

are ordinarily recommended. I found the treatment effective in relieving patients of fever, but not in preventing relapses or enlargement of the spleen. In respect of these two manifestations of malaria, I wished for a better drug, and the change from quinine to cinchona febrifuge I was led to adopt after reading the convincing contribution 'On a Standard Treatment for Malaria' by Acton and Knowles (1924). In spite of this article this treatment has enjoyed little popularity in this country. It is now being realized that quinine has not been able to fulfil the expectation of an ideal cure for malaria.

Believing that few patients would like the cinchona mixture, it occurred to me to try the febrifuge and test its efficacy in the form of tablets. The first case on which I tried the febrifuge was one of my servants who every year suffered from malarial fever with severe rigors and bilious vomiting. His spleen was enlarged and by 1925 it had reached the umbilicus. Until then he was being treated with quinine hypodermically. It used to relieve him of the fever but had no influence on his spleen.

After the last injection 4-grain tablets of cinchona febrifuge (Java) were given, three tablets a day, morning, noon and night, to be swallowed with water, for seven days, then twice a day for a fortnight and once a day for a week more.

The servant himself having noticed a definite reduction in his spleen, asked me to confirm it. On examination I was greatly struck with the marked reduction in the size of his spleen. The response to cinchona was spectacular, the spleen was now less than half, there being improvement in his general health, and the pallor in his face was replaced by some redness.

This case so greatly impressed me that I commenced the use of cinchona febrifuge tablets in my practice in place of quinine, and I found it to be a success not only in ridding the patients of fever but in preventing relapses and definitely reducing enlarged spleens. One effect, which does not appear to have been alluded to in the literature, is the laxative effect of the febrifuge. In fact this effect was brought to my notice first by my servant and then by the patients, by their enquiring if I had added anything to the tablets to move the bowels.

Fever and hypertrophy of the spleen, the most prominent symptoms of malaria, develop with the disease and disappear as it is cured. The therapeutic value of cinchona febrifuge in malaria has long been accepted. From 1925 to 1932 when I had to retire from practice on account of ill health, I used cinchona febrifuge almost with uniform success for nearly seven years in place of quinine.

Among rural populations suffering from malaria, my experience suggests that cinchona febrifuge powder should be the drug of choice. Honey is a good vehicle for making pills or

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PRELIMINARY REPORT ON AN EXPERIMENT IN COOLIE-LINE SANITATION

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The problem presented

FROM a public health point of view the three major scourges of the Assam Valley tea estates are malaria, dysentery and hookworm disease. The two latter are, essentially, diseases of faulty sanitation since, in both, infection is spread by badly disposed faeces. The management have done a great deal towards improvement of coolie-line sanitation by their enthusiastic adoption of the tube-well system of water supply which avoids the danger of contaminated surface water. This measure has, undoubtedly, reduced the incidence of dysentery and other bowel diseases but has, of course, had no effect on hookworm infection and has left untouched the problem of fly-spread of bowel infections. The coolies, at present, defæcate on the ground in any convenient situation round about their lines, very frequently among the tea bushes themselves. Conditions are, therefore, ideal for contamination of food by flies and for infection and re-infection by hookworm of the coolies working among the tea bushes. Moreover, the intolerable smell pervading certain areas can be easily imagined. The provision of some type of latrine is the only solution to the problem,

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paste and since honey is available in villages, 4-grain pills can be made with it for adults, and for children a proportionate quantity can be made into a paste with honey. This method of administering cinchona febrifuge has been found very suitable.

As cinchona febrifuge is efficacious and cheap it will ensure the greatest benefit to the greatest number for the money available. According to Acton: 'A most important point in the treatment of malaria is that it shall be continuous'. It must also be realized that the method of administration and the doses which have varied within wide limits count in the successful treatment of the malaria sick.

Since 1916 I began giving as a routine a 3-grain dose of quinine hydrochloride just at the commencement of the rigor or of fever if without a rigor, with the idea that fresh parasites in the plasma before entering erythrocytes would be killed in greater numbers, as quinine is absorbed very rapidly and a small quantity of it is inimical to the freshly liberated parasites. This single preliminary additional dose of quinine gave better results than cinchona febrifuge without it.

