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The Chief of the Malaria Section
has the honour to communicate hereunder the
following note

MALARIA SURVEYS IN THE GOLD COAST 1953-1955

by

Dr M. J. COLBOURNE
Ministry of Health, Gold Coast

and

Mr F. N WRIGHT
Ministry of Health, Gold Coast

Surveys have been carried out in the Gold Coast between 1953 and 1955 with the object of defining the incidence of the disease and the vectors responsible for its transmission (Colbourne and Wright, 1955 a and b).

Monthly entomological surveys have been made in Accra and it is hoped that they give an accurate picture of the seasonal changes in transmission. The surveys in the northern savannah and in the forest were carried out twice, once at the end of the dry season and once at the end of the wet season, in this way an indication is given of the malaria transmission in the rest of the Gold Coast without interfering with the continuity of observations in Accra. It is hoped that these results from outside Accra will be useful for comparison with those from South Western and North Western Nigeria.

The methods used to obtain these results and a discussion of the effects of the disease in the Gold Coast have already been described (Colbourne and Wright 1955b). As the technique adopted for blood examination and entomological investigation was recommended by the Nigerian Malaria Service at the WHO Malaria Course in Lagos in 1952, the results should be comparable with those produced for Nigeria at this conference.

THE FOREST BELT

Bomfa, chosen as a typical forest village in the cocoa-growing area of the Gold Coast, has a population of 1,431 who live in houses built of adobe or swish. The houses of the prosperous have corrugated iron roofs and cement floors; those of the less prosperous grass roofs and mud floors. Sanitary facilities consist of pit latrines dug on the outskirts of the village and a drinking water supply obtained from a bottomless 44-gallon drum half buried in a seepage.

No mortality or morbidity figures are available except from the Medical Field Unit survey carried out in November, 1953, which revealed 6 cases of trypanosomiasis, 86 of yaws, 19 of non-lepromatous leprosy, 31 of filariasis and 8 of blindness. Twenty-five cases of schistosomiasis were found in schoolchildren which indicates that the disease occurs in the village; it was noted however that guinea worm infection was absent.

Transmission

The total rainfall at Bomfa averages some 64 inches per annum falling between March and November.

Using "knock-down" sprays gambiae and funestus were shown to be the most numerous species. The Room Density Index (RDI) in the wet season was 5.2 with gambiae more than twice as numerous as funestus and 1.8 in the dry season with gambiae now less than twice as numerous as funestus. A. hargreavesi and A. nili occurred in small numbers.

In the wet season gambiae had a sporozoite rate of 15% (15/102) and funestus 11% (11/100). In the dry season the gambiae rate was 10.3% (6/58) whilst that of funestus was 14.7% (5/34). On the assumption that the wet season survey conditions last for eight months and those of the dry for four months it was calculated that a person was liable to receive about 24 infected bites per year.

Malaria rates

The Parasite and Spleen rates are shown in Table I and the Gametocyte Rates, Average Enlarged Spleen and Parasite Densities in Table II.

The spleen rates are very similar to those reported from South Western Nigeria, following the same general shape but remaining higher to a later age. In Ilaro in 1949 the parasite rate in the 11-15 age-group was 47.2%, in Bomfa in 1953-1954 it was 77%, but the Positive Parasite Density indices (PPDI) (allowing for a slight difference in enumeration) were nearly the same in the two areas showing that the densities in this age-group were very low.

The P. falciparum gametocyte rates also were very similar to those found at Ilaro, though again rather higher in the older children.

The density of gametocytes was always low, on only two occasions exceeding 100 per mm^3. In most of the films positive for P. falciparum gametocytes only one or two crescents were found in 100 oil immersion fields.

Of the 851 bloods examined, 595 were positive; 540 contained P. falciparum; 107 P. malariae and 30 P. ovale. P. vivax was not found. P. malariae was common in toddlers and was found in 20% of all bloods examined in the 1-4 age-group.

Parasite rates in infants are shown in Table III, the relation between these rates and those derived from entomological data will be discussed below.

