PARASITIC INFECTION IN THE KASYASYA CLUSTER OF VILLAGES IN NORTH EASTERN ZAMBIA

*Boakye A. Boatin, MB., ChB., M. CommH., Phil..
**Peter Dukes, PhD..
***Fred K. Wurapa, MD., MPH., FWACP..

Tropical Diseases Research Centre, Ndola,
Zambia.

Summary

In a survey of parasitic infections in the Kasyasya cluster of villages in the north eastern corner of Zambia, trypanosomiasis which had occured in epidemic proportions the previous year was notably absent. The prevalence of S.mansoni, malaria, (P.falciparum) and D.perstans were found to be over 30%, considerably lower than that of a nearby cluster of villages. Prevalence of S.haematobium was also low at 7.2%. The prevalence of aneamia was low at 10% despite a hookworm and notable splenic enlargement rates of 22% and over 50% respectively. Community participation in the survey was excellent at about 90% or more in all procedures.

Introduction

In the early part of 1982, there was an unusually high number of trypanosomiasis cases, 11 out of a population of 75 (14.7%) in the village of Kasyasya in the Northern Luangwa valley (Dukes et al, 1984). Ormerod, (1961) suggests that the people in the valley have never regarded the disease as anything new, however, it may well be that the inhabitants did not distinguish it from other fevers and myalgia which resulted in death. Trypanosomiasis in the Luangwa valley has been sporadic in occurrence, however, Buyst (1974) in a period of 18 months recorded 246 cases; an apparent outbreak for the first time in Zambia. 13% of these cases were recorded from Kasyasya village.

In March, 1983 about the same period as the previous year's outbreak, a village survey was undertaken in Kasyasya and the neighbouring villages to:

a) attempt to confirm whether there was increased transmission of trypanosomiasis during the cultivation period.
b) obtain baseline information on other parasitic infections in the study villages.
c) assess the participation rates of the villagers in the various examinations.

This paper reports on some of the findings of this survey.

Materials and Methods

5 villages, Kasysya, Wainga, Moses, Kayanike and Figolo were surveyed. A presurvey census update of the 5 villages was done and the opportunity was taken at the same time to explain the purpose of the survey and the procedures to be used.

Stool, urine and blood specimens (by venepucture in all except children under 5 years) were obtained from the participants. Clinical examination and laboratory tests were done using a specially designed protocal.

Blood was analysed on the spot for packed cell volume (PVC) using the microhaematocrit centrifugation method. A second sample was examined for the presence of trypanosomes usjng the miniature anion exchange/centrifugation (mAEC) technique of Lumsden et al (1979). Giemsa prepared stained thick films were examined within 24 hours of preparation for trypanosomes, malaria parasites and microfilaria. Mice were inoculated with 0.5 ml blood from over 75% of the participants and were examined regularly for the presence of trypanosomes for a period of 2 months.

Eluents from filter paper blood blots from participants were used to determine the immunofluorescent antibody status for trypanosomes using a modification of the method by Wery et al (1970).

Stool specimens were examined specifically for S. mansoni/ova and other intestinal helminths by the Kato technique as described by Martin et al (1968), and urine specimens examined

*Visiting Scientist in Epidemiology (TDRC) Ndola.
**WHO Technical Advisor at (TDRC) Ndola, now with Tsetse Research Laboratory, Langford House, Bristol.
***WHO Senior Epidemiologist at (TDRC) Ndola.

for the presence of S. Haematobium ova by the sedimentation method.

Results

A total of 226 individuals were enumerated during the presurvey census in the 5 villages. Table (1) illustrates the participation rates for the various activities. 12 (5.3%) of those enumerated refused any form of examination and a further 8 (3.5%) had travelled out of the study area at the time of the examination.

