The frequency of three pre-natal events—namely, direct foetal irradiation, virus infections and threatened abortion—was significantly higher among the dead children than among the live children.

One other pre-natal influence—namely, excessive maternal age—appears to increase the risk of leukaemia in childhood and to be related to the fact that this disease and mongolism tend to occur together.

The frequency of three post-natal events—namely, *x*-ray exposures in infancy, acute pulmonary infections and severe injuries—was significantly higher for children who subsequently died of leukaemia than for other children. In the "pre-antibiotic era" some of these children might have died before showing signs of the leukaemia.

The health of the mothers and the home background of the children were not significantly different in the two groups, but there were minor points of difference in the family histories of cancer and leukaemia.

Our final conclusions are that foetal irradiation does not account for the recent increase in childhood malignancies, but the finding of a case excess for this event does underline the need to use minimum doses for essential medical *x*-ray examinations and treatments.

A survey on the scale achieved could never have been contemplated without the active co-operation of doctors and health visitors too numerous to mention by name. Principal medical officers of health of local authority areas assumed responsibility for the field work of the investigation and completed the whole of their arduous and self-imposed task in the short space of 18 months. The interviews were done either by principal or by assistant medical officers of health, and health visitors did invaluable work in tracing cases and controls. We record with gratitude the high standard of the work in all regions.

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REFERENCES

Bell, J. (1940). *Ann. Eugen. (Lond.)*, **10**, 370.
Carter, C. O. (1956). *Brit. med. J.*, **2**, 993.
Court-Brown, W. M., and Doll, R. (1957). *Spec. Rep. med. Res. Coun. (Lond.)*, No. 295. H.M.S.O., London.
Faber, M. (1957). "Radiation-induced Leukaemia in Denmark" in *Advances in Radiobiology*. Oliver and Boyd, London.
Hewitt, D. (1955). *Brit. J. prev. soc. Med.*, **9**, 81.
Kriviť, W., and Good, R. A. (1956). *A.M.A. Amer. J. Dis. Child.*, **91**, 218.
Logan, W. P. D., and Brooke, E. M. (1957). *The Survey of Sickness, 1943-1952*. General Register Office Studies on Medical and Population Subjects, No. 12. H.M.S.O., London.
McKenzie, A., Case, R. A. M., and Pearson, J. T. (1957). *Cancer Statistics for England and Wales 1901-1955*. General Register Office Studies on Medical and Population Subjects, No. 13. H.M.S.O., London.
Malpas, P. (1937). *J. Obstet. Gynaec. Brit. Emp.*, **44**, 434.
Manning, M. D., and Carroll, B. E. (1957). *J. nat. Cancer Inst.*, **19**, 1087.
Merrit, D. H., and Harris, J. S. (1956). *A.M.A. Amer. J. Dis. Child.*, **92**, 41.
Paterson, J. C. S. (1958). Personal communication.
Registrar-General (1954). Decennial Supplement, England and Wales, 1951. Occupational Mortality, Pt. I. H.M.S.O., London.
—— (1954-6). Annual Statistical Review of England and Wales, 1953-5. Pt. I Tables, Medical. H.M.S.O., London.
—— (1945-56). Annual Statistical Review of England and Wales, 1943-55. Pt. II Table, Civil. H.M.S.O., London.
Simpson, C. L., and Hempelmann, L. H. (1957). *Cancer (Philad.)*, **10**, 42.
Stewart, A., Webb, J., Giles, D., and Hewitt, D. (1956). *Lancet*, **2**, 447.
Todd, G. F. (Ed.) (1957). *Statistics of Smoking*. Research Paper No. 1, Tobacco Manufacturers Standing Committee. London.
World Health Organization (1949). *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death*, 6th revision, 1948. H.M.S.O., London.

DIET AND ARTERIAL DISEASE IN A POPULATION SAMPLE

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It is a curious paradox that one of the most hopeful features of ischaemic heart disease is the apparent rise in its clinical incidence (Ryle and Russell, 1949; Morris, 1951); for it is this rise, especially as it affects the middle-aged, which suggests the importance of environmental factors rather than simple ageing. This raises the hope that if only the responsible change can be identified its reversal may possibly prevent or even cure the disease. Unfortunately, however, the search for the relevant change is impeded by the complexity of social development. For instance, the apparent fall in the mortality from ischaemic heart disease which Malmros (1950) observed in some Scandinavian countries during the last war, and which he attributed to the effects of food rationing, might have been due to some other of the many profound effects of war upon society.