The general picture is that of holo-endemic malaria with little seasonal variation and with almost universal infection during the first year of life.

THE NORTHERN SAVANNAH

Yorugu, five miles north of the Frafra town of Bolgatanga was chosen as typical of a northern savannah village of the Gold Coast. The population, numbering about 2,000, live in swish huts with grass roofs, several huts being joined together to form a compound. The compounds are scattered over an area of several square miles to form the widely dispersed village of Yorugu; from the results of an agricultural survey the population density can be assessed at about 420 to the square mile. The compounds tend to cluster on high ground, the valleys being less heavily populated.

Deep wells supply drinking water. Washing water is obtained during the rains from casual water, and during the dry weather from holes scraped in the beds of dried-up streams. There are no latrines, with the result that the crops of millet, maize and guinea corn are more luxuriant near the compounds. Each compound owns, on an average, 1 cow, 1 goat, 0.66 sheep and 0.16 donkeys.

No mortality figures are available, but a recent survey of a nearby village revealed an infant mortality of about 250 per 1,000; at Yorugu a Medical Field Unit in November 1954, in a limited survey, discovered among 1,912 people 7 cases of yaws, 10 of leprosy, 50 of onchocerciasis and 2 of guinea worm. No cases of trypanosomiasis, schistosomiasis or blindness were reported.

Transmission

The yearly rainfall here is about 41 inches falling from April to October.

In the wet season gambiae was 1-1/2 times as numerous as funestus, whilst in the dry season funestus was practically absent. The only other species found in either survey was A. rufipes.

The RDI was 2.9 in the wet season and 1.1 in the dry season. In the wet season gambiae had the high sporozoite rate of 25% (30/119) and funestus 7.4% (6/81); in the dry season the gambiae rate fell to 7.8% (14/180), no figure being obtainable for funestus.

Assuming that the wet season survey conditions last for seven months and those of the dry for five months, the number of infected bites received per person per year was calculated to be about 28.

Malaria rates

The Parasite and Spleen rates are shown in Table IV and the Gametocyte Rates, Average Enlarged Spleen and Parasite Densities in Table V.

There is little difference between these rates and those from the forest; they are similar to the figures from North Western Nigeria, although the latter show some seasonal change; it should be remembered that Sokoto is 180 miles further north than Yorugu.

The main differences between the figures for the forest and the northern savannah are found in the adults who have a lower spleen rate in the north - possibly due to a taller and thinner physique - but a higher parasite rate and density index. This, together with the high gametocyte rate especially at the end of the dry season, suggests the development of a lower degree of immunity.

The low density of gametocytes and the proportions of the different species of parasites showed little difference from that found in the forest.

The parasite rates in infants are shown in Table VI. The Frafra inhabitants of Yorugu do not allow their young children to leave the compounds in which they have been born. This makes the collection of figures difficult in an area where each compound is a bow shot from the next but it ensures that the infections found were actually contracted in the compounds.

The general picture is again of holo-endemic malaria with remarkably little seasonal change.

ACCRA

Accra, the capital of the Gold Coast, a town of about 140,000 inhabitants, was chosen for the survey as being representative of the coastal plain. It was considered that the conditions found in the rather scattered suburbs would be typical of the rest of the coastal plain, and that the centre of the town would show the results of urban conglomeration.

Transmission

Accra has an average rainfall of 28 inches per annum falling from April to June with a secondary rainfall in October. These figures together with anopheline densities are shown in Table VII.

In Central Accra negligible numbers of anophelines were taken throughout the year, the numbers increasing outwards from the centre.

The sporozoite rate tended to be lowest in the dry season and reached a maximum shortly after the anopheline population began to decline. The yearly average for the whole of Accra was 3.2%, the highest monthly rate being 17% in the suburbs in July; rates in intermediate areas never exceeded 10%.

The number of infected bites received per person per year ranged from 0.1 in Central Accra to 21 in the suburbs.

