

plasmochin separately exhibited untoward or toxic symptoms. The remaining 76 cases received atebirin and plasmochin together during the five days' course, *i.e.*, atebirin and plasmochin were swallowed at the same time according to the dosage. In this series 16 persons, or 21.05 per cent, exhibited untoward symptoms. Of these one had extremely severe gastric pain, vomiting and slight collapse, while the others complained of gastric pain of moderate to slight intensity and pigmentation of the skin.

Pregnant women bear the drugs well. Persons exhibiting a high degree of idiosyncrasy to quinine can take these drugs without any discomfort. One patient could not tolerate a grain of quinine and was a constant sufferer from malaria; she was given atebirin and plasmochin together for five days more than a year ago, and ever since has been keeping well.

Cost of treatment.—The actual cost of one course of atebirin and plasmochin for an adult is Re. 1-11-8. As against this, the cost of one course of quinine treatment for three weeks is Re. 1-11-4½; but from the view-point of the saving in hospital costs, and reduction in the time lost by the patient, it is certainly a cheaper method of treatment than quinine.

Summary and conclusions

1. Atebrin and plasmochin are effective in the treatment of malaria due to all strains of plasmodium in Bengal.
2. It is uncommon to find a temperature above 99°F. after 48 hours' treatment.
3. With the exception of subtertian gametocytes it is rare to find malarial parasites in the blood after the third day of treatment.
4. In subtertian malaria plasmochin also should be given owing to its specific action on the subtertian gametocytes.
5. In the absence of absolute certainty regarding the species of parasite, it is beneficial to use atebirin with plasmochin in all forms of malaria.
6. Atebrin produces a rapid reduction in the size of the spleen.
7. People exhibiting idiosyncrasy to quinine tolerate atebirin with plasmochin well.
8. Atebrin given alone occasionally produces certain untoward symptoms which are seldom serious.
9. Atebrin and plasmochin given together cause untoward symptoms in a larger percentage of cases and the symptoms are more severe.
10. It is safer to give atebirin for the first five days followed by plasmochin for the next five days.
11. The cost of treatment is on the whole less than treatment with quinine.

(Continued at foot of next column)

NOTES ON AN EXPERIMENT ON THE PROPHYLACTIC AND CURATIVE VALUE OF ATEBRIN AND PLASMOCHIN THERAPY IN A TEA GARDEN IN ASSAM*

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Introduction.—Malaria is a serious problem in all industrial concerns in India, especially in the tea industry. It is responsible for the loss of many working days, especially at a time when a tea garden can hardly afford it, not to speak of children's deaths, anamia, loss of vitality and weakening of the power of resistance to other diseases. The necessity of malaria control is appreciated by all, but it is a very difficult problem to face. Moreover it is probably not realized by many that in order to form an accurate opinion regarding the practicability of permanent malaria control in any given locality, mature judgment, wide experience and a thorough knowledge of anti-malarial measures are required. Also the ability of the authorities concerned to provide large funds for it and the cost of maintaining it subsequent to its adoption have to be considered. Hence in many tea estates temporary anti-malarial measures are adopted of which drug prophylaxis is one. For about the last seven years plasmochin, and for about two years atebirin, have gained prominence in this respect and many papers have appeared as to the value of these drugs from various parts of the world with such varying results that we decided to make an experiment ourselves and form an opinion of our own as to the efficacy of these drugs as prophylactic and therapeutic agents in this locality. Bokpara Tea Estate of the Budla Beta Tea Company, Limited, was selected for this experiment and Colonel H. C. Garbett, C.I.E., V.D., superintendent of the company, kindly obtained the sanction of Rs. 1,000 for this purpose.

*Read at a meeting of the Assam Frontier and Budla Beta Medical Society held on 11th October, 1934.

(Continued from previous column)

The treatment of malaria with atebirin and plasmochin is a distinct advance. The treatment is simple, short and economical. The consistent use of this drug should effect a considerable reduction in the number of malaria cases and the consequent loss of working days due to this disease on Indian railways.

