THIRTY-SECOND SCIENTIFIC MEETING—FIFTEENTH SCOTTISH MEETING

INSTITUTE OF HYGIENE, THE UNIVERSITY, GLASGOW,
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THE ROLE OF NUTRITION IN SOCIAL MEDICINE

Morning Session: Chairman, Professor T. FERGUSON

Professor T. Ferguson (Institute of Hygiene, University of Glasgow): It was inevitable that food and the nutritional wellbeing of the people should assume political importance and be major social problems long before there was much formal conception of social medicine. In classical times Juvenal wrote that there was nothing so effective as bread and plenty of diverting shows for keeping the people to their duty, and Ramazzini, in discussing the diseases of flour millers, pointed out how necessary it was to ensure for the people ample supplies of bread, for otherwise "bellies would rise in insurrection".

In Scotland, Hector Boece, one of the early commentators on national diet, lamented that strength and vigour had failed among the people as they declined from the temperance of their elders, but not all visitors to Scotland in those early days found the same opulent gluttony, and Ray, a hundred years later, was frank in his criticism: the Scots neither had good bread, cheese or drink, nor would they learn to make them.

The 16th century saw the introduction of measures for the control of food supplies and food policy. Stimulated by one of the periodic dearths, the Privy Council appointed a commission to make prices for all manner of victuals and to decide what steps should be taken to procure food for the people. The Commission drew up a schedule of rationing, which, however, was based on class distinction rather than on physiological needs. The year 1562 saw the introduction of the "political Lent", certainly not the last occasion on which an attempt was made to clothe administrative expediency in the respectable garb of science or religion.

During the 17th and 18th centuries, lean years recurred with monotonous regularity and reached a climax in the famine of 1698–99. It does not appear that any public measure was adopted for the relief of the poor at this time; but in 1783, when famine was again present, the House of Commons voted money for the relief of distress in the northern parts of Scotland.

Conditions were still bad at the end of the 18th century. The Glasgow weavers and their families made potatoes the main part of their food; many of them could get little else. Sinclair, the historian of the times, concluded that the principal dangers in the mode of living of the people arose from the use of potatoes and tea, and from the great abundance of spirituous liquors. The general reliance on potatoes as the primary source of food had catastrophic results when the crop failed in 1846. Oatmeal, which was scarce, came to be the staple food of the poor; a common basis of allowance seems to have been 1 lb. of meal per day per individual, sometimes "a degree less" to adult females. The dietary of the institutions of Scotland in the 19th century was bad. It observed the traditional reliance on meal, contained only a small amount of animal

food, and certainly lacked variety. Poorhouse dietaries were strongly criticized by *The Scotsman* in 1863, when the daily cost of food supplied averaged about 3½d.; *The Scotsman* pointed out that the diet was calculated to sustain life but not more, and so closely was the calculation made that doubts would arise whether it did not subject many of the inmates to slow death from gradual inanition.

Much has happened since 1863, and nutrition is now generally recognized to be one of the basic issues of social medicine.

Introductory Paper

Professor E. P. Cathcart (Department of Physiology, University of Glasgow): There are two wise sayings which should adorn the laboratory walls of all those who engage in research in nutrition, one of Claude Bernard (1927), "We must have robust faith and not believe", and the other Occam's Razor, "*Entia non sunt multiplicanda praeter necessitatem*", *i.e.*, don't propound fancy explanations until you have exhausted the known. Experience will prove their worth. Too many of today's investigators seem to me to jump too readily to conclusions which are not warranted by their data. Many of the deductions and inferences drawn about the causal agencies are just about as sane as to say that because some compounds of arsenic cure syphilis the existence of syphilis is due to the absence of arsenic from the food.

In discussing this problem of food we must recognize that there are two phases involved which are often confused. We can speak of alimentation, which is the provision of food of adequate quality and quantity, and we can speak of the state of nutrition, which is only in part dependent on the provision of an adequate diet. It is much easier to discuss alimentation in quantitative terms, a quantity, however, which may vary within wide limits dependent on the physiological needs of the organism fed, than the difficult and obscure problem of nutrition. Many speak glibly about the state of good or optimum nutrition. What does this term really mean? I personally interpret the term simply as a synonym for the state of good health or fitness. If we had some means of gauging or determining this state all would be well. Everyone realizes that mere size is no guide. We all recognize that many athletes who are thin to the verge of emaciation may be in perfect training and presumably in the state of optimum nutrition for them and, at the same time, we see great powerful bull-necked individuals apparently in the pink of condition who, on medical examination, are found to be "poor" lives. One man may be said to be in a state of eutrophy and the other of eusitia, of being in the one case well nourished and in the other well fattened.

I cannot accept McCarrison's (British Medical Association, 1939) definition of nutrition. He holds that it is not a condition of body but the function, the sum of the processes, that keep it in condition, that is, in health. I regard this functional interpretation as being too narrow. To me the state of good nutrition is an end result of perfect environmental conditions in the widest sense of the term, the provision of adequate food, sleep, play, housing and psychosomatic relationships. It most certainly does not depend solely on the nature of the food supplied. Moreover, as Hutchison has rightly stated, "the nutrition of any individual is not a

fixed and static thing; on the contrary it is, like health, capable of various degrees".

As it is the influence of the food supply which I am supposed to discuss, it is evident that with the time at my disposal only some phases of the question can be dealt with. In the first place I would draw attention to the touching faith in that blessed word calories. We are repeatedly told that some people or other are getting 1500 or 2000 Calories a day. Why this stress on calories? Is it the result of pure ignorance? Is this stress meant to deceive? The statement obviously means nothing unless the composition of the food from which the calories are derived is known. It is only too often forgotten that calories are merely convenient heat units which are used for the drawing up of the physiological balance sheet. Calories have no nutritive value. If it were merely a question of the provision of calories, then an appropriate supply of alcohol or any other organic material would prove adequate. Even reputable conferences can come to conclusions which do not seem to be very reasonable. Thus in the report of the League of Nations Health Committee (1936) there is a very reasonable definition of the caloric needs of a man or woman living an ordinary everyday life. A list of calorie supplements per hour of work for varying degrees of muscular activity to be added to the basal level of 2400 Calories is given. These supplements range from 75 Calories per hour of work for light work to 300 Calories and upwards per hour for very hard work. As a matter of fact Vernon, Bedford and Warner (1927) have shown that no man works at a steady pace throughout his working day, and that, generally speaking, the duration of his voluntary rest pauses is directly proportional to the severity of his work. Hence it follows that the actual amount of physical work done in the course of the working day, be the occupation regarded as heavy or moderate, is not so different in energy demand as might be assumed from a casual inspection of the performance. One of the best and most frequently quoted series of actual determinations of energy expended on work, those of Becker and Hämäläinen (1914), is marred by the fallacy that the energy expended in one or two hours, *i.e.*, the duration of the actual experimental control period, multiplied by either 8 or 4 gives the exact expenditure of an eight-hour day. There is the additional fallacy that a man can put up an exhibition sprint at a rate which it would be impossible to maintain for eight hours.

There is another aspect of alimentation about which there has been a good deal of talk and on which much very questionable emphasis has been laid. This is the need, many seem to think the absolute need, for first class protein. The general consensus of opinion seems to favour the inclusion of about one-third of the total protein in this form. I suppose the virtue, such as it is, which lies in the inclusion of so-called first class protein, or protein of high biological value, is that its chemical make-up most closely resembles tissue protein and therefore its inclusion will save a certain amount of metabolic waste. I think that the deduction is correct and that the inclusion of such high class protein sources as meat, milk, and cheese is fully justified. As a matter of fact, dietary surveys have shown that the majority of diets, even those of the less well situated members of society, contain around 30 per cent. of this good type of protein. Mitchell (1937) has demonstrated that the same end can be

achieved by the use of supplements, *i.e.*, the combination of two or more sources of protein. Thus the combination of beef protein with a biological value of 66 and flour proteins with a value of 55, in the ratio of 1 of beef to 2 of flour, gives a combined biological value of 73. The result speaks unequivocally for the need of variety in diets, in other words for the use of a good mixed diet. Until the work of Mitchell and his pupils our ideas on what constituted biological value were very indeterminate. There was indeed a definite tendency to believe that the biological value of any protein was a fixed value. Work from Mitchell's laboratory made it clear that this stability does not hold but that the biological value varies inversely with the concentration of protein in the diet. Thus egg protein at a level of 8 per cent. of the diet has a biological value of 91, at 12 per cent. of 84, at 16 per cent. of 62 and at 20 per cent. of 53.

Protein would seem to play a leading role in another phase of biological activity, growth. Protein certainly can, when given within certain limits, stimulate the rate of growth in the lower animals, but when given in larger amount the growth-promoting property decreases. It is obvious that growth promotion can only take place during childhood and adolescence. Will this speeding up of growth in children be reflected in adult size and is this increase, if it does occur, desirable on any grounds; will it, for example, increase constitutional wellbeing? Hutchison (1936) has rightly asked, "Should we aim, as some enthusiasts would have us do, at feeding children in such a way as to produce the maximum growth and development of which each child is capable? Does maximum growth make for health and longevity? There is certainly some evidence that it does not." It must not be overlooked that in relation to the intake of food, as compared with that in many other animals, growth in man is extremely slow. Hence it follows that, generally speaking, food will have far less influence on growth than might be expected from experiments on small, fast-growing laboratory animals. Even if this acceleration of growth were reflected in adult life we have always the heredity factor to reckon with, the factor which is generally regarded as primary in the government of growth. The increase in weight may, I believe, be ignored. For most people, to put on weight is only too easy and in the majority of cases is neither desired nor desirable. What will be gained if the enhanced adult stature is attained? If such increase of stature took place generally it would, for example, necessitate the complete renewal of most of the machinery and benches in workshops and factories, as the prevailing design of working level is suited to men of the present average stature.

There is no doubt that if the food consumed is inadequate in quality and quantity a restriction in growth will result. Yet even if growth is retarded it has been clearly demonstrated, in the case of both animals and man, that the potential ability to grow is retained for quite long periods. It is impossible, of course, to plan properly controlled experiments on children to elucidate this problem, so we must rely on animal experiments. Still, indirectly we can study analogous data which show that the recuperative powers of children are also great. I think this is made abundantly plain, for example by the intensive study of Hardy (1938) of 415 boys and girls between the ages of 6 and 12 or 13, and of 58 per cent. of the original group to the age of 20. These children were ordinary

representative pupils in an industrial urban community who suffered from the ordinary run of illnesses. The average number of illnesses per child up to 12 or 13 was six, ranging from one or two to twelve. All anthropometric measurements made in childhood were again carried out at maturity. Seasonal change in growth was allowed for. There was no evidence of any general retarding influence of illness *per se* on physical growth. Incidentally it may be noted that the boys and girls most frequently ill tended to be both taller and heavier than the average child, and at no age during childhood were they found to be below the median stature of those children with fewest illnesses.