Other attempts to correlate diet with the clinical or necropsy incidence of ischaemic heart disease in different populations are all open to similar criticism, since the various races that were studied differed in many ways besides diet (for example, Keys *et al.*, 1954a, 1954b; Bronte-Stewart *et al.*, 1955; see Yudkin, 1957). A more direct approach is to compare, within the same population group, those with and without the disease. This method has been used in comparing hospital cases with unaffected hospital patients, or else with healthy volunteers (for example, Gertler, White, *et al.*, 1954). Such studies are open to the serious objection that patients and controls come from different population groups. The proper control for a man in hospital with ischaemic heart disease is a man taken at random from the same population group; such ideal control is almost impossible of achievement.

An investigation requiring a completely acceptable control group is more suitably based upon the population at large. Such an approach is most laborious, for, in order to find a small number of people with the disease from among the general population, it is necessary to interview and examine a much larger number. In addition, those discovered may have only a limited desire to co-operate. In the present study these problems were simplified by making use of material which had been collected for a different purpose, but which was also very suitable for a controlled study of diet and arterial disease. Our purpose was to determine whether, within a defined section of the general population, the diet of those who had clinical ischaemic heart disease or intermittent claudication differed from those who had not.

Methods

In 1953–4 one of us collected data for a study on the inheritance of diabetes mellitus. The names and addresses were obtained of all first-degree relatives of (*a*) 550 diabetics

attending hospital, and (*b*) 520 patients attending the skin, minor surgical, and general medical clinics. These relatives were invited to attend the hospital for interview and examination, when specific questions were put regarding, *inter alia*, symptoms of arterial disease. This information provided the material for the present survey.

From each of the two groups of relatives was collected a group of "atheromatous" patients, consisting of those who gave a history of angina pectoris, cardiac infarction, or intermittent claudication; in each instance the last was supported by the absence of one or more ankle pulses. Each "atheromatous" subject was matched by the next person of the same age (± 3 years) and sex who gave no history of these symptoms. These "less atheromatous" subjects formed the control group. Persons over the age of 65 were excluded, as also were diabetics. Jewish subjects were matched by Jewish controls. All subjects were of British nationality.

The selected subjects in the atheromatous and control groups were each sent a letter in which they were asked to say if they were willing to answer questionaries about their diet, and also to state their occupation in the past 10 years, and whether or not they were taking any special diet. When a control subject could not be traced or would not agree to take part, a letter was sent instead to the next suitable person on the list. The subjects eventually studied comprised 7 pairs of relatives of diabetics and 17 pairs of relatives of non-diabetics. The atheromatous group consisted of 5 subjects (3 men and 2 women) with a history of cardiac infarction, 14 subjects (4 men and 10 women) with angina pectoris only, and 5 subjects (3 men and 2 women) with intermittent claudication only.

The assessment of the diet was based on answers to questionaries sent through the post, each questionary dealing with one day's food. All the common foods that might be eaten at each meal were listed, together with space for the insertion of any other dishes. The subject was asked to mark against each dish the quantity that was eaten; the measures specified on the questionaries were homely rather than scientific—for example, for porridge, the number of tablespoonfuls; and for butter, whether "thick," "thin," or "average." At the end of each sheet was the question, "How much did you smoke during the day?"

The questionaries and instructions were identical for both the atheromatous and the control group. No suggestion was made that fat, or any other food, was regarded as of special importance. All subjects were led to believe that they were being studied as members of the healthy population. Fourteen pairs of subjects were questioned in the months of November and December, and the remainder in April and May.

Each subject initially received two questionaries without prior notice on a Monday morning. The first related to the diet of the previous day, and had to be filled in from memory; the second dealt with the diet for Tuesday. This arrangement was adopted so that the first questionary would be free from bias due to changes in diet introduced because the subject knew he or she was being questioned, and so that the second questionary would be more or less free from bias due to faulty memory.

A second pair of questionaries was posted one to three weeks after the first, again without prior notice. The posting day was determined randomly, and again one questionary was retrospective and the other prospective. The members of each pair of subjects received their questionaries simultaneously.