The predominent species was A. gambiae, funestus only being found on rare occasions in the suburbs at the height of the rains. Investigations in progress suggest that A. melas may be of importance locally.

Malaria rates

Two areas were selected for spleen and blood examination, one in the centre of the built-up area where transmission might be expected to be low and one in the suburbs where anopheline breeding places were widespread.

The Parasite and Spleen Rates are shown in Table VIII and the Gametocyte Rates, Parasite Densities and Average Enlarged Spleen in Table IX.

The rains started unexpectedly early in 1954 so the survey was restricted to children in order that adequate numbers could be examined before transmission from new breeding sites had started.

The suburbs show, after the rains, figures associated with a high rate of transmission with lower rates after the dry weather. In Central Accra there is a marked seasonal change but the levels reached are much lower than those found in the suburbs.

The parasite rates in infants have been worked out for the various seasons and districts and are shown in Table X.

Investigation into the travelling habits of the people of Accra showed that about 30% of the 1-4 age group and 40% of the 5-10 age-group had left Accra, in all cases the spleen and parasite rates were higher in those who had travelled. Of 55 infants followed up from birth to 6 months, 16 spent some time out of Accra.

Investigation into the use of antimalarials showed that they were used by about two-thirds of the population; there was no marked difference in the parasite rates in the two groups,

The suburbs of Accra show after the rains the spleen and parasite rates associated with holo-endemic malaria, but these rates fall during the dry season. Central Accra does not fit into the WHO classification.

Summary

The results of the three surveys are summarized in Table XI.

DISCUSSION

Effects of malaria

The effect of malaria on the health of the people of West Africa is by no means clear. It is not intended to attempt to recapitulate the evidence for the effect of the disease in the Gold Coast, as this has already been discussed (Colbourne and Wright 1955b) together with similar evidence from Nigeria. Briefly, it appears that malaria causes the death of about 5% of children born. These deaths occur in the first few years of life, except in Central Accra where some may occur after the fifth year. Morbidity is considerable in small children but schoolchildren aged about seven years suffer only a few days' sickness each year. Adults suffer about one or two days' sickness a year.

It had been hoped that the pilot control schemes now in progress in West Africa would be able to show the amount of morbidity and mortality saved by the elimination of malaria, but unfortunately such figures have proved difficult to collect.

Classification of malaria

It has been shown during the past few years that the use of the scheme of endemicity of malaria recommended at the Kampala Conference leads to considerable difficulties in West Africa. It is impossible to fit many of the types of malaria found into the definitions suggested; selection of material within the 1-10 age-group could produce widely different results. In these surveys none of the spleen rates in the whole 1-10 age-group is over 75%, but the forest and the northern savannah are clearly holo-endemic. The marked difference between the spleen rates in Central and suburban Accra would have been obscured by the use of the composite age-group. A further objection is that, when reading reports from other parts of Africa in which the WHO classification is used, it is not clear whether the writer has done his best to fit the situation he has found into the classification or whether, in those areas, it is accurate.

For a full description of a malaria survey complete entomological and parasitological results are required but for a comparison of endemicity a briefer description is needed. A useful measure is the maximum parasite rate and the age at which it is reached. This may be expressed as a single figure as the inoculation rate derived according to the methods described by Macdonald (1950). We have found it most convenient to use the number of infected bites per year which avoids the confusing number of zeros in the daily inoculation rate. Davidson and Draper (1953) transferred the same calculation into "interval between infective bites".

This method has been attempted in the course of these surveys and the results are shown in Tables III, VI and X. It was used as an experiment and in future surveys many of the pitfalls could be avoided.

The disadvantages are clearly seen. In Yorugu (Table VI) for the reasons described above it was difficult to collect adequate numbers, so that the percentages in the younger infants are based on small numbers and their reliability can only be accepted as they fit well on to the theoretical curve. The Bomfa figures are based on larger numbers and again fit well on to the theoretical curve.

The Accra figures confirm that there is marked local and seasonal variation in transmission. The numbers are small for any particular group but it is suggested that they give a good indication of the seasonal change in the various parts of Accra.

