

Mr. R. M. Titmuss has kindly assisted us with these calculations, and considers we are justified in giving a rough estimate that the number of living people in England and Wales who have suffered from peptic ulcer is around 1,500,000 and may even be higher. We do not wish to stress these figures except to indicate that peptic ulcer seems to be an appreciable problem in this country.

### Peptic Ulcer: A Modern Industrial Problem

Unfortunately many cases of peptic ulcer relapse, and the majority of those who have had ulcers have to follow simple rules to avoid further symptoms—e.g., regular meals with balanced diet, avoidance of common indigestible foods, avoidance of undue fatigue, and maintenance of a calm philosophical outlook on life. It is a problem which mainly confronts men during their working life and often when at their prime. Although peptic ulcer does not cause heavy loss of life (little more than 1% of non-violent deaths) it results in much suffering and incapacity for work. The ulcer subject has "guts" even if they are weak ones, and he does not give in easily. The man with a duodenal ulcer is usually of special value to industry, for he is over-conscientious, with plenty of drive and a sense of good standards of work.

The magnitude of the problem demands further study of those factors in modern industrial life which favour peptic ulcer.

### Summary

An analysis in given of all patients with digestive trouble coming to a large general hospital in Greater London. Of 1,522 patients, 952 were found to have peptic ulcer.

The ratio of women to men with peptic ulcer was 1:4.7.

The ratio of gastric to duodenal ulcer was 1:2.5. This is higher than in previous London series.

The ratios of previous series are considered and possible causes for discrepancies discussed. An important factor is the exclusion of out-patients in most series, for patients with duodenal ulcer probably have less chance of hospital admission than those with gastric ulcer.

The ratio of gastric and duodenal ulcer in Service series is found to be equivalent to the figure for males under 45 in the present civilian series.

Calculations suggest there are about 1,500,000 living people in England and Wales who have suffered from peptic ulcer.

Thanks are due to Miss C. F. Harris, our dietitian, who has kept a careful record of all in-patient and out-patient diagnoses. We are also grateful to Mr. R. M. Titmuss for statistical advice.

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Increased standard rates of pay and improved conditions of service for mental nurses in Scotland are among the recommendations by the Scottish Nurses' Salaries Committee to the Secretary of State, who commends them for adoption by hospitals in a circular issued by the Department of Health for Scotland. The Taylor Committee has been dealing during the last three years with nurses' salaries and has still to submit its complete report, but puts forward to the Secretary of State a summary of the points on which agreement has been reached up to date. The present recommendations will apply from April 1, 1945. The scales awarded are broadly similar to those recommended last year by the Rushcliffe Committee for mental nurses in England and Wales.

## NUTRITIONAL MACROCYTIC ANAEMIA AND THE ANIMAL PROTEIN OF DIET

BY

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The incidence of anaemia, especially of nutritional macrocytic anaemia, in relation to the animal protein content of the diet is of interest in countries such as India, where most of the population live on barely adequate or frankly inadequate diets. During war and post-war periods, when nutritional anaemias are probably more widespread, the subject becomes of world-wide importance.

The study of the incidence, type, and severity of cases of anaemia in relation to the diets of a population affords some evidence of the inadequacy of such diets. This note is based on 50 consecutive unselected cases of anaemia seen between May 1 and Sept. 15, 1944, studied from this point of view. They occurred among a population of adult male Indians (17,000 meat-eaters and 1,188 vegetarians), all the sick of which were admitted into one hospital. The men had been on known rations for over two years. The men and their quarters were medically inspected regularly. The locality was a desert and the climate was extremely hot in summer. The hospital admission rate was the low one of 1.5 per 1,000 per day. There was practically no fresh malaria and the dysentery rate was very low. All cases with red blood counts of under four million cells per c.mm. or corresponding haemoglobin of under 11.6 g. were investigated, with the exception of cases admitted for obvious pulmonary tuberculosis. This arbitrary standard was adopted to exclude borderline cases.

The following normal ranges for absolute values, suggested for general use in India by Napier and Das Gupta (1942), were adopted for analysis of this series: mean corpuscular haemoglobin (M.C.H.) of 24 to 33 micromicrograms ( $\gamma\gamma$ ), mean corpuscular haemoglobin concentration (M.C.H.C.) of 30 to 35%, and mean corpuscular volume (M.C.V.) of 80 to 100 cubic microns (c. $\mu$ ).