The food content of the diets was calculated from the completed questionaries, using the food tables of McCance and Widdowson (1946) for the carbohydrate, protein, and fat content of prepared dishes, and data provided by Hilditch (1956) for the fatty-acid composition of the fats. In order to allow for the differences in diet between Sundays and weekdays, each subject's intake was calculated first for a whole week, and the daily means were derived from this. For convenience, the values for total fat have been broken down in the proportions of their constituent fatty acids: the resulting figures are in a measure misleading, since natural glycerides are always mixed. The fatty acids were grouped as saturated, mono-ethenoid, and poly-ethenoid (including di-ethenoid); they were also separately grouped into those with a chain length of 18 or more carbon atoms, and those with shorter chains.

Results

In the atheromatous group both men and women were on average slightly older than their controls, the mean difference being 0.54 year (Table I). Body measurements showed the atheromatous subjects to be a little shorter and a little heavier than the controls. The atheromatous men were on average 11.2 lb. (5.1 kg.) below their highest known weight, as compared with 8.1 lb. (3.7 kg.) for the controls. For the women the differences were 6.8 and 7.8 lb. (3.1 and 3.5 kg.) respectively.

Since the atheromatous subjects were on average slightly heavier than the controls, it is necessary to consider how far this might affect their calorie intake. The relation between calorie intake and body weight for the two groups was therefore studied (Table II), and it was found that there

TABLE II.—*Relation Between Calories and Body Weight for Males*

Body Weight (lb.)		Mean Daily Calories
lb.	kg.	
110–	49·9	2,330
130–	58·9	2,680
150–	68·0	2,870
170 and over	77·1+	1,980

TABLE I.—*Comparison of Age, Bodily Measurements, and Diet in Atheromatous and Control Subjects*

	Males			Females			Total			
	A	C	A–C	A	C	A–C	A	C	A–C	P
Age (years)	56·60	55·90	+0·70	56·57	56·14	+0·43	56·58	56·04	+0·54	0·1/0·2
Height (in.)	65·30	66·00	−0·70	62·43	62·93	−0·50	63·63	64·21	−0·58	0·02/0·05
Weight (lb.)	153·9	146·9	+7·0	155·2	152·3	+2·9	154·7	150·1	+4·6	0·5/0·6
Highest known wt. (lb.)	165·1	155·0	+10·1	162·0	160·1	+1·9	163·2	158·1	+5·1	0·5/0·6
Calories/day	2,800	2,259	+541	1,856	1,697	+159	2,249	1,931	+318	0·05/0·1
Carbohydrate (g./day)	329·9	274·5	+55·4	211·5	209·6	+1·9	260·8	236·7	+24·1	0·3/0·4
,, (% cals.)	48·3	49·7	−1·4	46·7	50·6	−3·9	47·5	50·3	−2·8	0·1/0·2
Protein (g./day)	83·3	66·2	+17·1	57·8	56·7	+1·1	68·4	60·6	+7·8	0·1/0·2
,, (% cals.)	12·2	12·0	+0·2	12·8	13·7	−0·9	12·5	12·8	−0·3	0·7/0·8
Fat (g./day)	119·0	92·9	+26·1	80·8	65·2	+15·6	96·7	76·7	+20·0	0·02/0·05
,, (% cals.)	39·5	38·3	+1·2	40·5	35·7	+4·8	40·0	36·9	+3·1	0·05/0·1
Satd. fat (g./day)	65·5	49·3	+16·2	43·0	36·2	+6·8	52·3	41·6	+10·7	0·001/0·01
,, (% fat)	54·9	53·2	+1·7	53·3	55·5	−2·2	54·1	54·3	−0·2	0·4/0·5
Mono-eth. fat (g./day)	45·2	36·4	+8·8	32·2	24·6	+7·6	37·6	29·5	+8·1	0·02/0·05
,, ,, (% fat)	38·1	39·1	−1·0	39·8	37·6	+2·2	38·8	38·4	+0·4	0·2/0·3
Poly-eth. fat (g./day)	8·3	7·2	+1·1	5·6	4·4	+1·2	6·8	5·6	+1·2	0·05/0·1
,, ,, (% fat)	7·0	7·7	−0·7	6·9	6·9	0·0	7·0	7·3	−0·3	0·2/0·3
Short-chain fat (g./day)	48·8	38·3	+10·5	33·4	27·3	+6·1	40·0	32·1	+7·9	0·02/0·05
,, ,, (% fat)	41·0	41·3	−0·3	41·5	42·1	−0·6	41·3	41·8	−0·5	0·5/0·6

A = Atheromatous group. C = Control group. P = Probability.

was only a slight tendency for calorie intake to increase with body weight; in fact, in each sex the calorie intake fell off in the highest-weight group.