90% or more of those clinically examined provided stool, urine and blood specimens for examination. Table (2) shows the laboratory findings for the various specimens examined. The prevalence rates have been standardized for age by direct standardization using the projected 1983 population of the province. The age-standardized prevalence rates for the 5 villages showed no significant differences between the sexes; the data for males and females are therefore combined for further analysis.

a) Trypanosomes

No trypanosomes were found in any of the blood specimens examined, either by the (mAEC) technique or on the Giemsa stained thick film and none of the inoculated mice developed trypanosome infection within 2 months after the survey. 14 (6.8%) of the 205 individuals tested for the presence of trypanosomes antibodies had scores of 3+ or above, considered to be positive in this series.

b) Malaria and Dipertolenema Perstans

The age-standardized prevalence rates for malaria (P.falciparum) and microfilaria (Dipertolenema perstans) were 33.9% and 32.5% respectively. There was a negative correlation between the prevalence rates for malaria and D.perstans in the villages (correlation coefficient $r = -0.85$) even though this was not so for Moses village. In all the villages the highest prevalence of P.falciparum infections occured in the age groups below 9 years with a peak at the 0-4 year age group, whereas the highest prevalence of D.perstans was found in the age group over 20 years as shown in Table (2).

c) Helminths

The overall age standardized prevalence rate for S.mansoni for the 5 villages was 33.3%. The lowest prevalence, found in Wainga, was 16.6%. Table (3) illustrates the age specific prevalence rates. About 3% of the S.mansoni positive individuals were found in the two age group 0-4 and 60+ years. the under 1 year olds had an unusually high prevalence of 33.3%.

Kasyasya and Figolo had the highest prevalence of hookworm infections of about 29%. The prevalence of hookworm increased with age, with a peak at the 15-19 year age group and them declined. Only one person in the study area was found to have ascaris infection.

The prevalence of S.haematobium of 7.3% was rather low compared with that for other parasites found in the area. No. S.haematobium was found in children under 10 years old and Kayanike village had no S.haematobium infections at all. However, the prevalence rate showed 2 peaks at age group 10-14 and 20-39 years. The 20-39 year age group peak was accounted for by the peak age of infection in Moses and Figolo villages.

d) Packed Cell Volume

Table (4) shows the distribution of age groups with PCV values below or above 30%. The mean PCV values for each of the 5 villages was above 30% the level below which we defined anaemia to be present. Less than 10% of the 166 individuals for whom PCV estimations were measured had values below 30%, with no significant difference between males and females.

e) Spleen Size

Notable splenic enlargement defined as any enlargement equal to or greater than 2 on the Hacketts scale was found in 92 (45.5%) of the people. Table (5) sets out splenic enlargement by age groups. A higher proportion of females 53 (50%) had notable splenic enlargement than males 39 (40.6%) but the difference was not significant. Only 6.6% of the participants had grossly enlarged spleens equal to 4 on the Hacketts scale. The relationship between the prevalence of notable splenomegaly and malaria is shown in Figure (1). The highest proportion of individuals positive for malaria as well as with notable splenomegaly 17 (53.1%) was in the age group 1-4 years, however, there were significantly more individuals with notable

splenomegaly but parasitologically negative for malaria. $X^2 = 16.3$ $p<0.001$ dfl.

Discussion

Early records, Buyst (1984), indicate that Kasyasya village and some of the other villages in the Northern Luangwa valley experience occasional outbreaks of trypanosomiasis. The outbreak in Kasyasya in 1982, at the end of the rains might suggest increased transmission of trypanosomiasis in the preceeding few weeks, which mark intense farming activities in this area; a feature of the 1982 outbreak was that a lot of cases occured in the same hamlet at the same time.

That there were no cases of trypanosomiasis about the same period a year after the 1982 event, suggests that the event observed in 1982 is not a recurrent one and that the cultivation period is not necessarily a high transmission period for trypanosomiasis in the Kasyasya cluster. The sites of hamlets may however, render them more vulnerable to the infection. In a case-control study in the Luangwa valley, Wyatt el al (in press), showed that there was no increased risk of acquiring trypanosomiasis associated with farming.

Even though the 5 villages have the same water source, there were considerable but not significant differences in the prevalence of S.mansoni and S.haematobium within them. Kayanike village at the cross-roads of the villages surveyed had no S.haematobium at all, which may well be due to the absence of the particular intermediate host in that area. No attempt was made at snail search in the villages. The considerable differences in prevalence of S.mansoni and S.haematobium in the villages are consistent with the observation by Buck et al (1978). The problem of S.mansoni infection in the Kasyasya cluster (prevalence 33.3%) appears to be considerably less than that at the Kampumbu cluster (prevalence 63.2%) 12km away, (Sukwa et al, in prep). These 2 clusters have essentially different sources of water. Two infants out of the 6 whose stools were examined were found positive for S.mansoni. This is unusual; but no specific explanation is offered for this. It may, however, be suggested that there is a possibility of stool sharing with older members of the households.