Examinations were carried out on oxalated venous blood. The standardized Sahli haemoglobinometer was used. Stool and urine examinations, test-meal, sedimentation rate, Kahn test, and skiagrams of the chest were carried out, in addition to a full clinical examination, in all cases. The first blood examination figures, after admission, and the results of other investigations, are shown in Table I.

All 50 cases, except one, had complicating factors (Table II). An analysis of the 50 cases according to age, occupation, race, and living conditions failed to bring out any differences; but it was found that 27 of them were lifelong vegetarians, 2 were temporary vegetarians, and 21 meat-eaters. The vegetarians had never taken meat or eggs. The vegetarians and meat-eaters were fed from the same kitchens. They were equally exposed to malaria, hookworm, and other diseases. No difference in general body development was seen in the two groups. The two temporary vegetarians suffered from dyspepsia and undulant fever. The dyspeptic patient had omitted meat from his diet for six months. The undulant fever case had lived on a hospital milk diet without meat or eggs for two months.

It was possible to check with some accuracy what was eaten. The daily rations were: 18 oz. of atta (wheat flour) or rice, 2½ oz. of dhal (pulses), 3¼ oz. of ghee (clarified butter or vegetable oil), 2/3 oz. of condiments, 2 oz. of onions, 2 oz. of potatoes, 4 oz. of fresh vegetables, and 6 oz. of fresh mutton with bone, for five days in a week. Leafy vegetables were issued for only a few months of the year. The vitamin A content of the diet was also known to be low. In lieu of fresh meat vegetarians were allowed 4½ oz. of tinned milk three days a week, and 3/4 oz. of ghee and 3 oz. of atta or rice for two days a week. This amounted in practice to one tin of unsweetened milk containing 13 fluid oz., equivalent to 26 oz. of

fresh milk, each week. But of 27 vegetarians with anaemia only 11 had received milk in lieu of meat. No one had bought any extra milk from canteens or elsewhere. The meat ration of 6 oz. of fresh mutton with bone for five days a week amounted to 4 oz. without bone. This was checked in local carcasses. Therefore, 20 oz. of fresh mutton without bone

It was found that (a) 17 out of the 20 normo-microcytic group were meat-eaters, and (b) 26 out of 30 of the macrocytic group were vegetarians. The remaining 4 were meat-eaters and cases of sprue.

TABLE I.—Results of Blood Examination in 50 Cases of Anaemia

Case No.	R.B.C. (mills.)	Hb (g.)	M.C.H. (γγ)	M.C.H.C. (%)	M.C.V. (c.μ)
<b>Vegetarians:</b>					
3	2.0	7.28	36.4	29.03	125.3
4	3.55	12.6	35.4	28.8	122.8
5	1.25	4.9	31.5	28.6	109.0
6	1.2	4.7	39.1	36.1	108.3
7	4.0	9.05	22.6	24.46	92.2
8	2.8	12.4	44.2	32.6	135.0
9	1.7	6.35	37.3	31.7	117.6
11	1.9	6.69	39.2	30.4	115.8
13	1.8	6.35	35.2	28.8	122.2
16	1.4	5.85	41.7	31.6	132.0
17	2.5	8.3	33.2	31.9	104.0
20	3.2	13.0	41.2	33.3	121.8
22	3.4	6.2	18.2	20.0	91.1
23	3.5	10.5	30.0	32.8	91.4
24	1.08	4.46	41.2	37.1	111.0
25	1.5	5.85	39.0	30.7	126.6
26	3.0	11.7	39.0	36.56	106.6
27	2.4	8.3	34.5	26.7	129.1
32	3.1	9.92	32.0	26.1	122.6
35	3.75	12.6	33.6	28.88	116.2
36	1.8	7.0	38.8	30.5	127.1
39	2.7	12.2	40.5	38.1	118.5
40	3.0	9.9	33.0	30.0	110.0
41	3.7	9.65	26.08	26.08	100.0
43	3.7	13.02	35.1	36.2	114.8
50	4.15	10.3	24.8	21.4	115.5
<b>Temporary vegetarians:</b>					
29	1.8	6.45	35.8	30.7	116.6
14	2.1	6.72	32.0	26.88	119.0
<b>Meat-eaters:</b>					
1	4.2	9.6	22.8	24.0	95.2
2	4.3	9.1	21.1	21.4	98.8
10	3.0	4.96	16.5	21.5	76.6
12	4.2	9.3	22.1	28.4	77.8
15	4.7	8.7	18.5	20.9	88.2
18	4.3	9.3	21.6	24.4	80.8
19	3.8	8.0	21.05	24.2	86.8
21	4.2	9.5	22.6	26.3	85.7
28	3.8	6.8	17.8	21.2	84.2
30	4.3	9.9	23.02	24.7	93.0
31	4.0	7.45	18.6	21.3	92.5
34	4.2	7.95	18.9	22.8	82.8
37	3.8	8.55	22.5	25.3	88.6
38	4.8	9.3	19.3	21.1	91.6
42	5.5	10.5	19.9	22.8	83.63
47	4.9	9.1	18.5	24.5	75.6
49	4.25	10.92	25.6	27.0	94.8
<b>Sprue—vegetarians:</b>					
46	2.1	7.7	36.6	30.8	119.04
<b>Sprue—meat-eaters:</b>					
33	2.0	7.95	39.7	33.1	120.0
44	2.7	9.1	33.7	25.2	133.0
45	1.9	7.0	36.8	30.5	120.4
48	2.0	8.68	43.4	29.4	147.1