In connexion with this question of growth, reference may be made to certain studies on the influence of diet on the pre-natal state. Some three years ago Ebbs, Brown, Tisdall, Moyle and Bell (1942) in Toronto published a paper on this subject. One group of mothers on a poor diet was left as control, another group on a poor diet had it supplemented during the last three or four months of pregnancy, and a third group with a moderately good diet was improved by education alone. The authors reported that during the whole course of pregnancy the mothers on a good or supplemented diet enjoyed better health, had fewer complications and proved to be better obstetrical risks than those left on a poor ante-natal diet. They also stated that the incidence of illness and mortality up to six months was higher in the case of babies belonging to the poor diet group.

A similar type of study was carried out by Burke, Beal, Kirkwood and Stuart (1943) at Harvard with a like result, except that, whilst the Toronto group could find no marked relationship between diet and the incidence of pre-eclampsia, the Harvard investigators found an extremely high and definite connexion. On the other hand, an investigation carried out at Melbourne (Commonwealth of Australia Advisory Council on Nutrition, 1936) on the effect of ante-natal diets on caries in children went to show that the quality of the ante-natal diet exercised very little influence. Thus of 136 children whose mothers gave a history of deficient ante-natal feeding 47 per cent. had carious teeth; of 59 where the diets had been moderately good 34 per cent. had carious teeth, and of 126 where the ante-natal diet was considered adequate 46 per cent. had carious teeth. It may be remarked that no diet was considered adequate without at least one pint of milk a day, liberal butter, eggs, green vegetables and fruit, together with a sufficient quantity of meat and fish.

To return to the subject of the protein component of the diet, it may be remarked that there is no adequate explanation why those engaged on hard muscular work demand a high intake of meat. It cannot, apparently, be due to the need for maintenance, to make good nitrogen loss resulting from wear and tear, as even with the hardest work, provided the energy requirements are covered, the extent of muscle breakdown, as evidenced by increased nitrogen output, is small. Nor, so far as our evidence goes, is muscular work carried out more effectively on high protein diets. There is the further fact that the more virile races of the world are all large consumers of meat. In support of this statement I simply recall the interesting investigation (Schenk, 1936) into the diets of the 4700 athletes, of over 40 nations, attending the Olympic Games at Berlin in 1936, which showed that the great majority were large

consumers of animal protein. Why? Is it because meat extractives act as stimulants? Is it on account of the specific dynamic action? Is it because the flavour of meat helps the individual to dispose of the enhanced intake of less well flavoured energy-giving foodstuffs for the performance of work?

We must now turn to a more controversial field, that of the vitamins. Here there has been far too much enthusiasm, enthusiasm often based on perfectly erroneous ideas regarding the part played by the vitamins in metabolism. Even Hopkins, the very father of vitamins, was compelled to point out very forcibly that man could not live on vitamins alone. The tremendous output of literature on the subject has largely been due to the apparent ease with which feeding experiments could be carried out. Albino rodents have been responsible for much waste of paper and time. The clinical literature has also been flooded with cases purporting to be due to deficiencies of some kind or another. We are now, I believe, entering a period of more sober thought and careful assessment. The effect, up till now, on the majority of sound clinicians has been to raise doubt as to the real value of much of the work published. Gordon (1941) wrote, "As we approach this subject we get a whiff of the odour of sanctity and a peep within the veil at what the world has come to think is the mystery of mysteries. Red flannel and goose grease had their day before focal infection was king but now B_1 reigns in his stead. But in spite of the pandemic hysteria about vitamins and the tens of millions of dollars misspent upon them by the public, there are definite values in the same public's recognition that it cannot live on quantity alone, nor upon quality plus calories alone, and after this fitful fever they shall eat well."

This somewhat caustic comment is largely supported by the series of experiments which have been carried out on the re-inforcing of diets, such as the one recently published by Bransby, Burn, Magee and McKecknie (1946), with additional vitamins but without any material benefit. The negative results of the experiments of the Milk Nutrition Committee (1938) support the view that deficiencies of diet are very hard to assess.

In my opinion the fundamental difficulty in the vitamin problem lies in the need for the proper assessment of the quantitative requirements. There is abundance of evidence to show that the vitamins are essential to the wellbeing of the organism but, on the other hand, there are many conditions which have been ascribed to the lack of specific vitamins which do not clear up when the lack is made good. Thus cheilosis and corneal vascularization may not respond to the administration of riboflavin; you may have patients with all the classical signs of rickets in spite of the fact that they are receiving enormous doses of vitamin D each day; you may have little or no effect on dark adaptation in spite of a large intake of vitamin A; you may have subjects eating diets free from vitamin C for many months exhibiting no signs of the lack of this vitamin and you may have classical signs, like the presence of petechiae, which do not clear up with enormous doses of vitamin C; and you may find people starved to the greatest degree of emaciation, like those suffering from *anorexia nervosa* or the concentration camp inmates, who show few, if any, of the signs and symptoms of vitamin lack.

We have in the main to rely for our quantitative information on little more than guesses at the basic needs. So-called standards have been set up, but probably the majority of these standard figures are over-stated simply for the sake of safety. There seems to be a growing opinion that the latest of these standards, that of the National Research Council (1943, 1945) in the U.S.A., definitely errs on the high side. The fact that they are on the high side does not in itself do much harm, but when such standards are used in dietary surveys as the criteria of the adequacy of the diet, a wrong appreciation of the values of the diets in the survey can, it is clear, lead to very wrong deductions. Any diet, it is obvious, can be regarded as defective if you put your so-called standard high enough. It has been well said by Bessey (1943) that "Enthusiasm which leads to statements and conclusions beyond the limits of sound scientific evidence, no matter how well intended, eventually results in discredit to the sciences. This is happening far too often in the field of nutrition, with the result that many physicians and colleagues in other fields of science are slow to accept even that knowledge which is sound and of real importance. It seems to me that a curb on this over-enthusiasm would help promote a better understanding of the importance of nutrition to health on the part of some of those who are now skeptics."

We derive too much of our data from experiments on the lower animals, especially rats and mice. Are we completely justified in using these data? There is certainly a number of fallacies involved in our doing so. It is a commonplace to say that we fare best when a varied diet is consumed, not merely using a variety of components in the daily diet but with change from day to day. Essential material, perhaps in small supply one day, is made up for by an excessive intake on the next or next again. What about the experimental animals? They are confined in cages of limited size, kept at uniform temperature and fed on a rigid experimental diet, the same from day to day. It is forgotten that animals have selective appetites. The daily lives of these caged animals are the very opposite to those led when in the free state. Again, we can almost involuntarily mislead ourselves on the question of quantitative requirements. Certainly the administration of 2 ml. of milk to a growing rat weighing 50 g. does not seem an excessive amount and we are cheered by the result produced when this amount of milk is given to a rat on a defective diet. If instead of growing rats, we had been dealing with a growing child aged 8 or 9 years, and weighing, say, 25 kg. and had added to its diet, based on bodyweight, an equivalent volume of milk, *i.e.*, 1000 ml., would our wonder have been excessive if some change had taken place? Finally, in the great majority of the experiments carried out on animals, young, growing, healthy specimens are selected. Is this fair? We know perfectly well in daily life that as age increases metabolic phenomena tend to become less intense. Moreover, is there any reason to believe that the metabolic response of all animals is identical? As Mitchell (1937) remarked, "It is a good thing that our complacency in the infallibility of a sort of Jeffersonian doctrine that all animals are created equal is being disturbed. A study of rodent nutrition is profitable in an understanding of mammalian nutrition only as its findings are periodically checked with other mammalian species." Again, with reference to the point concerning the age of the experimental animals, he

remarks, "Our information has been obtained too largely upon the growing animal. We know little about the nutrient requirements of maturity and the physiological efficiency of the adult organism in the assimilation of food. What we do not know concerning adult nutrition we too readily infer from the established facts of adolescence, and I believe our inferences are liable to give a distorted picture of reality."

There is abundant evidence in clinical literature to show the close relationship between the psyche and the soma even if we do not go the length of postulating the existence of specific metabolic centres in the central nervous system. Further, whether or not there are nerves with trophic function is still unsettled. On the more commonplace plane there is the question of appetite. We recognize hunger and thirst as normal physiological attributes which reflect certain metabolic activities. Why should appetite be only too often regarded as almost a synonym for gluttony? Very often, it is true, it represents merely a desire to gratify the palate, as in most cases of obesity. Shakespeare had a much better and more physiological appreciation of the value of appetite than many research workers: "Now good digestion wait on appetite, and health on both." He also said: "Give me excess of it, that, surfeiting, the appetite may sicken, and so die." We all know that good digestion can be promoted by happiness, just as it may be inhibited by fear and anxiety. We also know that in certain pathological conditions some patients show a definite desire, called pica, for materials which under normal conditions would never have been regarded as normal adjuncts of a diet. This craving is quite on a par with the urge that overtakes certain animals to travel to "salt licks", and certainly for this urge there is a perfectly sound explanation. Is it not possible then that, under certain conditions at least, appetite is something more than a craving for food one likes or is accustomed to or a nostalgia for pies as mother made them? May it not be evidence of what might be called a physiological pica, an indication of the need for the correction of some somatic imbalance? All these different factors undoubtedly participate in this capricious complex, but, from time to time, in varying proportion. Is it habit or real need that leads to the huge consumption of sauces of various kinds, presumably to stimulate the appetite, or is it merely to act as a corrective to good food badly cooked? As Andrew Boorde said long ago, "God may send a man good meat, but the devil may send an evil cook to destroy it." (Poole, 1936).

It is easy to speculate. The greatest need today in the study of nutrition is more and better experiments on human beings. Far too much of the so called research work on nutrition has been carried out by individuals with little or no biological training. I think the cry for team work and planning is overdone. Truly original work can no more be produced "by means of some grand over-all planning scheme for science than one can produce great sonnets by hiring poets by the hour". We have got to deal not with a series of robots but with living human beings, with their likes and dislikes, their hopes and fears, their griefs and joys. As Durig (1938) wrote regarding the pathetic desire to lay down rigid dietary standards, "People who are free to choose their diet will not bother about such standards; those whose diet is prescribed for them, or who cannot afford a proper diet, cannot bother about them; and even specialists

and professors of dietetics cannot, and in any case will not, construct their own daily diet according to standards." Still, standards of some kind there must be, but their main value resides neither in their accuracy nor in their magnitude as such, but in the possibility they afford of carrying out uniform and comparable statistical investigations into nutrition among different peoples and at different social levels. The work is not easy and it requires a critical mind alert for the many pitfalls that surround the many-faceted problem of nutrition. As Mendel (1932) said, there is "no field of practical importance related to human wellbeing in which there is greater opportunity for dogmatism and quackery, for pseudoscience and unwarranted presumptions and prescriptions than in the domain of our daily diet".

References

Becker, G. and Hämäläinen, J. W. (1914). *Skand. Arch. Physiol.* **31**, 108.

Bernard, C. (1927). *An Introduction to the Study of Experimental Medicine.* New York: Macmillan.

Bessey, O. A. (1943). *Proceedings of the Research Conference on the Relation of Nutrition to Public Health*, p. 23. New York: The Nutrition Foundation.

Bransby, E. R., Burn, J. L., Magee, H. E. and MacKecknie, D. M. (1946). *Brit. med. J.* i, 193.