Description of the 'coolie line' where the experiment was conducted.—The experiment was carried out in one 'line' only, with a total population of 234, of whom 84 were men, 75 women and 75 children. The population was a stable one and there was no immigration of new labour into this line, not only during the season of experiment but for the last four years. There are 75 houses (of which 53 are 'pucca') in 10 rows running behind each other parallel to the 'pathar'—at distances from the 'pathar' varying from 25 yards, the nearest row, to about 200 yards, the row furthest away. There is a gradual slope from the houses down to the *bhil* which lies about 20 feet below the highest row and 10 feet below the lowest row. A sluggish stream flows into this *bhil* at the eastern corner of the line. This line is situated in the centre of the garden quite adjacent to the hospital but separated from two other neighbouring lines by a distance of quarter of a mile and one-eighth mile respectively. It has always been highly malarious and generally unhealthy. The inhabitants are mainly Oorihias from Cuttack—a people notoriously liable to ills of all sorts and with a low resistance.

Methods adopted.—The experiment with atebirin and plasmochin was undertaken in 1933 from July to the end of the year with the following objects:—

(1) To determine the value of these drugs as a prophylactic in the method and doses given.

(2) To estimate their value as curative agents.

(3) To ascertain the toxic effects, if any, of these drugs arising out of the method adopted.

It was obvious that in dealing with a labour force on a tea estate it was quite impossible to administer any prophylactic drug three times a day; the administrative difficulties were insuperable and the dislocation of labour entailed by such an undertaking prohibitive. Besides it seemed to be inviting trouble to give atebirin three times a day quite irrespective of time and relationship to food, weather and work, even if such a thing were possible with the limited staff available. We were strengthened in this opinion by alarming reports from a tea estate on which such an experiment was attempted and had to be perforce abandoned quickly owing to the *apparent* alarming ill effects of atebirin and plasmochin on the labour. This was to be expected with atebirin given somewhat indiscriminately as noted above. Consequently it was decided to administer atebirin in one dose daily in the evening after work was over at the time of the taking of the evening meal. This was possible on this estate as the line on which the experiment was carried out was contiguous to the hospital. It was felt that if atebirin was to be given to a labour force as a prophylactic, unless it could be given in one dose with food, it was doomed to failure

owing not only to untoward effects* of the drug, but also to the dislocation of labour and the lack of time of the medical staff available. It consequently had to be determined in what dosage the drug could be given in one dose to be of any prophylactic value and at the same time to avoid accidents. The writers determined on the following single doses of atebirin and the following course:—

Adult men and women (those over 8 years were counted as adults) were given 2 tablets or 3 grains in one dose per day after food in the evening.

Children between 4 to 8 years were given 2 grains in one dose per day after food in the evening.

Children between 1 to 4 years were given 1 grain in one dose per day after food in the evening.

Children under 1 year were given half grain in one dose per day after food in the evening. (The great majority of these children were breast-fed).

Those old enough to swallow were given the drug in tablet form; those too young in liquid form or rather in suspension in water. The administration was carried out by the junior writer and his staff in the evening between 6 and 7 o'clock. We can guarantee that the administration of these drugs was carried out properly in the manner indicated. It was decided to adopt the following procedure:—

Beginning on 17th July atebirin was given to the labour of the selected line to the number of 234 for five days, once daily in the evening after food in the doses already outlined. This was followed by plasmochin for five days, once daily in the evening after food in the following doses—

Adults were given one-third grain in one dose per day after food in the evening.

Children between 4 to 8 years were given a quarter grain in one dose per day.

Children between 1 to 4 years were given one-sixth grain in one dose per day.

Children under 1 year were given one-twelfth grain in one dose per day.

[Plasmochin tablets are available in two forms, *viz.*, (i) .01 gramme or one-sixth grain and (ii) .02 gramme or one-third grain. The latter is grooved in the middle and can be easily divided into two equal parts.]

This was followed by plasmochin in the above method and dosage given twice a week till the end of November. In addition a second course of atebirin was given to the children only, for five days in the doses already outlined, beginning on 28th August and ending on 1st September.