weekly was the main difference in the diets of vegetarians and meat-eaters, although 11 vegetarians had been drinking one tin of milk weekly. Excluding milk and meat rations, the diet

Aetiologically, as a low M.C.H.C. is accepted as indicating iron deficiency, and a high M.C.V. or macrocytosis as usually indicating a haemopoietic-principle (or principles) deficiency, the cases can be classified as: (i) Iron-deficient normo-microcytic cases consisting of 17 meat-eaters and 3 vegetarians. Sixteen were infested with hookworm, three had malaria, and one was a case of idiopathic hypochromic anaemia. (ii) Haemopoietic-principle deficiency macrocytic cases, consisting of 24 cases of nutritional macrocytic anaemia (all vegetarians), 5 cases of sprue, and 1 case associated with undulant fever. Nine of the nutritional macrocytic cases were "dimorphic" (see later). Thus there were two main groups—17 meat-eaters who had iron-deficiency (low M.C.H.C.) hypochromic anaemia, and 24 vegetarians with nutritional macrocytic anaemia. These significant facts are examined later in relation to the numbers of the population from which the cases were admitted.

Before this investigation there was a clinical impression that severe anaemia was associated with vegetarianism in this Indian population. To test this impression the cases were analysed according to severity. Severe anaemia was arbitrarily defined as one with a red cell count of two millions or below, or a haemoglobin of 5.8 g. (which is comparative to this R.B.C. level) or below. It was found that, whereas there was only one case (No. 10) of severe anaemia in the iron-deficiency group of 17 meat-eaters, there were 11 cases of severe anaemia in the 24 vegetarians with nutritional macrocytic anaemia. Three of the five sprue cases had also a severe anaemia. The only severe anaemia seen among the meat-eaters (excluding sprue cases) was not clinically serious. But the majority of the severe cases among the vegetarians were obviously seriously ill on admission to hospital.

**Incidence**

In view of the contrast in type and severity of anaemia shown by the vegetarian and the meat-eating patients in this series, the incidence was examined according to diet. It was found that in 4½ months 17 cases of anaemia came from the group of 17,000 meat-eaters and 26 from the 1,188 lifelong vegetarians—a rate of 2.6 per 1,000 per year for meat-eaters and 58.5 per 1,000 per year for vegetarians. Anaemia associated with sprue and undulant fever was excluded from the incidence analysis for the reason that the anaemia occurred during the course of another serious illness. The 24 cases of nutritional macrocytic anaemia came from the vegetarians—a rate of 54.1 per 1,000 per year. Not a single case came from the meat-eaters. Of the 20 cases of iron-deficiency anaemia 17 came from the meat-eaters and the remaining 3 from the vegetarians. Nine of the nutritional macrocytic cases also had iron deficiency (low M.C.H.C.), so that the incidence of iron deficiency was 10 times greater in vegetarians than in meat-eaters.

Severe anaemia as already defined occurred at a rate of 24.7 per 1,000 per year in the vegetarian group and 0.16 per 1,000 in the meat-eaters.

It would be of interest to compare these results with the incidence in areas where malaria and dysentery are rife.

