

vitamin B₁₂ than the control foetuses, showing that vitamin-B₁₂ deficiency in the mother may seriously affect the vitamin-B₁₂ stores of the foetus. It seems probable, therefore, that infants born of vitamin-B₁₂-deficient mothers will start life with defective body stores of this vitamin, even though cord blood levels may not be very low.

As was to be expected the levels in the breast milk followed closely the serum levels. Therefore if vitamin-B₁₂ deficiency in the mother persists the breast-fed child will have a lower intake of vitamin B₁₂ than children suckled by normal mothers.

The daily requirements of the infant for vitamin B₁₂ are not known. However, if the daily requirement of an adult weighing 50 kg. is taken at 1 µg. a day, the requirement of a baby weighing 3 kg. will, on a weight-for-weight basis, be approximately 60 mµg. a day. If the normal quantity of breast milk secreted in 24 hours is taken as 500 ml., then in order to supply the infant's needs the minimum concentration of vitamin B₁₂ in the breast milk should be in the region of 120 µµg./ml., and anything below this concentration may lead ultimately to vitamin-B₁₂ deficiency. When this defective vitamin-B₁₂ intake is coupled with low body vitamin-B₁₂ stores, then the infant may develop an overt vitamin-B₁₂ deficiency, with megaloblastic anaemia and neurological changes (Jahdav *et al.*, 1962). It may therefore be wise to treat all children born of vitamin-B₁₂-deficient mothers with prophylactic parenteral vitamin B₁₂.

Animals deficient in vitamin B₁₂ may give birth to young with skeletal and other abnormalities (O'Dell *et al.*, 1951; Grainger *et al.*, 1954). No such abnormalities were seen in the seven live children in this series, and macroscopic dissection of the two stillborn foetuses did not reveal any abnormality. It is not known whether the vitamin-B₁₂ deficiency played any part in the foetal death *in utero* and premature delivery in Cases 8 and 9.

Summary

Seven women with tropical malabsorption syndrome who had megaloblastic anaemia of pregnancy associated with vitamin-B₁₂ deficiency were investigated, together with their babies.

The women had a moderate to severe anaemia and low serum-vitamin-B₁₂ levels. Breast milk vitamin-B₁₂ levels in the puerperium were similar to serum-vitamin-B₁₂ levels. The babies had no anaemia, and had much higher serum-vitamin-B₁₂ levels than their mothers. One baby had "intermediate" megaloblasts in its bone-marrow.

The accumulation of vitamin B₁₂ in foetal livers was studied. This reached a maximum of 20 to 25 µg. of total liver vitamin B₁₂ at birth. Two stillborn foetuses from vitamin-B₁₂-deficient mothers had greatly reduced liver vitamin-B₁₂ stores.

Babies born of and suckled by vitamin-B₁₂-deficient mothers may have lower body vitamin-B₁₂ stores, may receive less vitamin B₁₂ in breast-milk feeds, and may be in danger of developing frank vitamin-B₁₂ deficiency.

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ANCYLOSTOMIASIS IN ENGLAND

BY

G. A. H. MILLER, M.A., B.M., B.Sc., M.R.C.P.
Medical Registrar, St. Thomas's Hospital, London

AND

J. BAMFORTH, M.B., M.R.C.P.
Medical Registrar, St. Thomas's Hospital, London

The arrival in England of large numbers of immigrants from tropical countries where hookworm infection is widespread prompted a study of such infections in this country. The occurrence of severe anaemia due to hookworm infection in several in-patients of this hospital further stimulated interest in the incidence of symptoms in this condition.

The study is divided into two parts. In the first part the incidence of hookworm infection in 99 apparently healthy immigrants selected for employment in a large London organization was ascertained by examination of their stools; the presence of eosinophilia and anaemia in these subjects was also recorded. The second part consisted of the analysis of the symptoms and effects of hookworm infection in cases diagnosed at this hospital.

Method.—Stool specimens were examined by the zinc sulphate flotation method (Otto *et al.*, 1941) within 12 hours of being passed, after being stored as soon as possible at 0° C. Two 7/8-in. (22-mm.) square coverslip preparations were scanned under the 16-mm. objective, and suspicious objects were examined under the 4-mm. objective. The haemoglobin level and the total and differential white-cell counts were estimated in all subjects. Occult blood was examined by the haematest

method without prior preparation. A haemoglobin of less than 10.7 g./100 ml. and an eosinophil count of more than 500/c.mm. were regarded as significant.

