection.

The prevalence of *Schistosoma haematobium* to the parasite was compared with the abundance of fresh water snails and the various plant species where they are attached to. Most intermediate hosts of human *Schistosoma* parasites belong to *Bulinus.*

North bank location which had the highest number of snails (54) correlates with LGEA nursery and primary school which the highest rate of infection. The high prevalence of *S. haematobium* in Northbank location might be due to the abundance of surface water, which enhances the development of high snail population, human water contact behavior and environmental factors that affect snail population favourably [15].

High number of fresh water snail signifies a high number of cercariae shed and this invariably increases the incidence of infection [16].

Water Snail populations fluctuated strongly decreasing towards the end of rainy season. The preference for different environmental conditions such as abundant microflora, oxygen content and other physico-chemical factors could be one reason why the water snail populations showed marked differences in each locality. Another factor could be the natural behavioral mode of adaptation which is different for each species. *Melaniodes spp* is a quiet water, surface feeding snail and could be washed down to the dam easily. It finds a resting place when the speed of water current becomes greatly reduced whereas *B. globosus* can cling to or settle to the bottom of the water and later come out to the surface. This would be made easier by the rocky nature of the substratum or bed of the Ichwa dam along the road to Federal University of Agriculture, Makurdi. Also [16] large numbers of *B. globosus* occurred in habitats that were slightly polluted with faeces or decaying vegetation. Careless discharge of effluent, piggery and domestic wastes may be another reason why more snails were recorded at dams close to the LGEA nursery and primary school. Though there was no particular trend in the variation of prevalence, it could be said from the result that increase in snail populations may result in an increase in the infection of humans by schistosome cercariae with increased human water contact activities.

The species involved can be identified by the shape of the outer shell. This was based on the fact that the school children come in contact with open bodies of water.

School children that that were found close to the dam and streams located at north bank had the highest prevalence of the infection compared with those who were usually in contact with fresh water snail in the various dams. Notably those school children who frequented and had prolonged contact with streams or rivers had the highest prevalence compared with those who rarely frequented open bodies of water as they come in contact with the intermediate host more often.

Species of Plants associated with the intermediate host were also found in these areas where the snails were abundant, from table, most species of plants associated with the parasite were located at north bank

5.2 Conclusion

The results from this study reveal that *S. haematobium* infection has a prevalence rate of 24.5% amongst school children within Makurdi LGA, with the parasite was noted to affect the rural population of school children more than those who lived within the township region of the LGA. The study reveals Male school children are more infected than females although this is insignificant. Also school children within the age group 15-19 years have been revealed to be more infected by the parasite. The study reveals that school children who expose themselves to water from wells and streams are more affected by the parasite than those who do not. Also school children whose parents are farmers are more susceptible to infection by the parasite than others. This points to the fact that epidemiologic factors that enhance susceptibility to the infection are still very much existent within the study area. These include ignorance, parental influence, poverty and poor personal hygiene.

Lack of portable water, exposure to contaminated water, exposure to the intermediate host, lack of health education and poor personal & public hygiene contribute to the spread of the infection.

Symptoms in persons infected with *S. haematobium* vary dramatically, ranging from mild symptoms to severe damage of the urinary tract including the kidney and bladder. It is in view of the above that it is suggested that the prevention and control of the disease be a major priority by both individuals and the Government.

REFERENCE

1. Ishaleku, D., Yako, A., Usman, D. and Azamu, S. (2012). *Schistosoma haematobium* Infections among school children in Keffi Town, Nasarawa State, Nigeria . *Scholarly Journal of Medicine*, 2: 104-107.

2. Bolaji, O., Elkanah, F., Ojo, J., Ojurongbe, O. and Adeyeba, O. (2015). Prevalence and intensity of *Schistosoma haematobium* among school children in Ajase-Ipo, Kwara state, Nigeria. *Asian journal of biomedical and pharmaceutical sciences*, 5: 6-11

3 Okwori, A., Sidi, M., Ngwai, Y., Obiekezie, S., Makut, M., Chollom, S., Okeke, I. and Adikwu, T. (2013). Prevalence of schistosomiasis among primary school children in Gadabuke District, Toto LGA, North central Nigeria. *British microbiology research journal*, 4: 255-261

4. Houmsou, R., Amuta, E. and Sar, T. (2012). Profile of an epidemiological study of urinary schistosomiasis in two LGAs of Benue state, Nigeria. *International Journal of Medicine and Biomedical Research*, 12: 39-48

5. Gberikon, G., Aguoru, C. and Yandev, D. (2015). Incidence of *Schistosoma haematobium* and *Trichomonas vaginalis* among Occupational status of patients attending some selected hospitals in Gboko, Benue state of nigeria. *International Journal of sciences*. 3:45-49.

6. Oguoma, V., Ugorji, D., Okolo, K., Mbanefo, E. and Umeh, J. (2010). Aquatic snail species of two adjoining rivers in Owerri, Imo state, Southeastern Nigeria. *Animal Research International*, 7(1): 1125-1128

7. Ngele, K., Kalu, E., Ukwe, M. and Onyeuwu, C. (2004). A survey of freshwater snail: the intermediate host of schistosomiasis in Bende LGA., Abia state Nigeria. *International Journal of Science and Nature,* 3(4): 879-882.

8 Cheesbrough, M. (2009). District Laboratory Practice in Tropical Countries. New York: Cambridge University Press 5: 236-240.

9. Ugochukwu, O., Onwuliri, C., Osuala, F., Dozie I., Opara F. and Nwenyi, U. (2013). Endemicity of schistosomiasis in some parts of Anambra State, Nigeria. *Journal of Medical Laboratory and Diagnosis,* 4: 54-61.

10. Dawaki, S., Al-Mekhlafi, H., Ithoi, I., Ibrahim, J., Abdulsalam, A., Ahmed, A., Sady, H., Atroosh, W., Al-Areeqi, M., Elyana, F., Nasr, N. and Surin, J. (2016). Prevalence and risk factors of schistosomiasis among hausa communities in Kano state, Nigeria. *Journal Of The Institute Of Tropical Medicine Sao Paulo*,7:45-76.

11. Umar, A., Oche, M., Arkilla, M. and Zailani, S. (2008). Prevalence and intensity of urinary schistosomiasis in settlements around the Goronyo dam, Nigeria. *Borno Medical Journal,* 5:4-10.

12. Ojurongbe, O., Sina-Agbaje, O., Busari, A., Okorie, P., Ojurongbe, T. and Akindele, A. (2014). Efficacy of praziquantel in the treatment of *Schistosoma haematobium* infection among school-age children in rural communities of Abeokuta, Nigeria. *Infectious Disease of Poverty Journal*. 3:34-37.

13. Balla, H., Babagana, I., Baba, S. and Ibrahim, H. (2015). Incidence of Urinary Schistosomiasis Amongst Out-of-School Pupils and "Almajiris" in Dikwa, North Eastern Nigeria. *Global Journal of Medical Research: C Microbiology and Pathology*, 15(2): 9-14.

14. Ivoke, N., Ivoke, N., Nwani, C., Ekeh, F., Asogwa, C., Atama, C. and Eyo J. (2014). Prevalence and transmission dynamics of *Schistosoma haematobium* infection in a rural community of south-western Ebonyi State, Nigeria. *Tropical Biomedicine*, 31: 1-12.

15. Jordan, P. (2014).The beginning of epidemiology and control of bilharzia. *Acta Trop*. 77:9–40

16. Brown, D.S. (2016) Freshwater snails of Africa and their medical importance. 2nd edition. Taylor and Francis, London. Pp 56.