**Some Clinical and Haematological Features**

1. The iron-deficiency group of 20 cases was mainly a mild normocytic-microcytic hypochromic anaemia. The red cell counts in the group varied between 3,000,000 and 5,500,000 (Hb only 10.5 g. in the latter case). The haemoglobin varied between 4.96 and 10.9 g. The 4 cases in this group which were not infested with hookworms were associated with malaria in three instances, and the fourth was an idiopathic hypochromic anaemia.

2. The 30 macrocytic anaemias were classified into 24 cases of nutritional macrocytic anaemia, 5 cases caused by sprue, and 1 case associated with undulant fever. In the 24 nutritional macrocytic cases the blood picture, as shown in Table I, was varied. The lowest red cell count was 1,080,000 and the lowest haemoglobin 4.46 g. Clinically, out of 11 severe cases 7 were seriously ill and were confined to bed. Others, though suffering from advanced anaemia, had few complaints. It was of

contained over 3,000 calories and over 80 g. of vegetable protein. The diet is emphasized because the anaemia, in its type and severity, was closely and regularly related to the diet consumed.

**Classification**

Haematologically, the cases grouped themselves as follows: Normocytic-orthochromic, 2; normocytic-hypochromic, 15; microcytic-hypochromic, 3; macrocytic-hyperchromic, 25; macrocytic-orthochromic, 4; and macrocytic-hypochromic, 1.

TABLE II.—Complicating Factors

Disease	Meat-eaters	Vegetarians	Temporary Vegetarians	Sprue
Hookworm	14	12	—	2
Roundworm	—	1	—	—
Tapeworm	—	1	—	—
Malaria	9	14	—	2
Bacillary dysentery	—	9	—	—
Amoebic dysentery	—	1	—	—
Amoebic hepatitis	1	1	—	—
Infective hepatitis	—	1	—	—
Syphilis	—	1	1	—
Active tuberculosis (closed)	1	1	—	—
Suspicious skiagrams of lungs	4	3	—	—
Dyspepsia	—	—	1	—
Undulant fever	—	—	1	—

interest to note that men with red cell counts below two millions were doing full duties before admission. Though every one of these 24 cases had a complicating factor, which was irregularly distributed, the incidence of such factors was not higher than in the remaining 26 cases, except that bacillary dysentery or its history was present in 9 cases and not in the anaemia of other groups. But each case occurred in a vegetarian, and, what is more, not a single meat-eater of the 17,000 had developed this type of anaemia. Vegetarianism was thus thought to be the principal cause of nutritional macrocytic anaemia in this series. It is not, however, the purpose of this note to discuss what is present in the meat ration which prevents the occurrence of macrocytic anaemia.

One case showed how quickly a severe nutritional macrocytic anaemia may develop. A champion wrestler—a vegetarian—had had excellent rations, with four extra tins of milk weekly, and plentiful fruit and vegetables, as he lived in a fertile part of the country. He was transferred to the desert, where his ration contained little or no fruit and vegetables, and no milk. After three months of this diet he developed a severe macrocytic anaemia with a red cell count of 1,250,000 and Hb of 4.9 g.

In the 5 cases of sprue anaemia there was nothing of particular note.

The patient with severe undulant fever developed macrocytic anaemia after two months in hospital. In health he was a meat-eater, but in hospital was given a milk diet without eggs. There was no clinical anaemia on admission, but after two months' fever he looked very pale, which led to a full blood investigation, with the following results: R.B.C., 2,100,000; Hb, 6.72 g.; M.C.H., 31.5  $\gamma\gamma$ ; M.C.H.C., 26.28%; M.C.V., 119.0 c. $\mu$ . The sternal marrow differential count showed 7.75% megaloblasts, 14% erythroblasts, 27% macroblasts, and 18% normoblasts. No other anaemia-producing factors were present. The blood picture in this case was of interest because undulant fever usually produces a microcytic anaemia, the macrocytic form being rare. The anaemia usually is not severe. Strong (1942) says: "The lowest recorded count by Basset-Smith was 2,500,000, and by Kern 2,800,000."

3. That 9 of these 24 macrocytic cases had an M.C.H.C. below 30% was of interest. Four were infested with hookworms. Two had achlorhydria, but free acid returned as anaemia disappeared. In the remaining three the iron deficiency appeared to be purely dietetic in origin. These 9 cases were similar to the "dimorphic" group recently emphasized by Trowell.