Dietary analysis showed not only significant differences between the atheromatous and control groups as a whole, but also discrepancies between these differences for men and women. Broadly speaking, the atheromatous men were much bigger all-round eaters than their controls, whereas the atheromatous women were bigger eaters of fat only. None of the atheromatous subjects was taking a special diet because of his or her disease.

The atheromatous males' calorie intake was 24% higher than that of their controls, and the likelihood of such a difference arising by chance is less than 1 in 100. Their mean consumption of carbohydrate was 20% greater ($P<0.01$), of protein 26% ($P<0.2$), and of fat 28% ($P<0.2$). The lesser degree of significance for the intakes of protein and fat was due to a wider scatter of the observations. Study of the percentage contributions of the various foodstuffs to the total calories showed only trivial differences between atheromatous subjects and controls.

In the case of the women, the atheromatous subjects still showed a higher calorie intake; but the excess (9%) was much smaller than for the men, and did not achieve the 1 in 20 level of significance. For carbohydrate and protein intake there was almost no difference at all; that is to say, the excess of calories was derived almost entirely from fat. Their excess fat consumption (24% more than the controls') was not itself significant, but the proportion of calories taken as fat was significantly increased (40.5% as compared with 35.7%, $P<0.05$). However, the combined data for the two sexes showed a significantly higher fat intake in the atheromatous group ($P<0.05$); and since the trends for the two sexes were similar, it is quite possible that these might each have achieved significance if more observations had been available.

When the figures for total fat intake are broken down in the proportion of their constituent saturated and unsaturated fatty acids, it may be seen that the atheromatous men ate an absolute excess of all fractions, as compared with their controls; this is not surprising, in view of their large total fat intake. They consumed, however, a rather higher proportion of their fat in a saturated form, and a correspondingly lower proportion as di- and poly-ethenoid fatty acids; the difference did not reach significance. Rather surprisingly the atheromatous women took proportionately less of their fat in a saturated form as compared with their controls. Although the excess of saturated fat in the atheromatous group achieved a probability of only 0.05–0.1 for each of the two sexes separately, the combined data for both sexes achieved a significance level of less than 1 in 100.

James *et al.* (1957) have put forward the hypothesis that the chain length of fatty acids may be more important than their saturation in relation to atheroma. Their suggestion implies that the short-chain fatty acids (contained in highest proportion in milk fat) may be atheroma-producing, whereas the long-chain acids (contained in highest proportions in most vegetable oils) may be atheroma-sparing; most animal fats occupy an intermediate position. Since vegetable oils make only a fairly small contribution to fat intake in this country, the problem resolves itself mainly into the relative amounts of milk fat and animal fat in the diet.

In the present analysis fatty acids have been grouped according to chain length into those with 18 or more carbon atoms, and those with 16 or less. Figures for the latter are included in Table I. The percentage contribution of short-chain fatty acids to total fat intake was very similar in the two groups, and hence the differences between the groups in absolute figures follow the same pattern as for total fat intake. There was no evidence to suggest that chain length possessed any peculiar importance.

In an attempt to assess some of the errors attaching to this type of dietary survey it was arranged that half the questionaries should be retrospective and half prospective. The results obtained from these two sets of questionaries have been compared. For carbohydrate intake the retrospective questionaries gave a mean daily intake for all subjects of 254.0 g. for weekdays and 267.2 g. for Sundays; the figures from the prospective questionaries were 251.0 g. and 270.8 g. respectively. These differences were not significant.

The subjects' occupations are summarized in Table III. The pattern was very similar in each group, both with regard to the likely expenditure of physical energy and (so far as could be ascertained) with regard to probable income. Apart from one retirement in each group, no change of occupation had occurred within the previous 10 years.

TABLE III.—*Occupational Distribution*

	Occupation	No. of Subjects	
		Atheromatous	Control
Male	Sedentary or clerical	4	3
	Light engineering	3	3
	Boot repairer	1	0
	Painter and decorator	1	0
	Warehouseman	0	1
	Barrow boy	0	1
	Lorry driver	0	1
	Retired	1	1
Female	Housewife	11	12
	Clerical	1	2
	Industrial cleaner	1	0
	Canteen assistant	1	0

All subjects were also asked to give details of any physical exercise or active hobbies undertaken apart from their occupations, and, in the case of the employed, the distance walked on the way to work each day. The mean distance walked to and from work each day was 0.95 mile in the atheromatous group, as against 3.1 miles in the control group. Of the atheromatous subjects, only five reported active hobbies (gardening or odd jobs); these occupied them on average for 8.6 hours weekly. Seven of the control subjects reported active hobbies, with a mean of 10.9 hours weekly.