The line population was seen by the junior writer every night till the end of September to detect any malarial cases or relapses and also

* We think it only fair to state that at the time when this experiment was begun the reported ill effects of atebirin were in all probability not due to atebirin at all, as such, but to its combination with plasmochin or the administration of it immediately following on atebirin before the latter is eliminated from the system. Our most recent experience inclines us to the opinion that the toxic effects of atebirin alone in the usual doses are negligible except for the yellow discoloration that shows itself occasionally.

to find out if there were any ill effects of the drugs. Blood slides of febrile cases (thick and thin films combined, stained by Giemsa's method) were examined for malaria parasites by the junior writer, and also some slides of children taken at random during the afebrile period. This daily work was continued by his successor Dr. D. C. Sen during October, November and December. All cases of malaria either primary after the first taking of these drugs or after a relapse were admitted to the hospital and given a five-day course of atebtrin followed by a five-day course of plasmochin in the dosage and method shown in table I.

the longest period being 103 days and the shortest eight days. Cent per cent of this series relapsed; two of them (both Indians) relapsed twice.

It will be noted from table II that relapse rates vary according to age groups from 153.3 per cent in those below two years to 4.31 per cent in those over 15 years, showing the absence of resistance in the very young and gradual development of relative immunity in later age groups. The total average relapse rate for all ages was 21.36 per cent. The total number of relapses was 50 out of 234 for the five months, August to December inclusive. It may be

TABLE I

Age	ATEBRIN		PLASMOCHIN	
	Duration of treatment	Dose	Duration of treatment	Dose
Adults	5 days	1½ grs. thrice daily after food.	5 days	½ gr. thrice daily after food.
Children between 4—8 years.	Do.	1½ grs. twice daily after food.	Do.	½ gr. twice daily after food.
Children between 1—4 years.	Do.	1½ grs. once daily after food	Do.	½ gr. once daily after food.
Children under 1 year	Do.	¾ gr. once daily after breast feed.	Do.	¼ gr. once daily after breast feed.

Table II gives the relapse* rate by ages.

On an average the relapse took place 41.3 days after the completion of the course of atebtrin, the longest period being 116 days and the shortest one day.

contrasted with the average number of relapses (on the same population during the same months) for the preceding five years which was 40.2. At first sight it occurs to one that atebtrin and plasmochin had a provocative effect on

TABLE II
Showing relapses by ages

	Below 2 years	Between 2—4 years	Between 4—6 years	Between 6—8 years	Between 8—15 years	Over 15 years	TOTAL
Number treated in the line.	15	29	20	11	20	139	234
One relapse	11	8	3	3	4	6	35
Two relapses	8	2	..	1	..	..	11
Three relapses	3	..	..	..	..	..	3
Four relapses	1	..	..	..	..	..	1
Total relapses	23	10	3	4	4	6	50
Percentages	153.3	34.48	15	36.36	20	4.31	21.36

In another series of 12 private patients (all adults)—6 Europeans and 6 higher-class Indians—treated by the senior writer, relapse took place after 38.7 days counting from initial pyrexia,

* All malaria cases occurring after the administration of the drugs are counted as relapse owing to the intensity of the infection in this line especially in little children from the age of two months onwards.

the relapse rate. But it may be pointed out that during this experiment we always kept a very vigilant eye on this line and all cases of malaria were detected and admitted into hospital without exception, but in other years doubtless many cases, especially very young children, escaped notice and were left untreated in the line. Allowance must be made for this.

But at the same time it is evident that the treatment had no marked controlling influence on the relapse rate in children.

It will not be out of place to mention in this connection that between June and December 1932 inclusive, the junior writer carried out an experiment in the same line to test the prophylactic value of cinchona febrifuge in children alone, who are the main reservoirs of infection. He divided the line into two halves in a crosswise manner and daily gave cinchona excepting Sundays to 34 children of half the line. Forty-five children of the other half were left as controls without any treatment. He found the relapse rate in the former group as 64.70 per cent and in the latter group as 66.66 per cent. As the number is small no definite conclusion can be made but it suggests the failure of cinchona as a prophylactic in children. It is however possible that some of the relapses might be reinfections.

This table brings out clearly that as the treatment continued (i) relapses due to malignant tertian parasites progressively diminished; (ii) there was no progressive reduction in relapses due to benign tertian parasites.