4. Koilonychia occurred in 7 cases (Table III). There was a low M.C.H.C. in all except one. Five cases had hookworm infestation. In one of these there was achlorhydria. The case with a normal M.C.H.C. (30.5%) had an M.C.V. of 127 c. $\mu$ .

5. Test meals gave the following abnormal results. Achlorhydria was present in 7 nutritional macrocytic anaemias and 5 iron-deficiency anaemias on the first examination. Acid was later found in four of the former group and two of the latter. Histamine was not available.

6. The results of the examination of the lips, buccal mucous membrane, tongue, and eyes have been tabulated. Cheilitis and angular stomatitis were common, but exact records were not kept in the earlier cases. Sublingual glossitis was a condition in which the under surface and sides of the tongue were very red and tender, and, in some, large red papules were present.

TABLE III.—Findings in Mouth, Eyes, and Nails

Disease	Meat-eaters	Vegetarians	Temporary Vegetarians	Sprue
Generalized glossitis .. ..	—	8	—	5
Geographical tongue .. ..	2	4	—	—
Sublingual glossitis .. ..	4	4	—	—
Enlarged numerous fungiform papillae	11	16	—	2
Koilonychia .. ..	5	2	—	—
Bitot's spots (xerophthalmia) ..	—	2	—	—

### Conclusions

A full blood investigation of 50 consecutive cases of anaemia in Indian men in an extreme desert climate, where there was a low sickness rate (about 1.5 per 1,000 per day), showed that the

admission rate to hospital for anaemia per 1,000 of population among vegetarians was 22 times greater than among meat-eaters. The incidence of severe anaemia was very much greater in vegetarians than in meat-eaters in this series.

The anaemia differed in type and severity in the two groups, being mainly macrocytic in the vegetarians (nutritional or tropical macrocytic anaemia) and hypochromic and either normocytic or slightly microcytic in the meat-eating group. No case of nutritional macrocytic anaemia was seen in a meat-eater.

In all cases except one a complicating factor was found, hookworm and malaria being most frequent.

The difference in the habits of the two groups, which were otherwise alike, was that social customs prevented the vegetarian group from eating the weekly ration of 20 oz. of fresh mutton in the meat-eaters' ration. The absence of this meat appeared to be the cause of macrocytosis and severity and frequency of anaemia in the vegetarian group. The rations contained over 3,000 calories and over 80 g. of vegetable protein. Riboflavin and vitamin A were known to be low.

It will be of interest to compare these results with findings when the stress of severe frequent malarial infection and dysentery is great.

One case showed that a severe macrocytic anaemia may develop within three months if milk, fresh fruit, and vegetables are much reduced in a vegetarian diet. Another case in which severe macrocytic anaemia developed during a prolonged fever (undulant fever) showed the need of liver and iron in the diet in cases of chronic illness.

### Summary

The incidence, type, and severity of anaemia in an Indian adult male population of about 18,000 were shown to depend on the meat content of the diet. Nutritional macrocytic anaemia occurred only in vegetarians in a series of 50 cases.

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## THE DIAGNOSIS OF DOUBTFULLY PENETRATING ABDOMINAL WOUNDS A LESSER OPERATIVE PROCEDURE

BY

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A diagnostic procedure for doubtfully penetrating abdominal wounds, introduced by me in the Desert Campaign and thereafter often referred to among field surgeons as my test, has recently (Rogers, 1944) been designated, not unkindly but with some lack of euphony, "Donald's explorotomy." Rogers mentions the test as if it were generally known, and does not elaborate it. Lest other references should appear I feel it advisable to put a description on record; otherwise the implications and limitations may not be understood. The circumstances attending its origin are not without interest.

In the casualty clearing stations behind El Alamein there was great congestion of casualties for the first week or so of the battle. Only first priority cases could be operated upon; all else had to travel on to the base hospitals, not far away in distance but a fair way in time. The first priority cases were numerous enough to overwork the surgeons, and among abdominal cases there had to be a discrimination as to who were worth operating upon and who were not, to an extent that I have not seen repeated.

Most penetrating wounds of the abdomen are easily diagnosed. With experience on the part of the surgeon the proportion of doubtful penetrations, usually with wounds of entrance at a distance, becomes less. But till that experience is gained, and after then in lesser degree, there are cases in which doubt remains and precious hours are allowed to pass in waiting for more signs. The alternative is an exploratory laparotomy. When severe casualties are waiting their turn in large numbers, as at El Alamein, it is galling to do a negative