Each questionary also included a question on the amount smoked during the day. Data from the answers are presented in Table IV; the results are expressed as grammes of tobacco per day (Doll and Hill, 1954). They show only trivial differences between the atheromatous and control groups.

TABLE IV.—*Smoking Habits*

Amount of Tobacco Consumed per Day (g.)	No. of Subjects			
	Atheromatous		Control	
	Men	Women	Men	Women
0	2	11	3	11
1–10	3	3	3	2
11–20	3	0	3	1
21–30	1	0	0	0
Not stated	1	0	1	0

Discussion

The division into atheromatous and control groups on the basis of a clinical history taken two to three years previously may be false or misleading in a number of ways. For example, the original history may have been erroneously interpreted; some control subjects may have developed evidence of atheroma since their history was taken; and others, though without symptoms, may yet have a dangerous degree of atheroma. Nevertheless it is indisputable that the two groups represent, respectively, a greater and a less severe degree of the disease, and the possible presence of the disease in the controls only enhances the significance of any differences found.

The method of dietary inquiry used in this study is new, and must therefore be examined critically. Errors may have been introduced through lack of understanding of the

questionaries, the wide interpretations that could be placed on the homely food measures employed, faulty memory, or changes in diet introduced because the subjects knew that they were being questioned. The similarity of results obtained from retrospective and prospective questionaries suggests that the last two of these were probably not of major significance. In addition, the tables of food values on which the analysis was based are certainly only approximate. All errors, however, were equally apt to occur in each of the two groups: for identical questionaries were sent to all subjects, and members of control and atheromatous groups alike believed themselves selected as typical members of the general population. It follows that, even if the errors were great, they are irrelevant to the significance of differences between the two groups. There remains the possibility that, through superior intellect or temperament, the members of the atheromatous group were less likely to omit information when completing the questionaries. This possibility cannot be disproved; but there was no evidence for it, and it is a criticism that can be levelled at any type of dietary survey.

The investigation has shown a number of significant differences in diet between the atheromatous and control groups, but their interpretation is difficult. It may be that highly significant differences in the intake of one foodstuff may be of no aetiological importance, but have arisen because they were linked with other differences in diet or way of life that are important. Owing to large random variations and the smallness of the series, it may be that factors of less statistical significance may be of greater aetiological significance; and other differences that in this survey have failed to reach any acceptable level of significance might in a larger series be shown to be important. Similarly, the degree of significance of some of the results might have been less in a larger series.

Despite the well-known difference in the sex incidence of ischaemic heart disease and intermittent claudication, little attention has been paid to the possibility that this might reflect differences in diet (see Keys, 1956). Field and laboratory studies have dealt almost exclusively with males, and reports of mortality trends have usually presented only combined data for both sexes. In some instances, such as calorie intake, the sexes showed similar trends, but the differences were greater in one sex. In other instances, however, the two sexes behaved quite differently. To take an extreme example, the percentage contribution of the mono-ethenoid fat fraction to total calorie intake was identical for atheromatous and control males, whereas the two female groups showed a difference of 2.6% ($P<0.01$). It must, however, be pointed out that a history of angina pectoris but not of infarction was given by 10 of the 14 women, but by only 4 of the 10 men. Thus the difference in diet may really represent, not differences between the sexes, but differences between cardiac infarction and angina pectoris.

The chief characteristic of the atheromatous men was that their calorie intake was 24% higher than that of their controls: expressed mechanically, their bodies appeared to be less efficient machines. In the attainment of this higher intake they showed little preference for any particular foodstuff as compared with the controls; hence there were no significant differences between the two groups as regards the respective percentage contributions to total calories of carbohydrate, protein, and fat. In absolute figures, the biggest percentage excess related to fat; but there was a fairly wide scatter of the differences between individual pairs of subjects, and the mean difference did not reach the 5% significance level. An excess carbohydrate intake, on the other hand, was more constant, and the difference between the two groups was highly significant.

