Reprinted from the BRITISH MEDICAL JOURNAL,
April 11, 1942, *vol. i, p.* 464

A NEW METHOD OF CONTROLLING THE HEAD LOUSE

BY

J. R. BUSVINE and P. A. BUXTON

Department of Entomology,
London School of Hygiene and Tropical Medicine

Mellanby (1941) has called attention to the high incidence of head lice, especially in girls, in large cities in England. Those who have had experience with children evacuated from cities or with young women in industry confirm his conclusions. Figures at our disposal accumulated at medical inspections indicate that in industrial areas in Britain the incidence in young women is about 30 to 50%.

The Problem

An essential point in the problem of control is that if the person lives among others who are infested it is of little use to cleanse the head, for it quickly becomes reinfested. Evidently what is needed is an insecticide which shall remain effective in the hair for as long as possible, so as to "proof" the individual; with such an insecticide one would have some hope of eliminating the insect from a large section of the community. If, on the other hand, a lousy person is admitted into clean surroundings (e.g., hospital or military service), all that is wanted is something that will destroy lice and also nits with certainty.

In treating a head it should be remembered that nearly all the unhatched eggs are close to the scalp, and that the lice must go to the skin for food. The insecticide must therefore cover the whole hairy scalp, but there is no need to saturate the hair at a distance from the head. In order to avoid an unpleasant appearance the volume of insecticide should be small.

Most of the substances commonly employed, such as paraffin, cresol solutions, sassafras, and alcohol, are volatile and therefore have no protective power. Moreover, it is doubtful whether they kill nits; and some of them, particularly paraffin, make the hair sticky and arouse opposition. As an admission of the ineffectiveness of these materials it is often recommended that after application the infested hair should be cut short or combed with a fine steel comb. We have ourselves recently tested both paraffin (kerosene) and phenol (1:40) on women on whom lice

as well as eggs were found. In each case a bathing-cap was worn for one hour after application. The results were as follows:

	No. of Cases	Failures (i.e., Living Lice or Nits)
Paraffin	12	..... 10 (83·3%)
Phenol	9	..... 7 (77·7%)

An Improved Method

We find that the following insecticides have great advantages over any others with which we are acquainted: (1) 25% technical lauryl thiocyanate in a white oil; (2) 50% lethane 384 special, in similar oil; (3) derris cream. (For specifications of these substances see below.) For any of these three the dose is 0.5 to 2 drachms (about 2 to 8 c.cm.) a head, the lowest dose sufficing for a child with short hair, the highest for a woman with long thick hair. The volume recommended is approximately that which people who apply brilliantine or hair oil generally use, so that the result is not unsightly, except on very fuzzy or very fair hair.

In applying these materials the hair should be parted by one hand and the liquid or cream put on the scalp itself with a teaspoon or pipette held in the other hand. This should be done on eight spots, four on each side; the material is then distributed by massaging with the fingers. It should not be distributed by combing, for that tends to draw the insecticide away from the scalp. The patient is instructed not to wash the head for ten days.

Advantages of the Method

1. The practical experiments are summarized in Table I. Some of the work was done by several different lady medical officers (R.A.M.C.) working in depots which admit girls into one of the uniformed Government Services. These ladies, whose careful help we acknowledge, did not know what drug they were using or in what concentration, so that their results are unprejudiced. On the other hand, they had many other things to do, and we think that some of their results are open to question, one difficulty being the recognition of live unhatched nits.

Table I shows that the three drugs, in the proportions recommended, are highly successful; failures *on those going into a clean environment* being generally under 2% and always under 10%. It also shows that if the concentrations of drug are reduced a considerable proportion of failures occur. The word "failure" is to be understood as meaning "incomplete kill," and if even only one live louse or egg is found up to the tenth day the case is recorded as a failure.