Burke, B. S., Beal, V. A., Kirkwood, S. B. and Stuart, H. C. (1943). *Amer. J. Obstet. Gynec.* **46**, 38.

British Medical Association (1939). *Nutrition and the Public Health.* London: British Medical Association.

Commonwealth of Australia Advisory Council on Nutrition (1936). *First Report*, p. 12.

Durig, A. (1938). *Wien. klin. Wschr.* **51**, 1.

Ebbs, J. H., Brown, A., Tisdall, F. F., Moyle, W. J. and Bell, M. (1942). *Canad. med. Ass. J.* **46**, 6.

Gordon, A. H. (1941). *Canad. med. Ass. J.* **44**, 329.

Hardy, M. C. (1938). *Amer. J. phys. Anthrop.* **23**, 241.

Hutchison, R. (1936). *Lancet*, **230**, 583.

League of Nations Health Committee. Technical Commission (1936). *Quart. Bull. Hlth Org. L.o.N.* **5**, 391.

Mendel, L. B. (1932). *The Diplomate*, **4**, 281.

Milk Nutrition Committee (1938). *Milk and Nutrition.* Part IV. Reading: Nat. Inst. Res. Dairying.

Mitchell, H. H. (1937). *Convegno Volta*, p. 97. Rome: *Reale Accademia d'Italia.*

National Research Council. Food and Nutrition Board (1943). *Repr. nat. Res. Coun., Wash.*, no. 115.

National Research Council. Food and Nutrition Board (1945). *Repr. nat. Res. Coun., Wash.*, no. 122.

Poole, H. E. (1936). *The Wisdom of Andrew Boorde.* Leicester: Garswood Press.

Schenk, P. (1936). *Münch. med. Wschr.* **83**, 1535.

Vernon, H. M., Bedford, T. and Warner, C. G. (1927). *Rep. industr. Fatig. Res. Bd, Lond.*, no. 41.

Afternoon Session: Chairman, Professor G. M. WISHART

Some Observations on the Nutrition of Mothers and Young Children During the War Years

Dr. N. I. Wattie (Child Welfare Department, Glasgow Corporation)

It has always been difficult to assess the relative importance for health of faulty diet, bad housing, and other conditions associated with poverty. Infant mortality rates, mortality rates in young children, and death rates from tuberculosis, particularly in young women, have always been high where these factors operated. These rates rise as we move northwards in England, becoming higher still in Scotland. Attempts to disentangle the effects of food, housing and climate by statistical methods are apt to be unsatisfactory even when information is available. During the thirties, Orr (1936) and others in their surveys showed that even in well fed nations a large proportion of the population was subsisting on a diet inadequate for full health. Orr further showed that, although only 10 per cent. of our population were in the class whose diet was deficient in every particular, that class contained from 20 to 25 per cent. of the children. Various experiments in which the diet of children was improved showed that faulty diet is undoubtedly one of the two main enemies of health. The other is bad housing.

Glasgow offers unsurpassed conditions in which to study the health conditions of women and children. The housing conditions of a large proportion of the population have always been notoriously bad; the number of overcrowded houses is very high, and the houses themselves are overcrowded on the sites. Unemployment and poverty have always been much worse than in England. In the period 1934–36, for example, over 20 per cent. of the insured population in the towns of the west of Scotland were unemployed. The diets of many families were found to be deficient in every constituent examined. Large numbers of families never bought liquid milk. The children and their mothers lived mainly on white bread, margarine with no vitamins, jam, and tea-bread. Soup was sometimes made, and the frying pan cooked sausages and on occasion meat. The last, however, was often consumed by the father of the family. Living in a state of chronic unemployment with 3s. a week for each child, parents simply could not afford to buy the essential body building and protective foods for their children. Public health measures were applied very widely. Milk was made available for infants attending welfare centres. Large issues of cod liver oil and other vitamin-rich substances, free or at reduced cost, to mothers and infants all helped to improve the diet of poor families. There was a corresponding improvement in health and physique. The gross forms of deficiency diseases were disappearing. The mortality rate at ages 1 to 5 was declining steeply, and there was some improvement in the infant and maternal mortality rates. But poverty, faulty feeding, and bad housing were still adversely affecting the majority of our Glasgow children in the pre-war years.

With the outbreak of war came a cessation of unemployment and the consequent diminution of poverty. Soon after came food rationing and the subsidies which brought the rationed foods within the purchasing power of everyone. On the other hand, the housing of the people undoubtedly deteriorated and overcrowding became worse than it had ever been. The war years have acted as a great biological experiment where one factor is changed for the better, while other conditions are either constant or more adverse. These years have not so much contributed new knowledge about the relation of diet to the wellbeing of mothers and babies as they have provided a wonderful opportunity for putting into practice the principles laid down in the previous years and for formulating the aims of future investigation.

Let us consider first some vital statistics. Since 1939 the stillbirth rate has fallen steadily both in England and Wales and in Scotland. In Scotland the fall has been from 43 in 1939 to 32 in 1944. A similar fall has taken place in Glasgow, where the figures are 45 and 36, respectively. With regard to the neonatal death rate, there has not been the same consistent fall. In fact, there was in 1940 and 1941 in both countries a rise due to an increase in deaths from infections. In both countries, however, the rate for 1944 was lower than that for 1939. The figures are for England and Wales 25·2 and 28·3, and for Scotland 32·8 and 36·5. In discussing this fall in the stillbirth and neonatal death rates Baird (1945) writes, "Improved nutrition during pregnancy seems to be the most likely explanation. This improvement has affected the whole country and every age group and parity, so that it is likely to be due to the better distribution and consumption of milk and other foods important for health."

Although there has been some fall in the maternal mortality rate in Scotland from 4·87 in 1932 to 3·0 during the war years, this rate is still not satisfactory. In a city like Glasgow there are still many difficult factors which affect the position. The relatively high incidence of rickets and the effects of other social factors in past years mean that there is a relatively high proportion of abnormal cases, and there is still in the city a shortage of ante-natal beds. Although additional maternity accommodation has been provided by the Corporation during the war to the extent of nearly 150 beds, the extraordinary demand for indoor confinement has meant constant encroachment on ante-natal provision.

Apart from maternal mortality, I should like briefly to make some observations about the general condition and physique of the mothers attending the ante-natal clinics. There are approximately 22,000 births annually; over 50 per cent. of the expectant mothers in Glasgow are supervised at the Corporation clinics, and another 20 to 25 per cent. at hospital clinics. There is no doubt that the general level of nutrition of the ante-natal patients is better than it was before the war. One reason may be that the clinic population is a younger one, mainly owing to the increase in marriages in war time. There is now a minority of old-looking mothers with complaints of debility, fatigue, hypotension, and varicose veins. This general improvement in nutrition, however, seems due not so much to age and parity but rather to the better economic conditions of the majority of the mothers. The increased consumption of milk has been most valuable, although there is a tendency, particularly in multiparae,

to share their milk and extra priority rations with the rest of the family. It is of supreme importance that the full allowance of milk, eggs, and meat should be taken up and consumed by the mothers themselves. Towards this end, much education has been carried out by the clinic staffs, but much more is still necessary.

In the main, however, the priority milk and the regular weekly purchase of rations have meant much better meals even for the poorest. More butter and margarine are bought proportionately, also more vegetables to eke out the meat and potato meal. As a rule, however, the nutritive values of the vegetables are spoilt by poor cooking methods. A serious handicap is the relatively high cost of vegetables. This high price has rendered much of the educational propaganda for increased consumption ineffective in Scotland. Another interesting fact is that many mothers who worked during part of their pregnancy had better meals at their work places than they ever cooked for themselves. A very ill-nourished and apathetic patient, for example, who had marked vitamin B deficiency, became completely changed in appearance and character in her next pregnancy when she worked in a public house and was given excellent meals until two days before full term.

All our medical officers report a marked reduction in the incidence of dental caries. There are two reasons for this gratifying improvement in the dental condition. One is undoubtedly the nutritional factor, the milk-in-schools scheme operative since 1934 and greatly expanded during the last five years, school feeding, and the war food policy. The other is no less important, however. It is clear that we are now seeing the beneficial effects of the school dental service and the ante-natal dental service. The teeth of the adolescents and young people of today are unquestionably better than those of the same age groups ten years ago.

With regard to medical conditions, there is evidence of some increase in cases of hypertension but no increase in the incidence of eclampsia. In pre-war years a large proportion of our ante-natal patients had some degree of hypotension; now they have a normal blood pressure; in certain cases increased work may cause a rise in blood pressure.

Large scale surveys of the incidence of anaemia show that in general the position with regard to iron deficiency anaemia is satisfactory. This is attributed mainly to the increased intake of iron resulting from the introduction of National Wheatmeal flour in 1942. There is still in Glasgow, however, a fair amount of apparent anaemia in expectant mothers, possibly aggravated by bad housing conditions, prolonged black-out, and few opportunities to get out into the open air. The women were very conscious of the change in their husbands' complexions on their first leave from the Forces.

At the ante-natal clinics special iron therapy is given to large numbers of women, and improvement has undoubtedly resulted in many cases. In others, however, this therapy has been disappointing in its results and it would appear that in these cases assimilation of medicinal iron is defective. Assimilation was improved in certain instances by giving, along with the iron, large doses of vitamin C. There is no doubt that the anaemia of pregnancy varies in type and response to treatment, dietetic and otherwise, and that a haemoglobin estimation is not by any

means always a reliable guide to the clinical condition or a reflection of the symptoms.

If the expectant mother takes up all her rations and her priority supplies, there should result a mixture of nutrients complete enough with one single exception to promote the good health of herself and her child. The exception is vitamin D. This vitamin is poorly represented even among the protective foods. A most disappointing feature of the position is the extraordinary apathy and indifference of the majority of expectant mothers throughout the country with regard to the uptake of the vitamin preparations. Glasgow is no exception. Although these foods are available for distribution at every ante-natal session throughout the city, and members of the W.V.S. attend specially to serve the mothers, less than 20 per cent. of our mothers take the vitamin A and D tablets. This apathy is difficult to understand. Unceasing teaching and propaganda go on not only at the various centres but through the medium of the press and cinema, and yet we are failing to make an impression. Since a reliable preparation of vitamin D is of paramount importance to the mother during the last few weeks of pregnancy and during lactation, we must urgently consider further ways and means of overcoming this indifference.

One of the most disappointing and disquieting features of child welfare in this country is the steady decline in the number of mothers who breast feed their infants. Before the war it could certainly be argued that many of our Scottish mothers were too poorly fed to be capable of breast feeding their infants satisfactorily. We had expected that the improved nutrition of the mother would have been reflected in an increase in the amount of breast feeding. But this is not so. At one clinic, for example, in 1940, of 100 infants on the first visit at one month or less, 46 per cent. were wholly breast fed and 38 per cent. wholly artificially fed. In 1945, the percentages were 36 and 55, respectively. Further, in 1945, by three months the percentage of artificially fed had risen to 74. In the municipal midwives' practice the majority of mothers breast feed successfully while under the midwife's supervision during the puerperium, but wean the baby as soon thereafter as possible. To overcome this difficulty, up till quite recently the midwife attended her cases till four weeks after confinement. Shortage of staff has unfortunately led to a temporary cessation of this continued supervision. The premature weaning of the child is due to alleged or real insufficiency of breast milk. The same sequence of events occurs in many hospital cases. Here there are, in my opinion, several factors in operation. A high proportion of babies born in hospital is dismissed home on complementary feeding. Is this due to too strict observation of test weighing in hospital, and impatience in the first few days when breast feeding is being established? Another regrettable fact is that the mothers are having to be sent home from hospital on the eighth, ninth, and tenth day of the puerperium. There is no doubt that this premature return to household cares and responsibilities seriously interferes with the establishment of lactation. A further point is that, in spite of accepted standards of feeding in pregnancy and lactation, the diets in some maternity hospitals are still below these standards.