Table V shows the monthly incidence of malarial infection in apparently-healthy children whose blood slides were taken at random.

This table shows that as the treatment continued (i) malignant tertian infection was reduced, (ii) benign tertian infection persisted, and (iii) total infection gradually diminished.

Therapeutic results of atebirin and plasmochin treatment.—It has already been mentioned that the cases that relapsed were admitted into hospital and given a full course of treatment with atebirin and plasmochin, that is five days' atebirin followed by five days' plasmochin in doses outlined in table I. Fifty cases were thus treated, 10 cases being adults and 40 children. Routine parasitological examination was made only on admission and discharge. On

TABLE III
Showing parasitic incidence of the relapse cases

B. T.	M. T.	Quartan	Mixed B. T. and M. T.	Unclassified	Parasites not found	Total
17	13	1	4	4	11	50

This table shows (i) that relapses were higher with benign tertian than with malignant tertian and (ii) that benign tertian and malignant tertian infections were the predominating ones.

The months of incidence of benign tertian and malignant tertian parasites are shown in table IV.

TABLE IV
Showing the months of incidence

Months	B. T.	M. T.	Total
August ..	2	4	6
September ..	4	6	10
October ..	5	2	7
November ..	4	1	5
December ..	2	..	2
Total ..	17	13	30

discharge all were negative to malaria parasites; the result of examination on admission has already been shown in table III. It is unfortunate that for want of time the blood of each patient could not be examined daily nor could a comparative study be made with quinine. Temperature finally came down to normal after 2.7 days of atebirin, the amount of atebirin taken being according to age.

The idea underlying the giving of plasmochin was not of course to control symptoms, but to prevent infection in others. As already mentioned, the blood of all patients was examined on completion of plasmochin treatment but crescents were not encountered in a single case, which shows its efficacy as a crescenticide in the dose and length of treatment adopted.

Failures of atebirin therapy.—In one case atebirin failed altogether to control temperature.

TABLE V

Months	Total number examined	NUMBER FOUND POSITIVE					Percentage
		B. T.	M. T.	B. T. and M. T.	Unclassified	Total	
September ..	26	2	3	..	4	9	34.6
October ..	25	5	..	1	1	7	28.0
November ..	25	3	..	2	..	5	20.0
Total ..	76	10	3	3	5	21	27.6

Another case resisted combined administration of atebtrin (by mouth) and quinine (by injection). Two other cases showed a rise of temperature on the day following the completion of the atebtrin course.

Toxic effects arising out of atebtrin and plasmochin treatment.—Yellow discoloration of the skin and eyes was noticed in three cases after the taking of 12 grains of atebtrin; this lasted about a week. One patient complained of diarrhoea after taking $7\frac{1}{2}$ grains of atebtrin—in this case it is difficult to say if the diarrhoea was due to atebtrin or was merely a coincidence. This however did not necessitate stoppage of atebtrin. One patient complained of anorexia after 12 grains of atebtrin, one patient complained of slight abdominal pain after 18 grains of atebtrin, three patients complained of giddiness, two after 12 grains and one after 9 grains of atebtrin. Abdominal pain was complained of by two patients during plasmochin treatment. It may have been due to plasmochin, but was more probably due to its combination with atebtrin that had accumulated in the system. Abdominal pain was relieved by temporarily stopping the drug, using aperients and milk diet.

It will be interesting to mention in this connection that two of the senior writer's private cases developed blackwater fever just after the completion of treatment with atebtrin and plasmochin given consecutively. Short notes of these cases are given below:—

Case 1.—Hindu male, aged 28 years, Bengali, compounder, had been suffering from malarial fever off and on for six or seven months. He experienced the last attack of fever on the 4th October, 1933. The blood slide was negative to malaria parasites. Two injections of quinine bihydrochloride gr. x each were given intramuscularly on successive days and the fever stopped. From the 6th to 10th October he was put on atebtrin one tablet thrice daily. From the 11th to the 15th October he was put on plasmochin one tablet ($\frac{1}{6}$ grain) thrice daily and on the 16th October he developed blackwater fever.