2. We know from laboratory experiments that all these three materials (in the dose and concentration stated above) remain effective on the hair for 8 to 9 days, provided the head is not washed; this is easily shown by taking hair clippings from a treated head at intervals, and putting lice to live on them in a rearing-box. The loss of activity after 8 or 9 days is believed to be due to insecticide rubbing off on the pillow, not to chemical change. The fact that with a single application one can "proof" a head for a period is likely to be of great value in civil life. Moreover, if the drug is not efficiently applied and a few eggs escape, the larvae hatching from them will almost certainly be killed as they move about the scalp.

TABLE I.—*Results of Trials of Head-Louse Insecticides*

Experimental Subjects	Insecticide	No. of Cases	Failures (%)
Recruits to Service "A" ..	25% lauryl thiocyanate	55	1·8
*Mediterranean evacuees ..	" " "	45	8·9
*Recruits to Service "B" ..	" " "	51	7·8
* " " " " ..	10% " "	18	39·0
* " " " " ..	4% " "	20	60·0
" " " "A" ..	50% lethane special	26	7·8
*Mediterranean evacuees ..	" "	13	15·4
* " " ..	Derris cream (1% rotenone)	12	8·3
Recruits to Service "A" ..	" " "	35	0
" " " " ..	Thin derris cream (1% rotenone)	187	1·1
" " " " ..	Thin derris cream (0·5% rotenone)	84	7·1

* These observations were made either by one of us, or by Miss I. Ledingham or Mr. A. C. Harvey, working for us. We know that the head was actually infested at the time the drug was put on (and many were specially chosen, as being very verminous), and a long and careful search on several days, up to the tenth, was made subsequently for live nits. For these reasons the results marked by asterisks are the most reliable.

3. Another advantage of these drugs is that small volumes are used, so that the hair does not appear to be very oily or greasy. We suggest that the thiocyanates might be introduced to the public as "medicated hair oil," and the derris cream as "medicated hair cream." We believe that under such names they would be very acceptable. Moreover, doctors and nurses (some of whom have had long experience of combing, oiling, and hair-clipping) comment favourably on the ease and convenience of the method. Several of the doctors who helped with the experiments have written and asked for further supplies and have passed the information to their friends.

The cost of the drugs is very low. A recent retail quotation for lethane special was 35s. per imperial gallon. This is enough for 2,200 heads, at a cost of under one-fifth of a penny a head. The cost of lauryl thiocyanate is rather higher. We have no information of the cost of the derris cream.

Objections and Disadvantages

1. The two thiocyanates (and to some extent the derris cream) have slight but disagreeable odours, easily masked by the addition of 2% of oil of citronella or oil of bay, etc. We have, however, often used them on our own heads without essential oils and without arousing comment from our colleagues or families.

2. The question of possible danger to man has been carefully gone into. It is certainly true that thiocyanates and emulsions containing rotenone may under certain circumstances cause dermatitis if applied to the bare skin of some individuals. In head application most of the drug is taken up by the hair, so that the dose actually on the skin is small and, in our experience, harmless. For a full study of the toxicity of these thiocyanates to mammals see Cameron, Doniger, and Hughes (1939). We admit that we use a considerably higher concentration (25%) than these authors regard as safe, mainly in order to prolong the period during which the drug remains effective in the hair. After preliminary experiments on ourselves and our colleagues we have applied this concentration to about 200 heads without any ill effects or discomfort. As to our derris cream, we have applied it in all to 250 heads and patch-tested it on the arms of 90 volunteers, and seen no symptoms of any sort. Prof. G. R. Cameron has been so good as to test it by putting very large quantities on the hair of rabbits and goats: he reports that a month later the animals were in good health. Emulsions of rotenone, or other substances derived from derris, may cause dermatitis, especially on the skin of the scrotum, and we do not recommend the derris cream or the thiocyanates for that part of the body. It is probable that there may be individuals (we have found none) who are particularly sensitive to one or other of these drugs, even if correctly applied to the scalp, just as others are intolerant of quinine, aspirin, etc.