REFERENCE

Acton, H. W., and Knowles, R. (1924). *Indian Med. Gaz.*, Vol. LIX, p. 177.

but many types have been installed in this district in the past and they have been universally unpopular with the coolies. They have been installed in the compounds of tea estate factories and hospitals and the coolies have objected to their communal aspect and refused to use them except under compulsion. The management have, therefore, not been encouraged to experiment with communal latrines in the lines. The question whether some form of latrine, which the coolies would be willing to use, could be provided at an economic cost was, therefore, taken up with the Superintendent of the Tingri Tea Co., Ltd. The Balimara line of Dirial Tea Estate was selected for the experiment, as it is a fairly isolated line of a reasonable size (the total population is 130 souls) and compactly planned. I was unfortunately prevented from making a stool survey of this line, before a mass treatment of oil of chenopodium (m. xxx) was given, by a tornado which swept the district and made heavy inroads on my time. The results of other surveys are given in tables I, II and III :—

TABLE I

Stool survey of a random sample of 255 coolies, resident in this district, of all ages and in good health

Infection	Number infected	Percentage incidence
All helminths	208	81.5
Hookworm	165	64.7
Ascaris	113	44.3

TABLE II

Stool survey of 112 persons, being the total population of an isolated line on another estate

Infection	Number infected	Percentage incidence
All helminths	103	91.9
Hookworm	97	86.6
Ascaris	54	48.2
Trichuris	61	54.4

TABLE III

Stool survey of 56 persons, being a random sample of coolies living on Dirial Tea Estate, excluding the Balimara line

Infection	Number infected	Percentage incidence
All helminths	49	87.5
Hookworm	40	71.4
Ascaris	33	58.9
Trichuris	29	51.8

In all these surveys a saline concentration method was used to eliminate errors in diagnosis as far as possible*.

The percentage incidence rates for dysentery in the Balimara line and in the other lines of Dirial Tea Estate are given in table IV :—

TABLE IV

Dysentery on Dirial Tea Estate

Line	Period of observation	Number of cases	Percentage incidence
Balimara ..	June 1936 to May 1937.	9	6.9
Other lines ..	Do.	38	3.7
Balimara ..	June 1937 to February 1938.	3	2.3
Other lines ..	Do.	27	2.6

Note.—Tube wells were sunk in 'other lines' in May 1936 but not in Balimara line until May 1937. The effect was to reduce the dysentery incidence of that line to that of the remainder of the estate. The latrine system was installed in Balimara line during February 1938.

Type of latrine provided

Enquiry among the coolies living in the Balimara line elicited the information that they would willingly use latrines if a separate one could be provided for each family and that, under such circumstances, they would themselves be responsible for the cleanliness of the latrines. Doubts as to smell and danger of contamination of the tube well were raised but were easily disposed of. The only type of latrine providing effective sanitation consistent with economy, considering the number needed, is the 'bored-hole'. The next problem was the design of a suitable housing which must be cheap, clean, easily erected and reasonably durable. Tales of difficulty regarding doors had also come to our ears. Sun-dried bricks, made on the estate with a Kapax machine, came to the rescue and made possible the design of a cheap and effective shelter. Doors were dispensed with and wing walls substituted and roofs were omitted for several reasons. Firstly, many coolies object to a roofed latrine on the grounds that 'it is wrong to defæcate in a house', secondly, the open construction allows of natural cleansing of the squatting plate by rain and, thirdly, cost was enormously reduced. The houses in this particular line are double, that is to say, each

* Approximately 0.5 c.cm. of stool was shaken up vigorously with 10 c.cm. of saturated common salt solution and the mixture transferred to a tube $\frac{3}{8}$ -inch in diameter holding 10 c.cm. A $\frac{3}{8}$ -inch cover slip was placed on the top, in contact with the upper surface of the mixture, and allowed to remain so for thirty minutes. It was then removed and examined under a $\frac{3}{8}$ -inch objective.

house has a central partition making it suitable for two families so that the latrines also were built in pairs. Scale drawings are appended (figures 1 and 2). A general plan of the lines is given in figure 3.

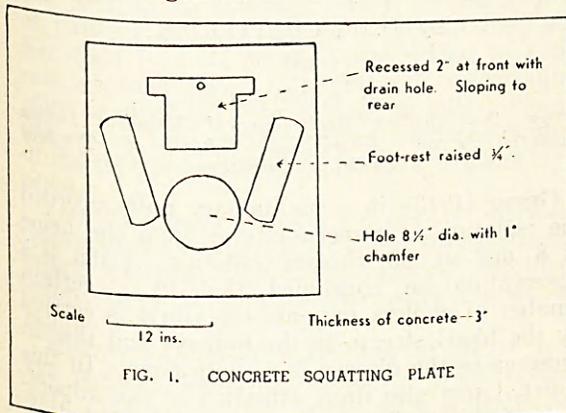


FIG. 1. CONCRETE SQUATTING PLATE

The general construction is as follows:—

The bored-holes are made in the usual way with a fourteen-inch augur and vary in depth from fourteen to twenty feet according to the