Case 2.—Hindu male, aged 40 years, Bengali, compounder, had been suffering from low fever in the evening for a month and a half, temperature never exceeding 99.4°F . On the 3rd December, 1933, his blood slide showed scanty malignant tertian rings. He had the last attack of fever on the 10th December, 1933. His blood slide was found negative for malaria parasites. Slides were then examined every day till the 20th December and were all negative. From the 10th December, 1933, he was put on atebtrin one tablet thrice daily for five days. From the 15th December he was put on plasmochin one tablet ($\frac{1}{6}$ grain) thrice daily for three days and the next day he developed blackwater fever.

It is significant that all the ill effects mentioned were observed in adults. This suggests that children probably bear these drugs better than the adults.

Contraindications.—We found no contraindications in the administration of these drugs. It is interesting to mention here that one adult female was admitted into hospital with high fever and intense jaundice. She was put

on atebtrin one tablet thrice daily for five days. Temperature finally came down to normal on the fourth day and jaundice disappeared in a further ten days' time. This suggests that malarial jaundice is not a contraindication to the administration of atebtrin. Four pregnant women who underwent the treatment tolerated the drugs well.

Relative cost of quinine and atebtrin.—The cost of a curative course of atebtrin (three tablets daily for five days) is Rs. 2-2. For an adult Indian patient of average health a curative course of quinine (twenty grains daily for seven days) costs annas 8 only. If we consider the relapse-preventing capacity of both the drugs the same, then quinine is decidedly much cheaper than atebtrin.

Summary and conclusions

1. The high incidence of malaria in a 'coolie line' in a tea garden in Assam gave an opportunity to carry out an experiment with atebtrin and plasmochin as to the efficacy of these drugs as prophylactic and therapeutic agents.

2. Two hundred and thirty-four people—159 adults (children over eight years were counted as adults) and 75 children were treated.

3. Prophylactic doses of atebtrin and plasmochin were distributed among the line population in the dosage and by the method described.

4. Those who developed fever were admitted into hospital and given a full course of treatment with atebtrin and plasmochin in the dosage and manner shown in table I.

5. There were 50 relapses* (21.36 per cent)—the vast majority of which were confined to the children population especially among those below two years of age, showing the absence of immunity in them. Of this age group, 11 cases had one relapse, 8 cases two, 3 cases three, and 1 case as many as four relapses.

6. The total infection and total incidence of malaria diminished to some extent; this diminution was due chiefly to the reduction of malignant tertian cases but there was no reduction either in infection or in incidence in benign tertian cases. But even this reduction of incidence in malignant tertian infections was not sufficiently satisfactory to compensate for the expense incurred.

* We consider that the use of the word *relapse* in this connection is misleading. When a patient is transferred to a malaria-free area for treatment, or is treated at a time of year when transmission is not occurring, then it is permissible to refer to a malarial attack as a *relapse*, but, in a highly malarious locality at a time of year when conditions are optimum for transmission, it is scarcely permissible to refer to *any* attack, unless it follows within a few days of the conclusion of treatment for the previous attack, as a relapse, and certainly not to refer to the thirty-five primary attacks—that is to say, primary as far as the experiment was concerned—as relapses, just because the patients had received a course of treatment for an infection which there is no evidence that they ever had, as these writers have done.—EDITOR, I. M. G.

7. The real value of an anti-malarial drug especially as a prophylactic agent can be gauged properly only when its efficacy is proved in terms of children and from this standpoint atebirin and plasmochin have failed, in our experiment, to fulfil the somewhat exaggerated claims made on their behalf. They have, however, decidedly better prophylactic value in adults.

8. We have not been able to determine the efficacy of atebirin relative to that of quinine but it is our impression that as a therapeutic agent atebirin is at least as efficacious as quinine in controlling the clinical symptoms and freeing the peripheral blood of malaria parasites.

9. On the point of toxicity atebirin is decidedly superior to quinine. It does not give rise to neurotrophic symptoms, is well tolerated by children and also those who have an idiosyncrasy to quinine as well as by pregnant women.