I should like here to pay tribute to the work of the Emergency Maternity Hospitals. Admittedly the number of patients dealt with is not very high, and the group is to some extent selected. Nevertheless the results obtained were extraordinarily satisfactory, as shown in a very low maternal mortality rate and a small number of stillbirths and neonatal deaths. The data are being published by Douglas (1946). In these institutions the diets were carefully arranged and controlled, and the patients really consumed them. No doubt the effects of the good feeding were enhanced by the enforced period of pre-natal residence necessitated by the distance of these institutions from the patients' homes, but the fact is that the Glasgow women who were sent to these hospitals came home looking the picture of health, their manifest good health and happiness being reflected in the high proportion who breast fed their babies without any difficulty.

It is essential that, as soon as may be, the special needs of the lying-in parturient women should be fully met. It would appear, however, when all the relevant facts are examined, that there is a strong psychological element in the problem of breast feeding. It is a plain fact that, consciously or subconsciously, great numbers of women simply do not want to feed their infants.

I do not propose to enter into a full discussion of the present position with regard to breast feeding. It is a problem of first importance but admittedly one of many aspects. Whether or not it is essential to reverse the present tendency, and whether we can do this, are both matters to which we should give our immediate attention.

With regard to the health of our infants and toddlers, the improvement, as reflected in lowered death rates and absence of gross forms of deficiency diseases, is evident all over the country. The infant mortality rate for Scotland has fallen from 65 in 1939 to 56 in 1945, and in Glasgow the rate for 1945 was 68, the lowest ever recorded. Weight charts at the various district clinics show that there has been a slight increase in the average weights of infants under one year, and the improvement in the heights and weights of Glasgow school entrants is well known (Young, 1944); it is shown in Table 1.

TABLE 1

IMPROVEMENT IN HEIGHT AND WEIGHT OF GLASGOW CHILDREN AGED 5 YEARS, BETWEEN 1930 AND 1944 (Young, 1944)

Period	Improvement in			
	Height, in.		Weight, lb.	
	Boys	Girls	Boys	Girls
1930 to 1944	0·93	0·77	1·98	1·78
1935–39 to 1944 ..	0·32	0·22	1·08	0·81

The direct relationship between good nutrition and sound dentition has been clearly proved by the Government's nutrition policy. In 1939

the proportion of school entrants in Glasgow found on medical inspection not to require dental treatment was under 20 per cent. In 1945 the proportion had risen to 48 per cent.

These important statistical data are evidence of the improved health of our young children. There are, however, one or two points with regard to their health which I should like to discuss briefly. There is no doubt that in general, despite the fluctuation in the infant mortality rate, the nutrition of children under one year is very much better than in pre-war years. Gross rickets in infants under 1 year is now hardly ever seen, and even the milder forms have become less prevalent year by year. During 1945, however, there was a striking fall in the incidence. Coincident with this reduction was a rise in the consumption of national dried milk. In 1944 the average number of tins taken up by mothers each week was 3000. In 1945 the weekly average rose to 10,000. The number is still increasing. This rise was mainly due to propaganda carried out by the Public Health Department and the Press after the outbreak of gastro-enteritis in 1944. Early in 1945 national dried milk was reinforced with 800 I.U. of vitamin D to each pint of reconstituted milk. It seems a fair assumption that this change in the feeding of such a large proportion of Glasgow infants is the chief reason for the reduction in the incidence of rickets and a factor in the reduction in the infant mortality rate, a biological experiment of profound significance.

It is argued, and rightly, that an important factor in the abolition of rickets in infancy is prevention through the medium of the mother's diet. Mellanby's work showed that when the mother is well fed the young are better able to withstand a diet low in calcifying qualities. It would appear a fair deduction that the progressive improvement in the incidence of rickets which has taken place during the war years is related to the improvement in the diet of the expectant mother. But the striking improvement noted in 1945 can, I think, only be due to the increased consumption of national dried milk. The results already obtained warrant an optimistic outlook for the future.

With regard to the toddler, the position is from some points of view less satisfactory. It would appear that with the improved nutrition of the infant signs of rickets in certain instances appear later. Our experience is that minor degrees of rickets are relatively more prevalent in the young toddler. More frequently seen, too, are toddlers with poor muscle tone and lax ligaments, causing knock knees and valgus ankles which lead to defects in posture and gait. Such children require ultraviolet light treatment and orthopaedic treatment to correct the deformity. Conditions in the average home today are not conducive to good standards of domestic care and cooking. Overcrowding and lack of proper cooking facilities, particularly in lodgings, cause makeshift meals with consequent malnourishment of the child. Further, in many homes nowadays the main meal is consumed in the evening at a time unsuitable for a toddler, and in a great many cases no midday meal is prepared specially for him. Has the increase in the provision of school meals some influence on this? If the children of school age are away from home all day the mother may not consider it necessary or worth while to prepare a meal for one child at home.

Another point in the management of the toddler is that in better class homes there is an increasing tendency to depend too much on preparations such as malt and emulsion instead of a mixed and balanced diet. Much education of parents is still necessary to ensure that the small toddler is adequately fed.

At the present time the lack of variety of protein foods suitable and palatable for young children makes the average mother's task difficult. An extension of the provision of nursery schools would have an immediate result in an improvement in the nutrition of our toddlers. In these schools the diets are carefully considered, attractive and varied menus are devised, and the foundations of lasting good food habits are firmly laid. It is to be hoped that the Education (Scotland) Act, 1945, will really prove to be a charter for children's nurseries.

Out of the chaos and destruction of war have come certain undoubted benefits to the nation. The war food policy, with its sound scientific basis, has resulted in a continued definite improvement in the health of mothers and children. We are, in fact, witnessing the first results of a great and successful experiment in preventive medicine, one almost worthy of being described as a five-year-plan for children.

The family is the ideal unit of a civilized community. It must be admitted that there has been for years an increasing disruption of family life. If it is to revive it must be actively built. We must create a state of society in which, first, there is an instinctive desire in all young people to have families, and second, our young people should have the requisite knowledge to rear their families wisely. Food is the physical basis of family life. Adequate food should be within the purchasing power of every family. But even if enough food is available there may be malnutrition from faulty feeding caused by ignorance and carelessness. We must lose no opportunity for education in food values and good cooking methods. In the nurseries and nursery schools the children themselves are taught good food habits, and their parents are reached through parents' clubs. Similarly, education of parents should be further developed through child welfare clinics and parents' clubs held there. In the raising of the school age we have a golden opportunity to give vocational training to our girls, particularly in nutrition, mothercraft, and domestic hygiene, and similar instruction, suitably modified, should be available for boys. In all this education there must be a pooling of resources and a combination of workers. The health visitor, medical officer, teacher, and dietitian have all their part to play. Each needs the help of the other. Such co-operative effort will have an enormous influence in promoting happy healthy family life.

References

Baird, D. (1945). *J. Obstet. Gynaec.* **52**, 217.
Douglas, C. A. (1946). *Trans. R. sanit. Ass. Scot.* In the Press.
Orr, J. B. (1936). *Food, Health and Income.* London: Macmillan and Co.
Young, J. M. (1944). *Corporation of Glasgow. Report on the Medical Inspection and Treatment of School Children.*

On the Difficulty of Isolating the Nutritional Factor in Disease from other Factors in the Social Background

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The Registrar General's Report on Occupational Mortality, 1938, indicated that there were certain factors in the social background causing higher disease rates in the lower economic groups. A study of the social background of these groups might be expected to indicate which particular environmental factors are responsible in different cases. The social background may be divided into five main components: housing, nutrition, occupation, leisure, and psychological relationships.

In a nutritional survey carried out in 1937–39 from the Rowett Institute (Pemberton, 1940), Thomson and I found that the incidence of bronchitis in children increased as the weekly expenditure per head on food diminished (Table 1). This might have been due to a direct relationship

TABLE 1

THE INCIDENCE OF BRONCHITIS IN RELATION TO FOOD EXPENDITURE IN CHILDREN FROM BIRTH TO 5 YEARS OF AGE (Pemberton, 1940)

Weekly food expenditure per head	Up to 5s.	5s. to 7s.	7s. to 9s.	More than 9s.
Percentage incidence of bronchitis: Boys ..	19·6	15·6	10·0	4·3
Number of children examined	327	154	39	23
Percentage incidence of bronchitis: Girls ..	17·4	11·2	7·1	—
Number of children examined	380	143	56	—

between bronchitis and malnutrition, or because other harmful environmental factors, for example overcrowding, were associated with a low expenditure on food.

Spence and Charles (1934) showed that the case mortality from measles increased as housing density increased (Table 2). Similarly, in this case,

TABLE 2

THE RELATION OF MORTALITY FROM MEASLES TO HOUSING DENSITY (Spence and Charles, 1934)

Housing density, persons per room ..	0·58	1·79
Case mortality from measles per cent. ..	0·16	2·26

the increased mortality might have been due to associated deterioration in the level of nutrition.

M'Gonigle and Kirby (1936), in their observations on the health of a population removed from a slum to a housing estate, found, paradoxically, that the mortality rates of the population so removed increased (Table 3).

TABLE 3

SLUM CLEARANCE FOLLOWED BY AN INCREASED DEATH RATE
(M'Gonigle and Kirby, 1936)

Period	Death rate per 1000	
1923–27	Housewife Lane 22·91	Riverside area 26·10
1928–32	Mount Pleasant 33·55	22·78

They attributed this to the reduced expenditure on food by the shifted population.

A similar separation of the housing and nutritional factors was shown for a group of non-commissioned officers in the Norwegian Army (Leitch, 1945). In that case, it was shown that an improvement in the diet caused a reduction in the incidence of tuberculosis and other infections when improvement of housing had failed.

During the war the housing of the population has deteriorated, while the nutrition has, on the whole, been maintained or improved. Some of the more important vital statistics, such as those shown in Table 4

TABLE 4

RECENT MORTALITY TRENDS IN ENGLAND AND WALES
(Adcock and Magee, 1946)

Year	Maternal mortality rate per 1000 total births	Infant mortality rate per 1000 live births	Tuberculosis mortality, crude rate per 1000 population
1939	3·10	50·6	0·621
1940	2·60	56·8	0·699
1941	2·76	60·0	0·692
1942	2·47	50·6	0·616
1943	2·30	49·1	0·619
1944	1·95	45·7	0·583

(Adcock and Magee, 1946) indicate that the health of the population has improved after an initial setback in the first years of the war. Some separation has therefore been obtained between nutritional and housing factors in their influence on morbidity and mortality.