3. We recommend that the head should not be washed for 7 to 10 days, and exception has been taken to this on the ground that one ought to emphasize the importance of cleanliness. None the less, in our experience it is better to leave the head unwashed for this period, probably because of the difficulty of ensuring that all parts of the scalp are treated. The alternative is to use a larger bulk of insecticide, which can be relied on to touch all parts but which looks very oily and unpleasant. With the derris cream it is probably even more important not to wash it off, because its effect on the louse is slow and because it probably does not kill nits.

A Field Experiment

One particular experiment, of which the facts are given in Table I, is worth fuller description, because the conditions were so difficult. There are certain hostels in London full of refugees from a Mediterranean country. The children and the mothers are heavily infested with head lice, and appear to regard these parasites as normal. The mothers refuse to be touched, and the nurses have been cleaning up the children's heads for many months without making any lasting impression. Miss I. Ledingham was good enough to give up nearly two months to treating these children and following them up. The work was rendered especially difficult by the lack of co-operation from the children's parents. Many washed off the insecticide at once and others prevented the children going for reinspection;

indeed, one mother was actually caught reinfesting her child's head with fresh lice "for good luck." For all these reasons it was possible to follow up only a portion of the hundred-odd cases treated; the results available are set out in Table II. Considering the great possibilities of rapid reinfestation, these figures are very satisfactory.

TABLE II.—*Reinfestation after Treatment (Mediterranean Evacuees)*

Insecticide	Failures at Different Periods after Treatment (%)			
	3–7 Days	10–14 Days	16–22 Days	25–32 Days
25% lauryl thiocyanate in white oil	4·4 (68)	8·9 (45)	25·8 (31)	33·3 (15)
10% „ „ „	0 (19)	37·5 (13)	—	—

Figures in brackets are the number of cases inspected in different periods.

Specifications

The specifications of the above drugs are as follows:

Lauryl Thiocyanate (dodecyl thiocyanate; lauryl rhodanate).—This substance is made only by Messrs. du Pont de Nemours at Wilmington, Delaware, U.S.A., and is obtainable in Britain through Imperial Chemical Industries, Ltd. The quality available is "technical," and is marketed in America as "lorol rhodanate." This technical grade contains 60% lauryl thiocyanate and 40% of certain homologues, some of which would be harmful to man if considerable proportions were present. This risk is greatly reduced by specifying that the thiocyanate was manufactured from lauryl alcohol which began to distil at or above 236° C. (atmospheric pressure) and of which 95% distilled below 319° C. The white oil which we have used as a diluent is a high-boiling paraffin (I.B.P. 325° C.), with a very low aromatic content, sold by the Shell Company as P31. We have reason for thinking that any refined oil of this type would be suitable.

Lethane 384 Special (12.5% N-butyl carbitol thiocyanate; 37.5% beta-thiocyanoethyl laurate; 50% refined paraffin).—Produced by Messrs. Rohm and Haas of Philadelphia, U.S.A., and obtainable in Britain through Messrs. C. Lennig, Windsor House, Victoria Street, London, S.W.1. It is to be noted that the material is sold in 50% dilution. We dilute it a further 50%, giving a final 25% concentration of the effective drugs. We have used the same oil as already mentioned.

Derris Cream.—This is made up for us by Messrs. Cooper, McDougall and Robertson of Berkhamsted. The cream we have used has been a solution of derris extract in castor oil, the whole emulsified suitably to make a cream containing 1% of rotenone and 7% of derris extract. In our samples the emulsifying agent was lanette wax, but there are other similar materials which might be equally effective.

REFERENCES

Cameron, G. R., Doniger, C. R., and Hughes, A. W. McK. (1939). *J. Path. Bact.*, **49**, 363.
Mellanby, K. (1941). *Med. Off.*, **65**, 39.

Printed in Great Britain by Fisher, Knight and Co., Ltd.,
The Gainsborough Press, St. Albans.