10. Ill effects are attributed to the combination of atebirin and plasmochin. In the method and dosage we followed, ill effects were very few and not at all dangerous.

11. The cost of a course of atebirin treatment is much higher than that of quinine but this higher cost is somewhat compensated for by the absence of neurotrophic symptoms. Therefore atebirin is a more suitable drug for those who can afford it but it cannot replace quinine in general use in a poor country like India.

12. Though it cannot be said with certainty that atebirin is a more effective therapeutic drug than quinine, it is undoubtedly a new anti-malarial weapon with some advantages over quinine and being, we hope, the precursor of more potent synthetic preparations has certainly opened up a new path for combating malaria.

13. As a gametocyticide plasmochin should be used in mass treatment, only under proper medical supervision and under suitable conditions.

14. In these days of economic depression, quinine will, in a tea garden, hold its present position till a cheaper and equally or more efficacious remedy is available.

15. We hold a very strong view that the published reports of atebirin and plasmochin treatment as prophylactics lose most of their value unless the age groups of the people so treated are given as well as the average length of time such people have resided in that locality.

Acknowledgments

We are indebted to the directors of the Budla Beta Tea Company, Limited, for sanctioning Rs. 1,000 towards defraying the cost of this experiment and to Colonel H. C. Garbett, C.I.E., V.D., superintendent of the company, for his good offices in obtaining this grant and for his interest and practical help. Our thanks are also due to Mr. H. O. J. Maxwell, manager,

Bokpara Tea Estate, for his co-operation and sympathy in the same and to Dr. D. C. Sen, L.M.F., who was responsible for the completion of the latter part of the experiment.

[During the last few years there has been, both in these columns and elsewhere, a considerable amount of discussion on the use of plasmochin by the sanitarian in an anti-malarial campaign. Experiments have been undertaken and reported; both successes and failures have been claimed—our use of the word *claimed* in connection with the failures is deliberate, as in most instances the writers have adopted an I-told-you-so tone in reporting these—but as a rule the discussions have not risen above the theoretical level. The theoretical case is perfectly clear; malaria, despite its name, is not born of the air and, therefore, if you can clear the population of gametocyte carriers, you must necessarily stop the malaria. Again plasmochin is a drug that will destroy with certainty all the gametocytes in any person to whom it is given in adequate doses. The point over which there is a disagreement of opinion is as to whether the facts that we know about plasmochin can ever be translated into practical politics, and, if the answer is in the affirmative, what are the special circumstances in which this can be done?

Conditions under which malaria exists and has to be controlled are so diverse that a very large number of experiments will have to be carried out to settle these questions; practical experiments, like this one carried out by Dr. Williams and his assistants, are therefore particularly welcome.

The writers have stated that the first object of their enquiry was 'to determine the value of these drugs [atebrin and plasmochin] as a prophylactic in the methods and doses given'. There are two aspects of prophylaxis—personal prophylaxis and general prophylaxis: the object of the former is to protect the person to whom the drug is given from an attack of malaria, of the latter to destroy the gametocytes circulating in his blood so that the general population is protected. There is no drug known to-day that will with any degree of certainty protect a person from malarial infection; neither atebirin nor plasmochin will effect this, even if given in large doses over long periods. However, both drugs given in adequate doses are capable of keeping the malarial infection at a sub-clinical level, as long as their administration is continued, and eventually of killing out the infection in some cases, but in these circumstances they are not acting as prophylactic but as curative drugs.

Dr. Williams gave a single sub-optimal course of atebirin and plasmochin in the middle of the malaria season followed by a single dose of plasmochin twice a week throughout the rest of the season. Even the extremists amongst those who have made 'the somewhat exaggerated claims', to which these writers refer, have never claimed that such a course could possibly protect the recipients from a malarial infection, or even keep the infection at a sub-clinical level beyond the few days during which the atebirin was being taken; we cannot therefore believe that it was personal prophylaxis that Dr. Williams hoped to achieve.

On the other hand this course might be expected to keep the population of the 'line' free from gametocytes (we are not told whether it did or not), and the scheme might therefore have been useful as a general prophylactic measure. The success of this would however depend entirely on whether this 'line' was an isolated one, sufficiently far from other human habitations to ensure that mosquitoes were not getting infected from other sources but we are told that it was adjacent to the hospital and two hundred yards from another line.