Difficulties may arise in distinguishing the effects of other background influences on health; for example, nutritional and occupational factors may be confused. A man suffering from bleeding gums, anaemia and muscular weakness may be suffering from scurvy or from lead poisoning. Similarly, misuse of leisure can produce signs and symptoms of vitamin B_1 deficiency, as in chronic alcoholics.

The fifth and final element in the social background which I want to mention in connexion with nutrition is the psychological factor. Patients suffering from peptic ulcer, a disease with an admitted psychological component, rarely appear to be well nourished in spite of a generous diet.

The child suffering from asthma, another psychosomatic complaint, is usually underweight and often has a dry skin and other evidence of malnutrition, and yet such children often have more than their share of maternal care.

In a given case history, it may be difficult to distinguish the various background influences which have been discussed. While it is certain that the nutritional factor is one of the most important, other factors also may be operating at the same time. Nevertheless, the clinician, in so far as he interests himself in the problems of social medicine, must attempt to isolate these factors if he is to deal with the case effectively.

REFERENCES

Adcock, E. W. and Magee, H. E. (1946). *Mon. Bull. Minist. Hlth*, **5**, 36.
Leitch, I. (1945). *Proc. Nutr. Soc.* **3**, 156.
M'Gonigle, G. C. M. and Kirby, J. (1936). *Poverty and Public Health.* London: Victor Gollancz.
Pemberton, J. (1940). *Some Signs of Malnutrition.* London University M.D. Thesis.
Spence, J. C. and Charles, J. A. (1934). *Investigation into the Health and Nutrition of Certain of the Children of Newcastle-upon-Tyne between the Ages of One and Five Years.* City and County of Newcastle-upon-Tyne.

Nutrition in India During and After the War

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Health

Morris (1945) introduces his review of the health of India by quoting the late Director of the All-India Institute of Public Health and Hygiene, in Calcutta, "The level of health in India is low. Preventible epidemic diseases, such as smallpox, typhoid, dysenteries, cholera and malaria are widespread. . . . Tuberculosis is spreading and each year presents a more menacing problem. The resistance of the population to disease is low. Malnutrition and nutritional diseases are omnipresent." The chief mortality statistics of the country confirm this gloomy picture. The average infant mortality rate is about 160, varying from 100 to 200 in rural areas and rising to 300 and more in some towns. Broadly speaking, one-quarter of all deaths takes place before the age of one year, and a further quarter between 1 and 15 years. The mean expectation of life at birth is 27 years. The maternal mortality rate is about 20 per 1000 live births. Such figures indicate that the standard of living must be low to a degree now almost unknown in the West, and this is confirmed by a study of such indices as average income, clothing standards, housing conditions and food consumption levels.

Diet

The achievement of an adequate standard of nutrition is probably the most fundamental and most urgent social problem in India. It is not merely a matter of improving on the present subsistence dietary levels,

but also of preventing a serious deterioration which seems to be inevitable in the next few years in the absence of some modification of present trends.

Many workers have reported the results of dietary surveys carried out recently (see, for example, Aykroyd, 1941; Wilson and Widdowson, 1942).

The Nutrition Advisory Committee of the Indian Research Fund Association (1944, 1) recorded that, "It has been found, in surveys of typical urban and rural groups, that the calorie intake of some 30 per cent. of families is below requirements, and that even when the diet is quantitatively adequate, it is almost invariably ill-balanced, containing a preponderance of cereals and insufficient 'protective' foods of higher nutritive value". This general conclusion is supported by the opinion of the Imperial Council of Agricultural Research, quoted by the Famine Enquiry Commission (1945, 2), that the following percentage increases in food production will be necessary to provide a "suitably balanced diet" for the present population of 400 millions: cereals, 10; pulses, 20; fats and oils, 250; fruits, 50; vegetables, 100; milk, 300; fish and eggs, 300.

Agriculture

The production increases just mentioned will have to be achieved in the face of immense difficulties. The papers of Ladejinsky (1939, 1942) and the monograph of Mukerjee (1938) show that agriculture is primitive, badly organized, very inefficient and burdened by an enormous population of cattle which contributes very little milk and almost no meat to human subsistence, even the dung being frequently diverted from agriculture by its use for fuel. Agricultural reform is hindered by widespread illiteracy and a deep-rooted conservatism. The possibilities of extension of cultivation by traditional techniques are now almost exhausted, for most of the fertile soil is already being tilled. Soil erosion takes a steady toll of fertility in many areas. The solution of the agricultural problem must lie mainly in increasing productivity by using modern technique, including fertilizers, better seeds and improved methods of tillage.

Famine

In the greater part of India the nature of the monsoon determines whether or not there will be enough to eat in each year. Shortages likely to cause local starvation are precipitated by any crop failure, but financial relief organized by the state under the Famine Code usually ensures proper distribution and evokes a flow of foodstuffs from so-called "surplus" zones which is sufficient to prevent disaster. In Bengal, at the end of 1942, a poor rice crop caused a degree of absolute food shortage which was little or no greater than had been experienced many times before, but under the abnormal social conditions caused by war a phenomenal rise in the price of rice took place during 1943. Various measures failed to secure either equitable distribution of rice stocks in Bengal, or relief by importing grain, and thus a major disaster occurred, which is estimated to have caused $1\frac{1}{2}$ million deaths. A full account of the Bengal famine is to be found in the Report on Bengal of the Famine Enquiry Commission (1945, 1). This Commission has also published a Final Report (Famine Enquiry Commission, 1945, 2), which deals with the food situation throughout India generally, and is a mine of information.

Population Pressure

The situation visualized by Malthus already exists in India, in so far as the population has outstripped capacity for adequate food production according to existing Indian techniques. It has already been stated that the present population of 400 millions presses very heavily on the available cultivable soil. The average population density in India is 246 per square mile and in many localities far exceeds any density known in Europe. The lightly populated areas are chiefly desert. Thus the only effective way of increasing indigenous food supplies is to increase productivity by applying modern scientific techniques, but an adequate increase will not be easy to achieve. It has been estimated that, in the absence of any major calamity, the population of India will have risen to 500 millions in 20 or 25 years' time. This underlines the urgent need for a bold and effective food supply programme, based on a well conceived nutritional policy. Looking further ahead, one can already see at least the germ of automatic limitation of population growth as the standard of living rises. It is encouraging to note the opinion of the Famine Enquiry Commission (1945, 2) that "a rise in the standard of living is the primary means of checking the rate of population growth". Others, dealing with the same problem, are pessimistic. For example, Blacklock (1943) considers that further improvement in public health may rapidly cause starvation. Carr-Saunders (1936) sees no hope except in family limitation, a policy which would be well nigh impossible to implement deliberately without social reform of a revolutionary nature.

Feeding the Army in India

I have had the privilege of being closely concerned with the nutrition of the Indian Army during the war, and I propose to illustrate the general problem in India from my experience. Although an army is a highly selected population, it cannot be divorced entirely from the social context of the country which provides the recruits and most of the rations. Thus certain military problems are directly related to civilian problems.

Recruiting Standards

The regular Indian Army, about 200,000 strong, was recruited mainly from the northern races, which are the best nourished and among which there is a very strong military tradition. In peace, therefore, the Army was able to recruit some of the most stalwart men in India, often big, muscular men, with great athletic powers. Yet, although there must be about 100 million men of military age in the country, and though military service is by no means unpopular, it is surprising how scarce men of a high physical standard are. Before the war, the minimum weight standard for a Sikh infantryman was only 122 lb. The rural Sikhs, in addition to being better fed than most Indian races, are not a genetically small or lightly built people.

A tenfold expansion of the Army took place during the war, and standards of recuitment became progressively lower. Table 1 indicates the degree of deterioration in official minimum weight and height standards for infantry between 1939 and 1945.

The differences shown in this Table do not reflect the full extent of the deterioration. By about 1943, it was officially permissible for men up

TABLE 1

DETERIORATION IN HEIGHT AND WEIGHT STANDARDS IN THE INDIAN ARMY BETWEEN 1939 AND 1945

Race	1939		1945	
	Height in.	Weight lb.	Height in.	Weight lb.
Punjabi Moslems ..	66	120		
Sikhs	66	122		
Rajputs	66	115	62	110
Jats	66	115		
Mahrattas	64	115		
Dogras	64½	115	61	100
Madrassis	64	115	62	105
Gurkhas	60	110	59	100

to 5 lb. underweight to be enrolled if it was considered that they would reach the prescribed standard within 3 months. For enormous numbers of men the only effective standard in practice was a simple capacity to perform specified types of work. I have seen battalions of Madrassi pioneers composed of men no larger than average British schoolboys aged about 12. In the latter half of the war, the average Indian infantryman at enlistment was a smallish, thin individual with spindly limbs, a rough dry skin and often many signs of specific nutritional deficiencies, including mild hypochromic anaemia. This picture became so uniform that it was something of a shock to come across a group of soldiers conforming to the highest standard that India can produce. On rare occasions one would meet a group of men about 6 feet tall, towering above other troops with them, and manifestly of excellent physique. It was difficult to believe that these were also Indians.

It is therefore necessary to realize that although, as McCarrison (1936) claims, certain types of Indian diet can support growth and development approaching the optimum, these nourishing diets are, in fact, very rarely consumed. The great mass of Indian manpower reflects, in its poor physique and ill health, the poor consumption standards revealed by dietary surveys.

The Reconditioning of Malnourished Indian Recruits

The reaction of malnourished recruits to military environment is, on the whole, remarkable. After enlistment they live in a reasonably hygienic environment, receive regular exercise and sleep, are treated for any obvious disease, and eat the standard Army ration. Of these ameliorating factors, the improved diet is probably the most important. By 1944 it was possible to provide a reasonably well balanced diet of more than 4000 Calories; in addition, particularly malnourished men received four-fifths of a pint of milk daily. It was gratifying to observe the results. Men seemed to change both bodily and mentally, and after a year it was possible to produce a reasonably well nourished soldier with a shiny healthy skin, and only a few very chronic signs of past dietary deficiency (Thomson, Verma and Dilwali, 1946). Given a fair chance, such men made excellent soldiers. Unfortunately, the demand for manpower was such that many categories found themselves on active

service before the reconditioning process, which takes about a year, was complete. However, the response of Indian peasants to good feeding and healthy living leaves no doubt that a sound nutritional programme pays handsome dividends; if Indian women and children could be treated in the way the Army had to treat adult males, the results would undoubtedly be highly dramatic.

Table 2 compares a typical village diet with a specimen ration for Indian soldiers as provided in 1944.

TABLE 2

COMPARISON OF TYPICAL VILLAGE DIET WITH INDIAN ARMY DIET, 1944

	Village diet oz.	Army diet oz.
Cereals	15 to 25	24
Pulses	0·5 to 1	4·5
Fats	Less than 1	2·75
Milk, liquid	Negligible	6*
Milk, dried skim	0	0·375
Leafy vegetables	0·5 to 1	12
Other ,,	2 to 5	
Sugar or gur	0 to 1	2·25
Meat, fish or eggs	0·5 to 1	3·5
Fruit	Negligible	4
Spices	Variable	0·57

* Particularly undernourished recruits received in addition 16 fluid oz. of milk.