The widespread use of antimalarials in Accra may have shortened the period of parasitaemia and therefore interfered with one of the assumptions on which the curves are based, but it has been shown above that there is little apparent difference in parasite rates in quinine and non-quinine takers.

Before accepting this inoculation rate as a suitable method for classifying malaria in West Africa it is necessary to compare the inoculation rates derived from the parasite rate with those derived from entomological data.

Entomological data

In attempting to express in mathematical form the risk of malarial infection from anopheline mosquitos it has been assumed that the gonotrophic cycle lasts 48 hours, the mosquito biting every other night and that in the forest and the northern savannah the conditions found at the time of the survey prevail for a specified number of months ascertained from the monthly rainfall figures. In the absence of precipitin tests the mosquitos are assumed to be entirely anthropophilic. Window traps were not used so the number of mosquitos leaving the houses before the spray catch is not known, nor is there any information as to the numbers biting outside. The neglect of these last two factors renders the calculated number of infected bites too low but in the forest and savannah it is of the order of ten times that calculated from the parasite rate in infants, a discrepancy which can be calculated from Ilaro data (Bruce-Chwatt et al. 1955) before spraying, and also reported and fully discussed by Davidson and Draper (1953) from Tanganyika; the latter postulate an immunity which suppresses the majority of infections. In support of this hypothesis it was found that the closest agreement between the calculated inoculation rates was in Central Accra which was the least malarious area with the lowest anopheline infective density; it would appear that when this critical density is exceeded the increased number of infected bites does not alter the parasitological picture in proportion to the increase in infected bites. Similarly calculations from Ilaro (Bruce-Chwatt et al. 1955) show a much closer agreement of the two rates in the later years of the spraying campaign when the Anopheline Infective Density was very low, the entomological figure being in fact smaller than that derived from parasitological data, possibly due to travelling outside the sprayed zone.

Although these three sets of figures, from Tanganyika, from Nigeria and from the Gold Coast agree in showing an excess of "entomological" bites when transmission is high and a closer agreement when it is low, we hesitate to stress the accuracy of our entomological inoculation rate from the forest and savannah which depended on the assumption that conditions found at the time of the survey had existed for several months. This objection does not hold good for the surveys carried out throughout the year in Accra where we found the same discrepancy in the suburbs and the same agreement in the centre of the town.

One important factor in the calculation is the sporozoite rate which in our surveys in the forest and northern savannah was much higher than that reported from Nigeria, but similar to some rates reported by Holstein (1954). Muirhead-Thomson (1948) working near Lagos found that the sporozoite rate was inversely proportional to the size of the population and this has been confirmed by Gillies (1954), but Holstein found that in the dry season when numbers were low the sporozoite rate was low or nil. The latter pattern agrees with our findings in Accra. The sporozoite rate of 7% found in the savannah at the end of the dry season is intermediate between the two patterns.

To elucidate this problem needs a continuous survey in one area and a larger number of dissections than those reported by some of the above authors. The question is complicated by the possibility that all sporozoites seen in glands are not infective (James 1931), and that older mosquitos may have a higher death rate than young ones (Kershaw et al. 1954); the latter finding may be important if this tendency is accentuated in adverse climatic conditions.

The high sporozoite rates found in our surveys and the low density of gametocytes suggests, in agreement with Muirhead-Thomson (1954), that infants and young children are not necessarily the most important source of infections.

Conclusion

Although the relationship between the parasitological and entomological inoculation rate is not clear both calculations place the various zones in the same order of endemicity and we consider that the calculation from the parasite rate in infants gives a good measure of endemicity.

If this method is adopted more widely in the future it will be necessary to concentrate on small children at the expense of scholars and adults, also in areas of high endemicity to subdivide the infants into smaller groups, the composite 0-1 group being just as misleading as the composite spleen rate. In addition note must be taken of travelling into areas of different endemicity and of the use of anti-malarials.