The prevalence of malaria in the area was lower than that for the surrounding areas; however, the age distribution showed a high prevalence in the under 10 year olds as is usual in such rural areas (Gardiner et al, 1984). The relationship between splenomegaly and malaria was as expected; it is suggested that the rise in splenomegaly in the older age group might be due to the presence of Tropical splenomegaly syndrome. The increase in prevalence of D.perstans with age is consistent with the findings of Buck (1978). This may be due to the rather long incubation period for microfilariasis and possibly tolerance of the infected individual to microfilaria. Whether the apparent inverse relationship between D.perstans and malaria is due to inhibitory action of one parasite on the other or more probably an age related phenomenon remains unclear.

The degree of anaemia in the community did not bear any relationship to the high prevalence rate of hookworm infection, a finding similar to the observations in Ghana (Bruce Tagoe et al, 1979). This is perhaps due to the low intensity (Geometric mean value 1.53 eggs/Gm of stool S.D. 2.19) of hookworm infection in the area.

Exactly what a positive IFA for trypanosomiasis means in an area such as ours is difficult to explain, but undoubtedly this represents some exposure to trypanosomes be they T.brucei or T.rhodesiense. A follow-up examination of those individuals found to be IFA positive during the survey will attempt to find out what eventually happens to such individuals.

We found very good community participation in the survey. This we believe was due to the presurvey preparation of the community by our epidemiology field team as this programme did not cater only for trypanosomiasis cases but also cared for sick people who needed on-the-spot treatment or transport to hospital.

Conclusion

In general, the level of parasitic infections in the Kasyasya cluster of villages, is low. Both schistosoma mansoni (33.3%) and haematobium (7.2%) occur in the area; hookworm is also present at a prevalence of 29%. Other intestinal parasites were absent. Malaria (P.falciparum) and D.perstans are present at about the same prevalence of 33%. The lack of trypanosomiasis in the area during the survey, suggests that outbreaks in the area are rather sporadic and are not necessarily recurrent. There was no evidence to suggest that the cultivation period represents intense transmission of trypanosomiasis in the area.

Acknowledgement

We are most grateful to Mr. Fred Kaona and

members of the field epidemiology team whose motivational and public relations exercises proved very useful during the survey. We are also grateful to the Director of TDRC, Ndola and the Director of Medical Services, Zambia for permission to publish.

This work received financial assistance from the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases and the Government of Zambia which is gratefully acknowledged.

FIG. 1 Age-specific distribution of prevalence of notable splenomegaly and malaria.