The problem is not much clarified by other reports. The fall in mortality from ischaemic heart disease in certain Scandinavian countries during the war (Malmros, 1950; Strøm and Jensen, 1951), which was associated with a fall in fat consumption, was associated also with a fall in total calories. The comparisons between native and white populations in South Africa (Bronte-Stewart *et al.*, 1955) do not offer any data on calorie intake. The studies of Keys *et al.* (1952, 1954a, 1954b) on samples of the populations of Minnesota, Naples, and Madrid included estimates of calorie intake; but these should probably be interpreted with caution, since members of such widely differing populations might also vary in their ability to provide accurate answers to dietary questionaries. The evidence from the present survey, if viewed in isolation, would tend to incriminate either a high total calorie intake or a high carbohydrate intake, rather than a high fat intake or a high proportion of calories eaten as fat.

Comparison of the atheromatous and control women showed (by contrast with the men) only a slightly higher calorie intake in the atheromatous group; but the proportion of calories taken as fat was significantly greater. In the combined data for the two sexes the excess in total fat intake of the atheromatous subjects achieved significance at the 5% level.

It has been suggested that atheroma may be aggravated by a relatively high intake of saturated or animal fat, or by a deficiency of unsaturated fatty acids (Kinsell *et al.*, 1952, 1953; Ahrens *et al.*, 1954; Beveridge *et al.*, 1955; Bronte-Stewart *et al.*, 1956; Sinclair, 1956). The present results do not favour the importance either of an absolute deficiency of unsaturated fatty acids or of a high relative proportion of saturated to unsaturated fatty acids. They are, however, consistent with the possible importance of a high total intake of saturated fatty acids.

Summary

The diet has been studied of (*a*) 10 male and 14 female subjects with atheromatous disease, and (*b*) the same number of randomly selected control subjects, each pair being matched for age and sex. Figures for the atheromatous group showed a higher intake of each of the main foodstuffs. Statistically, the most significant differences related to total calories and carbohydrate among the men, and to saturated fat for both sexes. The excess in total fat intake also reached significance at the 5% level. The data did not provide any evidence to incriminate any deficiency of unsaturated or long-chain fatty acids as an important aetiological factor.

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REFERENCES

Ahrens, E. H., Blankenhorn, D. H., and Tsaltas, T. T. (1954). *Proc Soc. exp. Biol. (N.Y.)* **86**, 872.
Beveridge, J. M. R., Connell, W. F., Mayer, G. A., Firstbrook, J. B., and De Wolfe, M. S. (1955). *J. Nutr.*, **56**, 311.
Bronte-Stewart, B., Antonis, A., Eales, L., and Brock, J. F. (1956). *Lancet*, **1**, 521.
—— Keys, A., and Brock, J. F. (1955). Ibid., **2**, 1103.
Doll, R., and Hill, A. B. (1954). *Brit. med. J.*, **1**, 1451.
Gertler, M. M., White, P. D., and others (1954). *Coronary Heart Disease in Young Adults.* Harvard Univ. Press, Cambridge, Mass.
Hilditch, T. P. (1956). *The Chemical Constitution of Natural Fats*, 3rd ed. Chapman and Hall, London.
James, A. T., Lovelock, J. E., Trotter, W. R., and Webb, J. (1957). *Lancet*, **1**, 705.
Keys, A. (1956). *Brit. med. J.*, **2**, 98.
——Fidanza, F., Scardi, V., and Bergami, G. (1952). *Lancet*, **2**, 209.
—— —— —— —— Keys, M. H., and di Lorenzo, F. (1954a). *A.M.A. Arch. intern. Med.*, **93**, 328.
—— Vivanco, F., Miñon, J. L. R., Keys, M. H., and Mendoza, H. C. (1954b). *Metabolism*, **3**, 195.
Kinsell, L. W., Michaels, G. D., Partridge, J. W., Boling, L. A., Balch, H. E., and Cochrane, G. C. (1953). *J. clin. Nutr.*, **1**, 224.
—— Partridge, J., Boling, L., Margen, S., and Michaels, G. (1952). *J. clin. Endocr.*, **12**, 909.
McCance, R. A., and Widdowson, E. M. (1946). *Spec. Rep. Ser. med. Res Coun. (Lond.)*, No. 235, 2nd ed.
Malmros, H. (1950). *Acta med. scand.*, Suppl. 246, p. 137.
Morris, J. N. (1951). *Lancet*, **1**, 1, 69.
Ryle, J. A., and Russell, W. T. (1949). *Brit. Heart J.*, **11**, 370.
Sinclair, H. M. (1956). *Lancet*, **1**, 381.
Strøm, A., and Jensen, R. A. (1951). Ibid., **1**, 126.
Yudkin, J. (1957). Ibid., **2**, 155.