Extension of this mathematical approach by Davidson (1955) has made it possible to forecast whether in a particular area, transmission is likely to be easily controlled.

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TABLE I. MALARIA RATES: BOMFA, 1953-54

Age in years	Spleen Rates				Parasite Rates			
	November 1953		February 1954		November 1953		February 1954	
	Number examined	Rate	Number examined	Rate	Number examined	Rate	Number examined	Rate
0 - 1	46	33%	35	46%	70	67%	53	62%
1 - 2	55	69%	35	71%	55	87%	42	83%
3 - 4	53	72%	53	87%	41	88%	52	86%
5 - 7	102	61%	52	77%	90	86%	52	92%
8 - 10	69	42%	50	52%	64	86%	53	70%
11 - 15	100	29%	47	28%	76	80%	50	74%
Adults M	92	15%	36	19%	50	30%	46	20%
Adults F	147	20%			57	21%		

TABLE II. GAMETOCYTE RATES, AVERAGE ENLARGED SPLEEN AND PARASITE DENSITIES: BOMFA, 1953-54

Age in years	November, 1953				February, 1954			
	Number examined	Gametocyte rate	Average Enlarged Spleen	Positive Parasite Density Index	Number examined	Gametocyte rate	Average Enlarged Spleen	Positive Parasite Density Index
0 - 1	70	24%	2.36	2.55	53	9%	2.12	4.00
1 - 2	55	22%	2.34	3.39	42	16%	2.40	3.60
3 - 4	41	34%	2.45	2.94	52	21%	2.39	3.17
5 - 7	90	12%	2.03	2.10	52	11%	1.92	2.24
8 - 10	64	17%	2.10	1.65	53	6%	1.88	1.67
11 - 15	76	16%	1.58	1.43	50	10%	1.69	1.51
Adults	107	3%	1.42	1.35	46	4%	1.57	1.00

P.P.D.I. = Positive Parasite Density Index (an arbitrary index expressing the weighted mean value of all parasite counts in the sample of the population found infected).

A.E.S. = Average Enlarged Spleen (as defined by Covell et al. 1953) is the weighted average of all enlarged spleens found in the examined sample of the population.

The gametocyte rate refers to *P. falciparum* gametocytes only.

TABLE III. INFANT PARASITE RATES: BOMFA, 1953-54

Age	November, 1953		February, 1954		Total	
	Examined	Rate	Examined	Rate	Examined	Rate
0 - 2 months	7	-	7	-	14	0%
3 - 5 months	18	61%	15	53%	33	57%
6 - 8 months	20	75%	14	79%	34	76%
Over 9 months and under 1 year	25	84%	17	82%	42	83%
Over 1 year and under 3 years	55	87%	42	83%	97	86%
Approximate number of infective bites per year needed to provide these rates		1.8		1.8		1.8

TABLE IV. MALARIA RATES: YORUGU - BOLGATANGA

Age in years	Spleen Rates				Parasite Rates			
	October 1954		April 1955		October 1954		April 1955	
	Number examined	Rate	Number examined	Rate	Number examined	Rate	Number examined	Rate
Under 1 year	38	71%	33	51%	33	89%	34	76%
1 - 2	53	72%	47	79%	38	97%	47	96%
3 - 4	34	76%	45	73%	34	97%	45	100%
5 - 7	52	65%	43	49%	52	96%	43	95%
8 - 10	36	55%	44	30%	36	94%	44	98%
11 - 15	52	33%	41	24%	51	84%	42	95%
Adults M	123	3%	91	2%	83	45%	96	54%
Adults F	120	9%	92	11%	72	50%	91	54%