Results

Group 1.—The stools of 99 immigrants entering employment in a large London organization were examined. The stools of 13 were found to contain the ova of *Ancylostoma duodenale*. (*Ancylostoma duodenale* and *Necator americanus* cannot be distinguished from the appearances of their ova.) Of these 13 subjects, two had a significant anaemia (9.5 and 10.2 g./100 ml.).

Group 2.—This group consists of 34 cases of hookworm infection diagnosed at St. Thomas's Hospital during the past five years. The majority of the cases (28) were diagnosed during the period of this study when most immigrants coming to the hospital were examined by us, and a few (6) were obtained from the hospital records. They are classified as follows: 14 cases with symptoms caused by hookworm infection—anaemia 7 (5 males, 2 females), abdominal pains 12 (anaemia + abdominal pains 5)—and 20 cases with symptoms from other causes and not related to hookworm infection—for example, duodenal ulcer, pregnancy, pericarditis, sickle-cell anaemia, urinary infection, schistosomiasis, etc. In 7 of the 12 cases with abdominal pains attributable to ancylostoma infection the barium-meal findings were normal. (Barium-meal investigations were not performed in the other five cases.)

Group 1 Cases with Ancylostoma Infection (13 Cases) and Group 2 (34 Cases) Combined.—The incidence of eosinophilia was 38% (17 out of 47) and of occult bleeding 26% (12 out of 47). The length of stay in Great Britain was under one year in 25 cases, two years in 4, three years in 5, four years in 3, five years in 5, six years in 4. It was unknown in 1 case.

Discussion

It is obvious that a proportion of immigrants arriving in Britain from tropical countries where hookworm infection is endemic will be carrying the parasites, and this investigation is an attempt to estimate the frequency and importance of this infection.

The problem of helminth infection among U.S. Service men returning from the second world war has been studied (Kuntz, 1959), and Weil (1953) reported cases of hookworm infection among Puerto Ricans in New York. In this country MacLean (1958) examined the stools of 21 coloured workers seeking employment with the Metropolitan Water Board and found 6 (28%) of them to be excreting ancylostoma ova. This investigation was extended by E. Windle Taylor (personal communication, 1961) by an examination of another 56 West Indians, of whom 31 (55%) were found to be excreting ancylostoma ova. Apart from the outbreak of ancylostomiasis among Cornish tin-miners studied by Boycott and Haldane (1903) there have been few other reports of cases in Great Britain.

As immigrants from the West Indies have been arriving in this country in large numbers (153,000 in 1955–60) the incidence of ancylostoma infection in 13% of unselected cases which we report suggests that a large number of persons in Great Britain are now harbouring these parasites. It is therefore important to assess the likely effects of the infection in this section of the

population. From the public health point of view, ancylostoma infection is not an important problem, as spread of the infection in this climate is prevented by the failure of the ova to mature to the larval stage. The duration of the infection in conditions where reinfection is impossible is limited, and none of the 47 infected persons had been in Great Britain for more than six years. The persistence of an experimental infection lasting 15 years has been recorded (Palmer, 1955), and our results show that infection may persist for at least five years. It is evident that only a small proportion of subjects excreting ancylostoma ova have symptoms attributable to the presence of the parasites. Thus of the 13 cases discovered in group 1 none had any symptoms, though two were mildly anaemic, and of the 34 cases in group 2 only 14 had symptoms attributable to ancylostoma infection.

Anaemia is the cause of the most severe symptoms attributable to the disease, and may be gross enough to lead to congestive cardiac failure in an otherwise healthy person (two of the group 2 cases). Abdominal pain simulating peptic ulceration is a well-recognized symptom of ancylostoma infection, and radiological changes associated with hookworm duodenitis have been described (Leslie and Tovey, 1955). The fact that 12 of the 34 cases in group 2 presented with abdominal pains attributable to ancylostoma infection emphasizes the importance of considering this disease not only in immigrants with anaemia but also in those with abdominal pain.

Summary

Cases of ancylostoma infection diagnosed at St. Thomas's Hospital are discussed, and a survey of apparently healthy immigrants is reported.

It is suggested that ancylostoma infection is becoming more common in this country because of immigration and should be borne in mind in immigrants with anaemia and in immigrants presenting with vague abdominal pains.

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