This experience indicates that good feeding can, from the consumer's point of view, be made a practical proposition. There were difficulties in persuading recruits to accept all essential changes in the traditional pattern of consumption, but these could be, and usually were, overcome. Such difficulties are too often made an excuse for pessimism and inaction.

Army Nutrition in the Base Areas

The general picture presented by Indian troops in base areas was influenced by the physical condition of recruits on enlistment, but at the time when Japan entered the war it was evident that primary malnutrition was being caused by inadequate rationing arrangements. Early in 1943, clinical riboflavin deficiency in particular was not uncommon, and a severe epidemic of this disease occurred in an isolated station on the North West Frontier.

The difficulty of feeding the Indian Army on an adequate level was almost entirely one of provision. Before the war, troops received a few staple articles of diet, such as cereals, pulses, fats and sugar in kind according to a fixed scale. In addition, cash was given to each unit commander from which he had to purchase other items locally. It so happened that the local purchase items included most of the perishable protective foods such as vegetables, meat and milk. Few unit commanders worried particularly over the nutrition of their troops so long as there was enough to eat and complaints were few, so the Army diet naturally tended to follow the traditional village pattern, although adequate purchasing power ensured sufficient calories, a reasonably high intake of vegetables, and a small but regular consumption of milk, and sometimes of meat.

By 1942, the impact of war had caused a considerable increase in the price of food, and, in addition, there were now large new concentrations of troops in many areas, who could not easily be supplied from local markets without causing adverse repercussions among civilians. Thus the purchasing power of the cash allowance tended to fail in two ways. Administratively, it was clear that a complete ration in kind was required, and one of sufficiently high nutritive value to meet the needs of malnourished recruits. To formulate such a proposal on paper was simple, but there were enormous practical difficulties. Markets were very short of supplies and imports on a sufficiently large scale were impossible. An elaborate new machinery for procurement, including new production under special agricultural schemes, and for distribution had to be built up. All this took time, and it was not until the middle of 1943 that a complete ration in kind was made available for all Indian troops in India. The design of the new ration scale, though an improvement on previous standards, was by no means perfect. The pressure was kept up, however, and by the middle of 1944 several improvements were introduced, and it could now be claimed that all Indian troops in base areas were receiving rations adequate in quantity and of reasonably high nutritive quality.

This stage was not reached without much difficulty. Military demands on the country undoubtedly played some part in raising the price of food, and possibly caused a small degree of real additional shortage among the civil population. Nearly all the vegetables required had to be grown specially for, or even by, the Army. Milk remained seriously short in spite of expansion of military dairy farms, and enough was eventually obtained only by importation in the face of much competition in world markets. The meat problem remained more or less insoluble; this is the one article of diet of which the production, distribution and consumption are complicated by an almost impossible series of religious bans and taboos. Replacement of part of the meat requirement by fish and dairy produce was fairly successful from the supply point of view, but there is room for doubt whether such substitutes are entirely satisfactory from the nutritional aspect. One wishes that food yeast had been available for large scale trial.

This involuntary experiment of feeding some two million Indians on a reasonably high nutritional standard illustrates the shortage of protective foods in India, and some of the difficulties of implementing an adequate nutritional policy even under the most urgent circumstances. But it does show that much can be done, and that Indians of all classes can be persuaded to consume a diet containing adequate amounts of the protective foods, meat being a possible exception under present conditions.

Nutrition on the Burma Front

When Burma fell in 1943, it was necessary to maintain a large army in the remote territory which forms the eastern frontier of India. Local resources of food were negligible, and in the absence of airborne supplies all food had to be transported up the long and narrow route from Calcutta via the Brahmaputra valley. The railway ended at Manipur Road, whence everything had to go on by road to Imphal and beyond. For a short time it was not always possible to ensure that troops received sufficient calories; and even when that problem was solved, most perishable foods tended to go rotten on the way, so that forward troops received

an unbalanced diet. Production of canned foods in India was negligible, and it took time to procure supplies from overseas. Gradually it became possible to provide a reasonably adequate diet with canned milk and vegetables; but the Indian soldier does not take kindly to many varieties of tinned food, and in one respect in particular the Indian ration remained consistently worse than the British ration in the same area. British troops received a plentiful supply of meat, chiefly in the form of bully beef. Indian troops would not touch beef and only on rare ocasions would they accept canned mutton. Strenuous attempts were made to provide live goats for slaughter by units, but most animals failed to survive the journey. Dehydrated goat meat factories were started in India, but their output was small and erratic, and dehydrated meat became unpopular when it was discovered that some early consignments were infested with larvae owing to unhygienic conditions in the factory. Thus the Indian soldier on the Burma front was more or less a vegetarian, whether he liked it or not; and owing to his upbringing he did not mind much. In terms of known nutrients, the Indian diet differed markedly from the British diet only in its animal protein content.

Troops in this area were all heavily exposed to malaria. Under normal conditions the sick rate among Indian troops is slightly less than that among British troops and, while this ratio held good more often than not on the Burma front, it was soon apparent that, whereas the British soldier recovered quite satisfactorily from repeated attacks of malaria, rather large numbers of Indians developed an acute type of conditioned malnutrition characterized by severe anaemia, gross wasting and, often, chronic diarrhoea. This condition did not respond readily to treatment and constituted a heavy source of wastage. In 1942 and 1943 the picture was striking and alarming. Many Indian hospitals showed rows of very anaemic and grossly emaciated men, a sight which was rare in British hospitals. Most physicians concluded that the cause must lie in the low animal protein intake of Indian troops, and the medical administration at headquarters was bombarded with a spate of opinions as to the cause and cure of what was variously called "anaemia", "marasmus", "malnutrition", "para-sprue", and even "sprue". It was relatively easy to show that the condition was not one of simple inanition following chronic malaria. A haemoglobin survey among healthy troops in the area revealed surprisingly little anaemia, so that chronic iron deficiency with hookworm infestation seemed to be eliminated as a primary cause. There is little doubt that many of the affected men had low blood protein, and hence the animal protein deficiency theory assumed some plausibility. It was possible to do something to improve the animal protein intake of Indian troops by supplying tinned milk and fish, but no striking effect was apparent. Finally, many physicians considered the negligible meat consumption of Indian troops to be at the root of the evil. During all this time it was not possible to arrange a proper investigation with full laboratory facilities, and this short account covers a great deal of controversy. A rather elaborate investigation was planned for 1945, but the greatly changed military situation made short work of many good intentions; and in the event, it seems that by that time the problem had become greatly modified and considerably less acute.

Marriott (1945) differentiates the type of secondary malnutrition

appearing in Burma into two groups, namely, sprue-like syndromes, seen in both British and Indian troops, and anaemia, seen almost entirely among Indian troops. My own impression is that the distinction in Indian troops was never very clear-cut, but that the secondary malnutrition of Indians gradually changed character between 1942 and 1945. In the earlier part of this period severe anaemia was the dominating factor, and cases were very common. Later on, sprue-like characteristics became more common and severe anaemia relatively rarer, and fewer cases seemed to occur. The change may possibly be attributed to a general improvement in the standard of feeding, but environmental and other possible operative factors cannot be excluded. An account of sprue among British troops is given by Keele and Bound (1946). So far as I am aware, no similar account of this syndrome and related syndromes among Indian troops has been published to date.

The hypothesis that an inadequate ration of meat was at the root of the earlier form of this troublesome group of diseases (Marriott, 1945) is plausible. Taylor and Chhuttani (1945) have shown that clinical anaemia was many times more common among vegetarian than among non-vegetarian Indian troops in Iraq. We know that meat is a good source of the extrinsic haemopoietic factor of Castle, and exercises a therapeutic effect on the anaemia of pellagrins (Moore, Vilter, Minnich and Spies, 1944). While the symptomatology in Indian troops in Burma was not confined to that of clinical anaemia, anaemia was an important part of the syndrome, and it is possible that a borderline deficiency of unknown nature was a factor in precipitating a nutritional crisis under such strains as repeated malarial haemolysis.

The interest of events in the Army on the Burma border is that they provide grounds for considering whether a vegetarian or lacto-vegetarian diet can be entirely satisfactory under conditions of physiological stress such as those imposed by chronic malaria. This is a field which requires further investigation, and is obviously of considerable practical importance in a country like India. It was being studied by means of a feeding experiment on recruits when I left India.

The Future

Since the bulk of this paper was written, news has arrived of poor harvests and the possibility of widespread famine, and of renewed political tension. When the immediate crisis has passed, will good counsel prevail and sufficient purposefulness be found to remove the threat of yet further deterioration in the future?

It would be unrealistic to refrain from all comment on the political situation. Nearly all Indians with any education and sense of community are politically conscious to an intense degree. Most of them would probably consider that a political solution must necessarily precede any wholehearted attempt at social reform. Thus we have the strange fact that social problems are rarely dealt with in constructive fashion, if they are mentioned at all, in Indian political manifestos. It seems to be a law of human nature that the immediate reaction to an intolerably depressed standard of living is a political one. It would be rash to discuss this aspect of the problem here; but I should like to stress that the Indian point of view, whether it be right or wrong, must be reckoned with. It is

certain that the masses of India cannot be mobilized to take part in a drive towards social improvement until political calm is restored and the Government is widely supported.

Here, then, is a puzzle for Britain and India alike. It cannot be solved too soon, for famine seems likely to underline the desperate condition of Indian society for the second time in 3 years; and no lasting solution will result from inactivity or patchwork reconstruction.

The present Government of India has initiated a useful amount of fact finding by expert committees and commissions, of which only a few need be mentioned here. The Nutrition Advisory Committee of the Indian Research Fund Association (1944, 1, 2) has reviewed the nutritional aspects of the problem (1944, 1) and has drawn up a formal statement of requirements in terms of nutrients and of foodstuffs (1944, 2) which is intended to form "a basis for the formulation of satisfactory food policies". The Famine Enquiry Commission (1945, 2) has reviewed the problem of food and agriculture and has made several recommendations on how the Government should start to implement a long term food policy. The Report of the Health Survey and Development Committee (1946) has recently been published. There is now no good reason why the start of the practical work should be delayed.

To solve India's food problem will be a most formidable and expensive task, but it can be completed if goodwill is achieved and all the resources of modern technology are applied. Although the Food and Agriculture Organization of the United Nations can undoubtedly afford great assistance, the chief driving power must come from within India itself. Education is thus one of the prime necessities; but the educational plan will have to reckon with the devil of politics and the deep sea of religion.

References

Aykroyd, W. R. (1941). *Nutr. Abstr. Rev.* **11**, 171.

Blacklock, D. B. (1943). *Brit. med. J.* ii, 805.

Carr-Saunders, A. M. (1936). *World Population: Past Growth and Present Trends.* Oxford: Clarendon Press.

Famine Enquiry Commission (1945, 1). *Report on Bengal.* Delhi: Government of India Press.

Famine Enquiry Commission (1945, 2). *Final Report.* Delhi: Government of India Press.