TABLE V. GAMETOCYTE RATES, AVERAGE ENLARGED SPLEEN AND PARASITE DENSITIES: YORUGU - BOLGATANGA. 1954-55

Age in years	October 1954				April 1955			
	Number examined	Gametocyte rate	Average Enlarged Spleen	Positive Parasite Density Index	Number examined	Gametocyte rate	Average Enlarged Spleen	Positive Parasite Density Index
Under 1 year	38	50%	2.1	4.0	33	38%	2.1	3.7
1 - 2	38	45%	2.4	3.8	47	51%	2.2	4.0
3 - 4	34	29%	2.0	3.3	45	62%	2.1	2.8
5 - 7	52	14%	1.9	2.4	43	51%	1.9	2.2
8 - 10	36	14%	1.9	1.9	44	39%	1.6	1.7
11 - 15	51	14%	1.7	1.7	41	26%	1.5	1.7
Adults	155	8%	1.5	1.5	183	15%	1.5	1.2

TABLE VI. INFANT PARASITE RATES, YORUGU - BOLGATANGA

Age	October 1954		April 1955		Total	
	Examined	Positive	Examined	Positive	Examined	Rate
0 - 2 months	3	0	6	1	9	(11%)
3 - 5 months	8	8	9	6	17	82%
Over 6 months and under 1 year	27	26	19	19	46	98%
Over 1 year and under 3 years	38	37	47	45	85	96%
Approximate number of infective bites per year needed to provide these rates						3.3

TABLE VII. RAINFALL AND ANOPHELINE DENSITIES IN ACCRA, AUGUST, 1953 - JULY, 1954

		1953					1954							Total
		Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	
Average rainfall over past 20 years		0.59	1.38	2.45	1.38	0.88	0.59	1.33	2.24	2.91	5.46	7.05	1.83	28.09
Rainfall 1953-54		0.57	1.01	6.78	1.25	1.14	1.16	2.28	1.81	3.80	5.40	4.24	0.40	29.84
Central	(Rooms examined	-	17	17	20	40	59	20	40	32	43	80	80	448
	(Total anopheline ♀♀	-	0	0	0	1	0	0	0	3	4	12	5	25
	(Room Density Index	-	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.09	0.09	0.15	0.06	-
Intermediate	(Rooms examined	66	80	51	58	80	93	56	100	80	80	60	96	900
	(Total anopheline ♀♀	129	8	7	8	36	7	3	18	23	161	441	97	958
	(Room Density Index	1.95	0.10	0.14	0.14	0.45	0.08	0.05	0.18	0.29	2.01	7.35	0.01	-
Suburbs	(Rooms examined	-	-	29	20	40	40	20	32	20	40	20	40	301
	(Total anopheline ♀♀	-	-	4	64	194	2	56	583	471	549	963	275	3161
	(Room Density Index	-	-	0.14	3.20	4.85	0.05	2.80	18.22	23.55	13.72	48.15	6.87	-

N.B. The Room Density Index is the average number of anophelines per room per day caught by the technique described.

TABLE VIII. MALARIA RATES IN ACCRA ACCORDING TO DISTRICT AND SEASON

SPLEEN RATES								
	Central Accra				Suburban Accra			
Age in years	Aug. - Sept. 1952 & 1953		Mar. - Apr. 1954		Aug. - Sept. 1952 & 1953		Mar. - Apr. 1954	
	Examined	Rate	Examined	Rate	Examined	Rate	Examined	Rate
0 - 1	80	9%	40	5%	142	18%	39	20%
1 - 2	74	16%	53	6%	35	74%	49	31%
3 - 4	77	26%	61	20%	47	77%	36	42%
5 - 7	136	35%	38	18%	211	46%	72	44%
8 - 10	91	31%	28	16% (8 - 15)	43	49%	13	
11 - 15	118	21%	30		40	20%		
Adults	109	4%			136	10%		

PARASITE RATES								
	Central Accra				Suburban Accra			
Age in years	Aug. - Sept. 1952 & 1953		Mar. - Apr. 1954		Aug. - Sept. 1952 & 1953		Mar. - Apr. 1954	
	Examined	Rate	Examined	Rate	Examined	Rate	Examined	Rate
0 - 1	78	11%	40	7%	149	28%	39	31%
1 - 2	75	32%	53	8%	35	89%	49	47%
3 - 4	77	47%	61	20%	47	75%	36	61%
5 - 7	136	43%	39	28%	211	68%	72	60%
8 - 10	91	44%	28	29%	43	67%	13	
11 - 15	117	44%	30	20%	41	58%		
Adults	113	26%			136	24%		