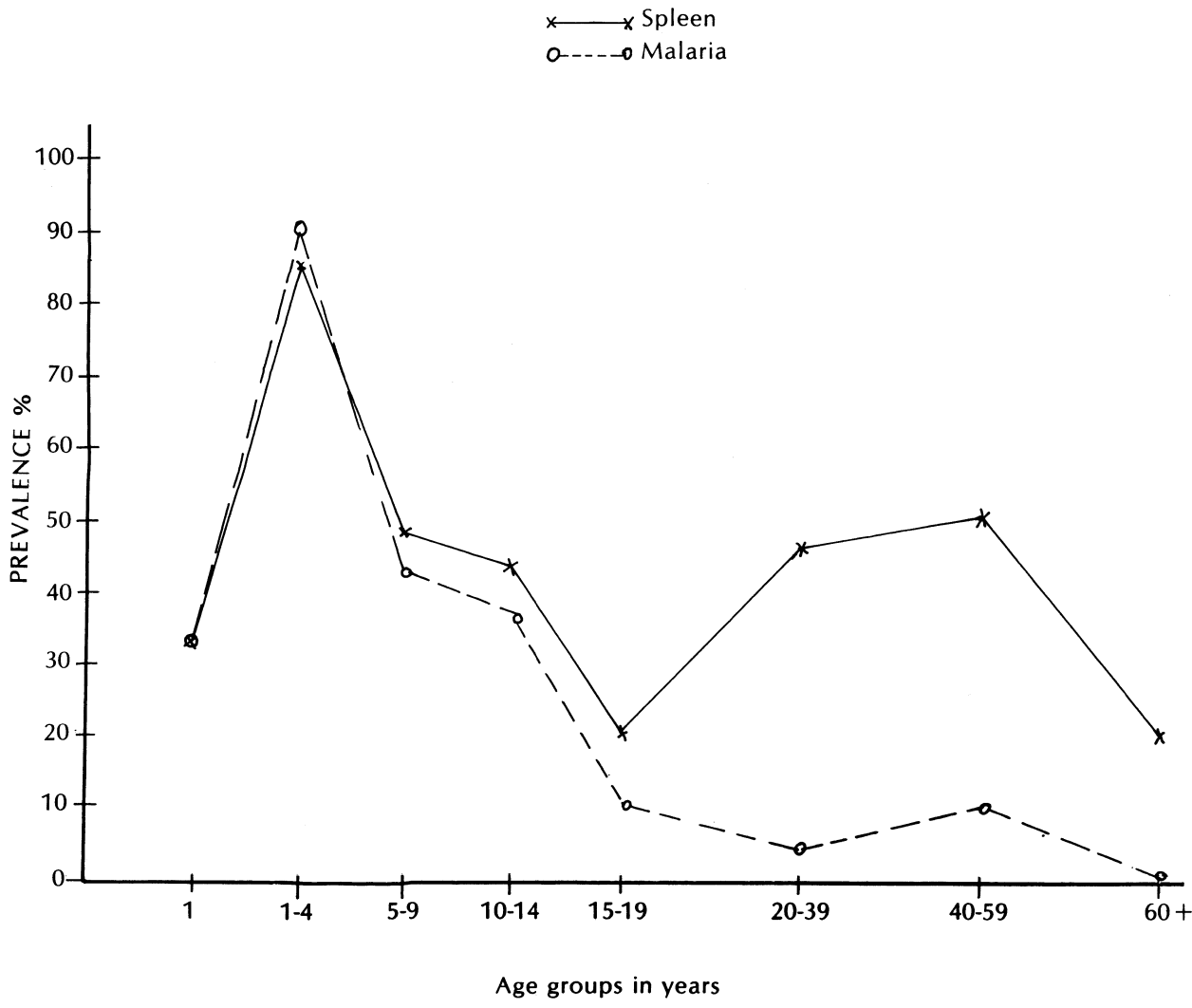

TABLE (I) Participation Rates of Individuals from the 5 villages in the Kasyasya Cluster. Participation rates of the population in specified procedures.

Village	Total Population from census	Physical Exam	(%)	Stool %+	Urine %+	Blood by xVP%+	xxFP%+	Refusals	(%)
Kasyasya	64	59	(92.2)	89.8	88.1	91.5	8.5	2	(3.1)
Figolo	57	46	(80.7)	95.7	95.7	82.6	17.4	7	(12.3)
Moses	46	46	(100.0)	100.0	95.7	76.1	23.9	0	(0)
Kayanike	31	29	(93.5)	92.1	75.9	82.8	10.3	2	(6.5)
Wainga	28	26	(95.9)	88.5	84.6	65.4	30.8	1	(3.6)
Total	226	206	(91.2)	93.7	89.3	81.6	17.0	12	(5.3)

(%) are based on the total census population for each village
+ = % based on the number of people from each village who had physical examination
xVP = Venepuncture
xxFP = Finger prick

TABLE (2) Age Standardized Prevalence Rates of Different Parasites by Village in the 'Kasyasya Cluster'.

	Parasites in Blood			Stool				Urine			
	P.falciparum	D.Perstans		S.mansoni		Hookworm		S.haematobium			
Village	N	+ve	Prev %	+ve	Prev %	N	+ve	Prev %	+ve	Prev %	N	+ve	Prev %
Kasyasya	58	14	30.9	19	29.5	53	18	38.0	17	29.7	54	7	9.3
Wainga	25	12	38.9	10	27.1	23	4	16.6	7	23.2	22	1	3.8
Kayanike	29	4	15.2	15	47.1	26	9	32.8	4	13.9	23	0	0.0
Moses	46	18	41.0	13	31.7	46	24	54.5	4	10.4	45	4	13.3
Figolo	40	7	25.0	16	33.3	43	11	25.9	13	29.8	43	3	5.3
Total	198	55	33.9	73	32.5	191	66	33.3	45	22.7	187	15	7.2
X_2 test for Homogeneity 4 df	13.4			5.03		10.9			10.4				4.3
P value	< 0.001			NS		<0.05			<0.05				NS

TABLE (3)

Age-Specific distribution of prevalence of various parasites in the Kasyasya Cluster