Health Survey and Development Committee (1946). *Report.* Delhi: Government of India Press.

Keele, K. D. and Bound, J. P. (1946). *Brit. med. J.* i, 77.

Ladejinsky, W. (1939). *Foreign Agric., Wash.*, **3**, 321.

Ladejinsky, W. (1942). *Foreign Agric., Wash.*, **6**, 265.

McCarrison, R. (1936). *Nutrition and National Health.* Cantor Lectures. London: Royal Society of Arts.

Marriott, H. L. (1945). *Lancet*, **248**, 679.

Moore, C. V., Vilter, R., Minnich, V. and Spies, T. D. (1944). *J. Lab. clin. Med.* **29**, 1226.

Morris, J. N. (1945). *Lancet*, **248**, 743.

Mukerjee, R. (1938). *Food Planning for Four Hundred Millions.* London: Macmillan and Co.

Nutrition Advisory Committee of the Indian Research Fund Association (1944, 1). *Report of Eleventh Meeting.*

Nutrition Advisory Committee of the Indian Research Fund Association (1944, 2). *Report of Twelfth Meeting.*

Taylor, G. F. and Chhuttani, P. N. (1945). *Brit. med. J.* i, 800.

Thomson, A. M., Verma, O. P. and Dilwali, C. K. (1946). *Indian J. med. Res.* **34**, 131.

Wilson, D. C. and Widdowson, E. M. (1942). *Indian med. Res. Mem.* no. 34.

Poverty Lines and Standards of Living

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Just before the War the International Labour Office (1938) published a report on *The Worker's Standard of Living*, reviewing the many official and academic inquiries conducted on this topic in different countries over a long period of years. One of the main methods used is that of

> "Setting up *standard budgets* for population groups at different levels of income. . . . It would seem that there is a tendency to accept three levels of such budgets for the working population, namely (1) a subsistence level; (2) a decency level; and (3) a comfort level. . . . In most countries the tendency is to regard the actual level of living of the common labourer as the subsistence level and the level of living of the skilled worker as the decency or comfort level. As a result, it is possible to draw a *poverty line* which lies below or near the subsistence level, and thus to grade the population of a country into four main groups of (1) those below or at the poverty line; (2) those on a subsistence level; (3) those on a level of decency, and (4) those at the comfort level."

Just as on a passenger ship or train, the journey of life can be made, according to the money available, in one of three classes. Third class, the poverty line, affords subsistence but not decency; second class provides decency but not comfort; and it is only at first class fares that comfort begins to be enjoyed. Every country has its own standards. The British version of the lowest level, giving subsistence without decency, is 57 years old and of high academic standing. It is the poverty line, used in numerous social surveys and in evidence before Royal Commissions, wage tribunals and other official bodies as a line of demarcation between poverty and sufficiency. In recent years, as a result of advances in nutritional science and of many other influences to be considered in this paper, the classical poverty line has seemed to recede into the background. But it lives on, emerging from time to time heavily made up in the guise of an optimum diet or a scientifically determined standard of human needs.

Nutritional science arose out of practical needs, and there is an excellent and growing urge to apply its great scientific achievements to the problems of human life and society, of health and disease. But the road back from the laboratory to practice is full of pitfalls and difficulties of a kind quite unlike those met with in rat-feeding experiments or chemical purifications. Social science and social medicine cannot just be picked up casually. Not only does social medicine have its own body of data and techniques, the more difficult because they have not yet been properly worked out and systematized; but also, when one touches on human affairs, one touches on differing human interests within society, which, unless one is clearly aware of them and on one's guard, may distort one's conclusions into utter falsity. Some of these peculiar difficulties and dangers are admirably illustrated in the picaresque adventures of the poverty line.

The classical poverty line first appeared in 1889, in the initial volume of the monumental survey of the *Labour and Life of the People of London*, conducted by Charles Booth (1889). It was a time of economic distress and social agitation, of the rebirth of that political and industrial movement that now occupies the Government benches in the House of Commons. Booth, a wealthy shipowner and philanthropist, thought that the descriptions of poverty and destitution by the early socialist propagandists must be grossly exaggerated, and set out by patient large scale inquiry among the people of London to discover the true facts. He found the indictment of widespread poverty to be fully justified, and set about agitating for reforms, being notably influential in the demand for state pensions for the aged poor. In his assessment of want, he used a poverty line, not precisely formulated, but such that the expenditure of a family of father, mother and three children of 1, 6 and 8, just on the line, averaged about 22s. 6d. a week. With this as his yardstick, he estimated the incidence of poverty among London workers at just over 30 per cent. His lead was followed ten years later by another wealthy philanthropist, Rowntree (1901), who published his well-known *Poverty: A Study of Town Life*, describing a survey in 1899 of the conditions of the working class in York. Rowntree improved on Booth's technique by clearly defining his poverty line in terms of the minimum income required to provide for certain prescribed basic needs. He laid down a scale of minimum expenditure for food, clothing, fuel, sundries and rent for families of different compositions, and considered families receiving less than the amount so calculated to be living in "primary poverty".

For food, Rowntree constructed the cheapest diet that would provide the accepted minimum requirements of calories and protein. Vitamins were then unknown, as was the need for animal or first class protein. Butcher's meat was left out entirely, and bread was presumed to be baked at home. A substantial proportion of the scanty milk allowance was skim milk. The average retail prices in York were used in pricing, except where the Co-operative price was cheaper. Clothing was the minimum necessary for decency, all presumed to be bought secondhand. The coal allowance was less than 2 cwt. a week, priced well below prevailing cost. Rent was taken as that actually paid. For all other expenses, including soap, lighting, household equipment, fares, recreation and expenses in sickness, a sum of 2d. per head per week was allowed. For the standard family of a couple and three children, paying average rent, the poverty line budget worked out at 21s. 8d. a week, comparing closely with Booth's 22s. 6d. a week for London ten years earlier, when the cost of living was slightly higher.

Rowntree makes it quite clear that he in no wise regarded his poverty line budget as a standard of sufficiency. His purpose was to shock the complacency of the public, and he purposely fixed his criterion as low as possible in order to blazon the fact that even at this Spartan level there was a substantial section of the population below the line. He later showed his opinion of the utter inadequacy of the poverty line by setting up a considerably higher standard as the least that human beings could possibly be expected to live on. The task of transforming Rowntree's poverty line into a standard of sufficiency was performed by other men.

The next three moves were made by the London School of Economics. In 1915 there appeared *Livelihood and Poverty* by Bowley and Hurst (1915), describing surveys of working class households in Northampton, Warrington, Stanley and Reading a year or two prior to the war of 1914–18. In 1925 Bowley and Hogg (1925) published *Has Poverty Diminished?*, an account of a post-war study of the same four towns, with Bolton added. In 1928 there commenced, under the direction of an impressive committee including Bowley and Beveridge, a vast *New Survey of London Life and Labour* (Smith, 1930), designed to assess the changes since the pioneer work of Booth. Surveys became fashionable, and soon the economics departments of the local universities were undertaking surveys of Merseyside, Southampton, Sheffield, Manchester, Bristol and elsewhere. All these efforts followed pretty much the pattern set by Rowntree. Family income was ascertained and compared with a poverty line, adjusted to the prevailing level of prices, but based, with various minor and unimportant tinkerings, on the list of minimal needs laid down by Rowntree in his shock-the-public budget of 1901.

There is, however, a profound change. In the hands of Bowley and his followers, the poverty line begins to appear as a measure of sufficiency. Here is just one out of the many possible quotations showing the process of transition. It is from Bowley and Hogg (1925):

> "An income at the minimum will, if the household is well administered with a good tradition of carefulness and a good standard of regularity, appear to provide the necessities and some of the amenities of life; other households with the same income will be squalid and in debt. To hold that the income is sufficient presupposes thrift and care."

So the onus is thrown on the moral character of the housewife, to provide "amenities" on an income designed by Rowntree to be small even for necessities. Very soon even this qualification was abandoned, and the conductors of surveys, usually after a preliminary caveat that the poverty line is merely an arbitrary measure, thereafter throughout their reports called an income over the line a "sufficient" income without any apparent reservation. In this form the poverty line passed into public life, purporting to be an established and accepted standard of human needs.

By this time such a standard had become an important public necessity. During the present century, under the influence of profound economic and political changes and especially of one of their manifestations, that broad movement of social protest and reform which was the true and only begetter of Booth's pioneer survey, the central and local organs of government have assumed functions and responsibilities that would have horrified the orthodox economists of the Victorian era. For a large and increasing proportion of the population, some public body has to decide on income, on how much it ought to be given to live on. First old age pensions, then national health insurance benefit and unemployment allowances, and more recently pensions for widows and orphans, are paid out of funds administered, and under schemes devised, by the State. Compensation for injured workmen, though paid by employers, is fixed in general by statute, and in individual cases by the courts. The exposure of the horrors of sweated industries led to the institution of trade boards, statutory bodies empowered to fix minimum wages for a substantial number of workers, lower wages being illegal. Similar machinery has

been set up for agricultural workers. In industries still subject to free competition and collective bargaining, the State has more and more assumed the role of mediator or arbitrator. In all these cases somebody has to make a decision on the question of what is the appropriate amount that this or that family ought to be paid.

The reasons for such decisions are never clearly stated, and the cash values of the various benefits and pensions seem on the surface to have been fixed in a haphazard fashion without any guiding standards or ideas. But deeper examination reveals an underlying harmony. Between 1912 and 1933 there grew up the conviction among academic economists that the poor ought, and could manage, to live on an income level allowing a family with three children the equivalent of 25s. a week at 1914 prices, say about 40s. a week just before the war of 1939. From professors of economics this conviction spread to the advisers who influence government policy, among whom, of course, professors of economics themselves hold an honoured place. So, without any undue publicity, allowances for the temporarily or permanently non-productive section of the population, the aged, widowed, orphaned, sick and unemployed, were fixed so as not to exceed the poverty line standard. Less could be given, but not more. The wheel had turned full cycle. Rowntree's intolerably low minimum of 1901 was transformed into the unattainable maximum in the troubled twenties and the hungry thirties following the first world war.

The first assault on the poverty line, no less effective because it was indirect, came from Rowntree. In his book, *The Human Needs of Labour*, first published in 1918 and revised in 1937, he makes no mention of his old poverty standard that other people were using as a measure of sufficiency, but sets out afresh to estimate the lowest level at which people should ever be forced to live (Rowntree, 1918, 1937). For a family of a couple and three children, Rowntree's "human needs" standard is about 40 per cent. above the poverty line, affording 53s. a week at 1936 prices against the 38s. a week of the lower scale. Rowntree makes it clear that his new standard is still not an optimum in diet, housing, or anything else. I shall have more to say later about the "human needs" standard, but its function, though not explicitly stated, was fairly clear from the beginning. The poverty line was appropriate for the unemployed. The "human needs" standard was a suitable minimum for the man in work, and in fact closely corresponded to the level of minimum wages being fixed by trade boards. It is the British version of the International Labour Office's (1938) second level, designed to allow decency without comfort.