In March and April, 1954, examination was confined to children

TABLE IX. GAMETOCYTE RATES, PARASITE DENSITIES AND AVERAGE ENLARGED SPLEEN IN ACCRA

	Central Accra								Suburban Accra							
Age in years	Aug.-Sept. 1952-1953				Mar.-April 1954				Aug.-Sept. 1952-1953				Mar.-April 1954			
	Number examined	Gametocyte rate	A.E.S.	P.P.D.I.	Number examined	Gametocyte rate	A.E.S.	P.P.D.I.	Number examined	Gametocyte rate	A.E.S.	P.P.D.I.	No. exam.	Gametocyte rate	A.E.S.	P.P.D.I.
0 - 1	78	2%	1.3	6.0	40	)	1.5	2.3	149	12%	1.8	3.6	39	12%	1.9	2.3
1 - 2	75	8%	2.0	3.5	53	)	2.0	2.0	35	) = 17%	2.0	5.4	49	16%	2.0	2.3
3 - 4	77	6%	2.2	2.9	61	)	1.8	2.3	47	)	2.4	3.6	36	22%	2.3	2.2
5 - 7	136	10%	1.8	3.0	39	= 2%	2.0	1.8	211	9%	2.3	2.9	72	21%	1.7	2.0
8 - 10	91	5%	2.1	2.6	28	)	2.0	1.6	43	) = 8%	2.1	2.7	13	) = 6%	1.5	
11 - 15	117	5%	1.8	2.3	30	)		1.1	41	)	1.6	1.8	3	)		
Adults	113	5%	2.0	1.7	8	)			136	5%	1.2	1.7				

TABLE X. INFANT PARASITE RATES, ACCRA, 1952-54

Age	Suburban Accra						Central Accra			
	Aug.-Sept.1952		Sept.-Oct. 1953		Mar.-Apr. 1954		Aug.-Sept.1952-53		Mar.-Apr. 1954	
	Examined	Rate	Examined	Rate	Examined	Rate	Examined	Rate	Examined	Rate
0 - 2 months	17	18%	24	4%	)	)	20	10%	)	)
3 - 5 months	37	40%	32	12%	) = 39	)=31%	33	9%	) = 40	) = 7%
Over 6 months and under 1 year	16	75%	23	30%	)	)	25	16%	)	)
Over 1 year and under 3 years	27	89%			49	47%	75	32%	53	8%
Approximate number of infective bites per year needed to produce these rates	1.8		0.73		0.9		0.4		0.15	

TABLE XI. SUMMARY OF RESULTS OF MALARIA SURVEYS IN THE GOLD COAST

	Inoculation rate expressed as infected bites per person per year		Maximum spleen rate and age at which reached	Maximum parasite rate	Adult parasite rate	Seasonal change in parasite rate at ages one to four years	Infant mortality rate	Percentages of predominant anophelines		
	From entomological data	From parasite rate in infants						Species	End of wet season	End of dry season
Central Accra	0.1	Between 0.15 & 0.4	35% at age 5 - 7 years	47%	26%	25%	87*	gambiae funestus	100 0	0 0
Suburban Accra	21	Between 0.73 & 1.8	77% at age 3 - 4 years	89%	24%	30%	245*	gambiae funestus	99 <1	99 0
The Forest (Bomfa)	24	1.8	80% at age 3 - 4 years	92%	25%	less than 5%	unknown	gambiae funestus	68 29	61 36
Northern Savannah (Yorugu-Bolgatanga)	28	3.3	79% at age 1 - 2 years	100%	50%	Nil	about 250**	gambiae funestus	58 39	98 2

* Average 1948-52

** Result of Medical Field Unit Survey in adjoining district, 1952-54