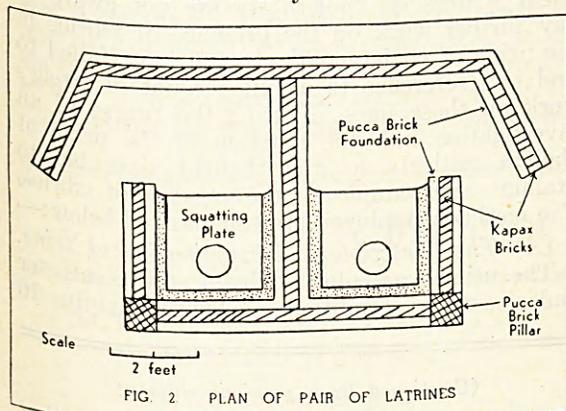


FIG. 2. PLAN OF PAIR OF LATRINES

level of the water table. They are covered by the squatting plates (set on cement) around which the shelter is built. Low foundation walls, one foot high, and two corner pillars are

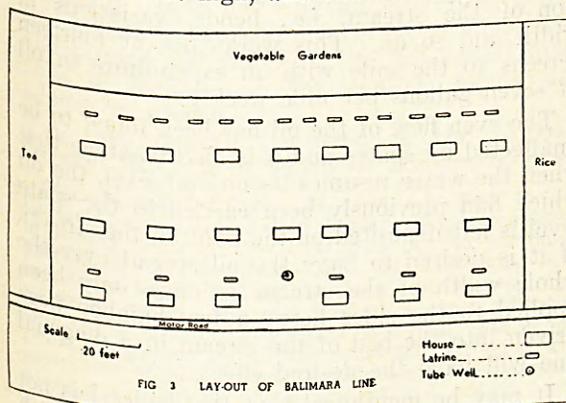


FIG. 3. LAY-OUT OF BALIMARA LINE

of pucca bricks. The main body of the walls is of Kapax bricks topped by two courses of pucca bricks to withstand direct heavy rain.

The full height of the walls from the ground is five feet six inches. The space between the squatting plate and the walls is filled in with concrete sloped up to the walls. The whole structure is made weather-proof by painting the Kapax bricks with two liberal coats of a mixture of tar and crude oil.

The estate manager has very kindly supplied me with the following specification and bill of costs for making one pair of latrines:—

Quantity	Material	Price		
		Rs.	As.	P.
200	.. Pucca bricks ..	5	0	0
500	.. Kapax ..	1	0	0
10 seers	.. Lime ..	0	4	0
2 bags	.. Sand ..	0	4	0
5 seers	.. Cement ..	0	7	0
15 "	.. Tar ..	3	12	0
2 gallons	Crude oil ..	0	11	0
2	Squatting plates	3	8	0
	Labour for boring	2	0	0
	" " building	7	0	0
	" " painting	0	4	0
TOTAL Rs. ..		24	2	0

He informs me that these costs are greater than they should be and that by employing labour directly instead of through a contractor they could be reduced by about Rs. 4, giving an all-in cost of about Rs. 10 per latrine (or family).

Practical experience.—From the very first these latrines have been completely popular. There has never been any hesitation on the part of any of the coolies in using them and they do, in fact, take a pride in keeping them clean. Within a very short time of their completion coolies from the other lines on the estate were asking to be similarly equipped. The management hope to equip one other line, at least, during the ensuing winter. The oil and tar coating appears to be effective in protecting the Kapax bricks from the effects of heavy rain and the bored-holes show no tendency so far to subside although no bamboo lining has been used. Aesthetically, there is some satisfaction in being able to walk anywhere round about this line without one's nostrils being assailed at every step. Regarding the effect on incidence of dysentery and hookworm infection, I hope to present a further communication at a later date.

Summary.—An account of the difficulties involved in securing adequate sanitation in Assam tea estates is given and a successful solution is described.

Acknowledgments.—My thanks are due to Mr. F. Woolley Smith, Superintendent, Tingri Tea Co., Ltd., for his permission to carry out this experiment, his interest in its progress and for permission to publish this account. I am also indebted to Mr. J. R. Morris, Manager, Dirial Tea Estate, for carrying the idea into effect, for his part in the design of the housings and for the specification accompanying this account.