	Parasites in Blood P.falc.			D.perstans		Stool S.mansoni			hookworm		Urine S.haematobium		
Age group	N	+ve	Prev %	+ve	Prev %	N	+ve	Prev %	+ve	Prev %	N	+ve	Prev %
1	9	3	33.3	1	14.3	6	2	33.3	0	0.0	5	0	0.0
1-4	22	20	90.9	1	4.5	23	0	0.0	2	8.7	21	0	0.0
5-9	37	15	40.5	8	21.6	37	10	27.0	8	21.6	36	0	0.0
10-14	27	9	33.3	10	37.0	25	14	56.0	9	36.0	27	5	18.5
15-19	22	2	9.1	6	27.3	21	11	52.4	8	38.1	23	2	8.7
20-39	38	2	5.3	19	50.0	38	18	47.4	9	23.7	37	6	16.2
40-59	33	3	9.1	21	63.6	32	9	28.1	7	21.9	30	2	6.7
60+	10	1	1.0	7	70.0	9	2	22.2	2	22.2	8	0	0.0
Total	198	55	27.7	73	36.9	191	66	34.6	45	23.6	187	15	8.0

TABLE (4) AGE-SPECIFIC DISTRIBUTION OF INDIVIDUALS WITH HAEMATOCRIT VALUES BELOW OR ABOVE 30% FOR THE 5 VILLAGES

	Haematocrit values			
Age groups in years	≤30	(%)*	>30	Total
0-4	0	(0)	2	2
5-14	7	(53.9)	52	59
15-44	5	(38.4)	65	70
45+	1	(7.7)	34	35
	13	(7.8)xx	153	166

* Percentages are based on the column total
xx Percentage based on row total

TABLE (5) SPLENIC ENLARGEMENT IN THE KASYASYA CLUSTER OF VILLAGES

		SPLEEN SIZE			
Age Groups	N	Hacketts 0-1	Hacketts 2	3	4
1	9	6	1	2	0
1-4	24	4	13	5	2
5-14	66	36	20	10	0
15-39	61	49	16	3	2
40+	42	24	6	8	4
Total	202	110	56	28	8

References

1. *Bruce-Tagoe AA (1977) Haematological values in a rural Ghanian population. Tropical and Geographical Medicine 29, 237.*
2. *Buck AA, Anderson RI and MacRae AA (1978): Epidemiology of polyparasitism I. Occurrence, Frequency and Distribution of Multiple infections in Rural Communities in Chad, Peru Afghanistan and Zaire. Tropenmed. Parasit 29, 61-70.*
3. *Buyst H (1974) The epidemiology, clinical features, treatment and history of sleeping sickness on the northern edge of the Luangwa fly belt. Medical Journal of Zambia 8, 2-12.*
4. *Dukes P. et al (1983) Sleeping sickness in the Luangwa valley of Zambia. Preliminary report of the 1982 outbreak at Kasyasya village. Bull. Société de Pathologie Exotique 76 605-613.*
5. *Gardiner C, Biggar RJ, Collins WE and Nkrumah FK (1984) Malaria in urban and rural areas in southern Ghana: a survey of parasitaemia, antibody and antimalaria practice. Bull of WHO 62 (4) 607-613.*
6. *Martin LK and Beaver PC, (1968). Evaluation of Kato thick smear technique for quantitative diagnosis of helminth infections. American Journal of Tropical Medicine and Hygiene, 17: 382-391.*
7. *Lumsden WHR et al (1979)* **Trypanosome bruce,** *miniature anion exchange/centrifugation technique for the detection of low parasitaemia: adaptation for field use. Transactions of the Royal Society of Tropical Medicine and Hygiene 73, 312-317.*
8. *Ormerod, WE (1961). The epidemic spread of rhodesian sleeping sickness 1908-1960. Transactions of the Royal Society of Tropical Medicine and Hygiene. 55, 525-538.*
9. *Wery M., Wery-Paskoff S. and Van Wettere P. (1970): The diagnosis of African Trypanosomiasis by the flourescent antibody test. Annals Société Belge Médicin Tropica 50, 613.*
10. *Sukwa TY, Wurapa FK and Bulsara MK: Changes in prevalence and intensity of* **S.mansoni** *infection following treatment in a community in the northern province of Zambia (in prep).*
11. *Wyatt GB, Boatin BA and Wurapa FK (in press) Risk factors associated with acquisition of sleeping sickness in North-East Zambia: a case-control study. Annals of Tropical Medicine and Hygiene.*