One thing that this enquiry has brought out very clearly is the imperative necessity of maintaining a

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THE INSPECTIONAL VALUE OF PHRYNODERMA AND 'SORE MOUTH'

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MALNUTRITION may be considered to be due either to disease or to dietary deficiencies. When it is due to the former it may require a long and thorough inspection to find the cause. But the medical inspection of groups of persons such as school children, gangs of labourers constructing railways or other public works, employees in factories, or convicts in jail, is often required to decide the adequacy or otherwise of their diets.

Conclusions from these inspections have been based to a large extent on general appearances. When an individual shows adequate subcutaneous fat, firm muscles, a shining skin, clear eyes, a bright unworried expression and an alert gait, he has been well fed. But when an individual is very thin, or fat and flabby, without muscular tone, has a dry and rough skin, and an appearance of fatigue or hyper-irritability, he is ill fed or diseased.

Not only are there many degrees between these extremes, but a well-fed and healthy person may be thin and not alert, and an improperly-fed person may have ample adipose tissue and retain muscular tone.

Consequently it is difficult to give sound judgment from general appearances, and the conclusions of one inspector may be at variance with those of another; and slack and casual inspection is likely to be the result where the conclusions are made from indefinite signs.

Attempts have been made to determine the state of nutrition of school children by measuring and weighing them, and comparing their heights and weights with those given in standard tables. This method has been far from successful because some children are naturally tall and thin and others are short and stout. It is much better to use the measure and the scales at frequent intervals, and judge from gains or losses, but this requires time and is not always practicable.

Therefore any definite signs, or even symptoms, which are due to dietary deficiencies, will be of great value for the inspections of groups of persons.

In two recent papers (1933 and 1934) I have discussed the prevalence of two signs of dietary

(Continued from previous page)

distinction between individuals of different age groups; had the adult population only been taken into consideration in appraising the value of this measure it might have been acclaimed as a success. (But in the absence of any comparable controls even this would have been questionable.) As it is, it must be reported as a failure, but only a failure as far as the special circumstances are concerned, and these appear to have been such that failure was a foregone conclusion.—
EDITOR, I. M. G.]

deficiency namely phrynoderma and 'sore mouth' among school children, prisoners, and others in Ceylon. The former sign is due undoubtedly to vitamin-A deficiency, and probably the latter also is due to this deficiency, although there may be other factors. It is not surprising that the poorest classes of the teeming East should fail to obtain a sufficient quantity of vitamin A in seasons when green vegetables are scarce, because they cannot afford comestibles of animal origin which contain this vitamin.

The great value of these two signs for medical inspections has become well established in Ceylon, and are of special importance to school-inspecting medical officers.

The following four examples, selected from among others, will serve to illustrate this:—

Example I.—In an inland town there is situated a well-built school run by missionaries, and they receive and teach four classes of children—(1) orphans who are boarded; (2) day scholars of the poorest classes who are taught in the vernacular; (3) boarders who pay fees and are educated in English; and (4) day scholars who pay fees.

The orphans live apart from the paying boarders and receive a much inferior diet.

Table I shows the results of the inspection:—

TABLE I

	Number examined	SHOWING PHRYNODERMA		SHOWING 'SORE MOUTH'	
		Number	Per cent	Number	Per cent
Day paying scholars	58	5	8.6	8	13.7
Paying boarders ..	54	6	11.1	3	5.5
'Vernacular' day scholars ..	43	20	46.5	16	37.2
Boarded orphans ..	52	43	82.6	20	38.4

The degree of phrynoderma and 'sore mouth' in those children who paid fees was very slight, with the exception of three girls who had advanced phrynoderma, and two who also had 'sore mouth'. On enquiry into their circumstances it was discovered that they were sisters, and had lost their mother and were being 'cared for' by a guardian.

Example II.—An orphanage situated in a country district was inspected. When the inspection was finished, a visit was paid to a free vernacular school in the same district to enable a comparison to be made between the children