Rowntree, in his "human needs" budget, retained the poverty line food figure, but increased the expenditure allowed on other items. During the hungry thirties, other and more powerful forces joined in an attack on the poverty diet. The new allies were strangely assorted. There were the biochemists and doctors, armed with the new knowledge that the human body needs a wide variety of amino-acids, vitamins and mineral salts, as well as its quota of energy-yielding foods, and that these dietary constituents could be obtained only from a varied and generous diet, including meat and fish, eggs and milk and dairy products, fruit and vegetables. There were the organized unemployed, labour and progressive movements, and reformers and philanthropists of all shades of

opinion, appalled at the widespread malnutrition at home and abroad resulting from the world economic crisis. And there were the agricultural interests for whom the economic crisis meant a glut of products, a slump in prices, and a shrinking market. All could and did unite in demanding that the findings of nutritional science should be applied in raising the dietary levels of the mass of the people, thereby abolishing hunger, improving health, and giving the farmer an assured and expanding market for his merchandise. Of the many phases of the fight against malnutrition, the only incidents directly relevant here are the British Medical Association Report in 1933, the League of Nations activity beginning in 1935, the publication of Orr's *Food, Health and Income* in 1936, and of the George standard in 1937 (British Medical Association, 1933; League of Nations Health Committee, 1936; Orr, 1936; George, 1937).

Orr's work is too well known to need elaboration here. The technique used was as follows: Sample budgets were collected giving the details of food expenditure of families at all income levels. The quantities of foodstuffs were translated into calories, protein, vitamins and mineral salts, and the figures so found were compared with the Stiebeling (1933) scale of dietary adequacy. He found that it is only at income levels of 20s. to 30s. per person, when about 10s. per head is spent on food, that a satisfactory diet begins to be enjoyed. About half the total population, including nearly three-quarters of the children of Britain, was getting less than the Stiebeling standard. These findings were admittedly based on rather small samples, but it is remarkable how closely they tally with a mass of other data, and the substitution for the Stiebeling scale of any other of the recognized standards makes no serious difference to Orr's general conclusions.

The League of Nations, in conjunction with the International Labour Office, issued a great deal of valuable factual material. The contribution most relevant here was the publication in 1936 of recommended diets of high nutritive value for children and nursing mothers (League of Nations Health Committee, 1936). The agricultural urge behind both Orr and the League of Nations is evidenced by the fact that they both give estimates showing that the nutritional improvements they advocate will lead to increased demand for the more expensive foods, milk, eggs, fruit and vegetables, butter and meat.

The episode that created most stir in Britain was the publication of a set of recommended diets, with costings, by a committee set up by the British Medical Association (1933), consisting mainly of doctors and advised by Professor Bowley. In contrast to the subsequent findings of Orr that at least 10s. a head had to be spent on food to obtain an adequate diet, the British Medical Association said it could be done on 5s. 11d. for a man, 4s. 11d. for a woman, between 2s. 8d. and 5s. 4d. for a child, and about 22s. for the standard family of a couple and three children.

The Nutrition Report of the British Medical Association is a most instructive example of how easy it is for the doctor or the laboratory scientist to go completely wrong when he ventures without due thought and inquiry into the field of social medicine. In constructing diets, there are three steps:

1. The specification of the amount of calories, protein, vitamins and salts to be contained in the diet;

2. The translation of these figures into quantities of foodstuffs, so chosen that it is possible for a housewife to turn them into meals which it is possible for normal people to eat;
3. The further translation of the quantities of foodstuffs into cash values, using the prices that the housewife would actually have to pay.

In the diets of the British Medical Association all three stages were shockingly scamped. It is commonly believed that these diets represent physiological optima. It is quite clear, however, that this is not so. To take one instance, milk for children, the report says:

> "It is considered that 1 pint of milk per day from the age of 1 to 5 years and of half a pint a day to 10 years constitutes a sufficient and safe quantity, but more could be given with advantage".

No quantities are specified for fruit and vegetables, only an expenditure on this item of 1d. a day for an adult and ½d. a day for a child. So the vitamin value of the diet must be gravely suspect. The indictment under this heading could be extended.

From the point of view of the housewife, the diets are completely unpractical. For instance, it was the pre-war custom in all classes in this country to eat about 5 lb. of bread per head per week, and to spread on it about 8 oz. of butter or margarine. But the British Medical Association diet no. 16, for two adults and three children, prescribes 8 lb. of bread a head with only 3 oz. of butter or margarine. Neither this diet, nor most of the others, contains any eggs. The list of absurdities could be greatly extended. So cogent were the criticisms under this heading that the British Medical Association asked a group of domestic science teachers to translate the diets into menus and recipes. The result, called *Family Meals and Catering*, was published in 1935 (British Medical Association, 1935). The experts did their best. They altered the diets out of all recognition. But to keep within the price limits, they had to prescribe so much cooking that they admitted the ordinary housewife could afford neither the time nor the fuel; they had to presuppose a limitless "store", from which "small items" like custard powder, sago, coconut and tins of tomatoes could be abstracted without cost; and they reduced the already derisory expenditure on fruit and vegetables, and advised also that adults should forgo all milk. Even so, the meals provided are obviously insufficient for normal appetites; and the pricing is conducted with the same debonair optimism as that in the main report.

So we come to the third stage, the translation of foodstuffs into cash values. Nobody has ever been able to buy the British Medical Association diets anything like as cheaply as the prices in the Report. This is partly due to the rather unfortunate coincidence that they did their pricing in June 1933, which happens to be the month in which the food index, at 114 (1914 = 100) was lower than at any other time since the war of 1914–18. By 1938 it had risen 24 points, to 138. But even in 1933 it could not be done for the money. The British Medical Association scales were based upon the lowest prices charged for the worst qualities of every article, as ascertained by several local medical officers. Various independent estimates are available. First, there were the monthly retail price figures of the Ministry of Labour. Then there was a number of

large scale inquiries by women's organizations into the cost of the British Medical Association diets. Thirdly, there were costings of these diets in connexion with several local nutrition surveys. Fourthly, there were the prices returned in the Ministry of Labour's inquiry into working class budgets in 1937–38 (Ministry of Labour, 1940, 1941, 1, 2). Costings from all these sources are closely concurrent, and agree that, after allowing for changes in price index, the British Medical Association diets would still cost from 10 to 20 per cent. more than the amounts stated in the Committee's report.

An appropriate final comment on these diets is provided by the data in Table 1.

In April 1939 the British Medical Association convened a conference on "The Wider Aspects of Nutrition". On page 40 of the report (British Medical Association, 1939), Viscount Astor, speaking on the agricultural aspect, gave, as "our additional consumer needs to raise our dietary to the optimum" the percentages shown in column 1 of Table 1. Dr. Crowden, who was a member of the British Medical Association Nutrition Committee, gives on page 33 figures for the actual national consumption of foodstuffs, and of the changes which would result if everybody were to switch over to British Medical Association diets. Percentages calculated from these figures are shown in column 2 of Table 1. Nobody at the conference appears to have thought the contrast at all odd.

TABLE 1.

ESTIMATED PERCENTAGE CHANGE IN NATIONAL CONSUMPTION OF FOODSTUFFS
(*a*) IF DIETS WERE RAISED TO OPTIMUM, AND
(*b*) IF DIETS WERE ON THE BRITISH MEDICAL ASSOCIATION STANDARD
(British Medical Association, 1939)

Foodstuff	(*a*) Viscount Astor's estimate per cent.	(*b*) Dr. G. P. Crowden's estimate per cent.
Milk	+80	−6
Butter	+40	−80
Eggs	+55	−78
Meat	+30	−29
Fruit	+120	−74
Vegetables	+85	−11

It was inevitable that the British Medical Association diets should lead to some revision of the old poverty line. This was carried out by a pupil of Bowley, R. F. George (1937). He added about 8s. 6d. to the poverty line figure for food, to allow the purchase of the British Medical Association diet plus some extra milk, and took off a shilling from the allowance for clothes.

It is clear that in 1935 and 1936 the stage was set for a real social effort to abolish malnutrition. But the opportunity was thrown away. There were two alternative paths for satisfying the farmers. One was to provide them with a greatly extended market by assuring every person the means to secure a fully adequate diet. The other was deliberately to restrict production and imports, giving the farmer his profits from artificially

maintained prices and Government subsidies. The second course was adopted. A large part of our food difficulties during the war and its aftermath arise from the voluntary blockade we imposed on ourselves in the pre-war years, instead of planning for plenty.

We come now to the latest development in our strange eventful history. The war brought a demand for a better world, and in 1941 the Government appointed a committee, under the chairmanship of Sir William Beveridge, which issued in November 1942 the celebrated Beveridge Report, now, with certain modifications, being passed into law (Beveridge, 1942). On page 89 the Report states:

"On the League of Nations dietary the weekly cost of food for a child at 1938 prices would be as follows:

0 to 5 years ..	4s. 6d.	10 to 14 years ..	7s.
5 to 10 ,, ..	6s.	14 to 15 ,, ..	7s. 6d."

Anybody can check these figures. Reliable retail price data are available in the Ministry of Labour monthly returns and the 1937–38 budgetary inquiry, which are in remarkably close agreement. Table 2 shows the computation for a child aged 5 to 10.

TABLE 2

COST OF LEAGUE OF NATIONS DIET AT 1938 PRICES FOR A CHILD AGED 5 TO 10

Costing for child aged 5 to 7

Type of Food	Intake		Price	Cost
	Daily	Weekly		
				s. d.
Protective foods				
Milk	1000 g.	12 pt.	6¾d. per qt.	3 4½
Eggs	1	7	1·9d. each	1 1¼
Meat, fish, liver or cheese ..	30 g.	½ lb.	1s. per lb.	6
Green leafy vegetables ..	100 g.	1½ lb.	2d. per lb.	3
Potatoes and other root vegetables	150 g.	2¼ lb.	6¾d. per 7 lb.	2¼
Cod liver oil	3 g.	¾ oz.	3d. per oz. wholesale	3
A source of vitamin C				
Raw vegetables or fruit ..		7 oranges	7 for 8d.	8
Supplementary energy-yielding foods				
Fats (butter, if possible) ..	20 g.	5 oz.	1s. 4¾d. per lb.	5
Cereals (calculated as bread)	100 g.	1½ lb.	9d. per 4 lb.	3½
			Total ..	7 0½

Child aged 5 to 7	7s. 0½d.
Extra for child 8 to 10	9¼d.
Child aged 8 to 10	7s. 9¾d.
Average, child aged 5 to 10 ..	7s. 5d.

The left hand side of the table gives the recommendations of the League of Nations (1936), with the actual daily quantities, for a child aged 5 to 7. I have converted them into weekly quantities in British units, and calculated the cost. At the foot of the table the extras recommended for a child aged 8 to 10 are similarly priced, and the average found for the whole age group.

The cost for a child aged 5 to 10 works out at 7s. 5d. against the sum of 6s. stated in the Report. Similar costings for children at other ages give the figures shown in Table 3.

TABLE 3

ACTUAL COST OF LEAGUE OF NATIONS DIET AT 1938 PRICES COMPARED WITH FIGURES IN BEVERIDGE REPORT

Age of child	Beveridge figure	Actual cost	Excess	
			Amount	Per cent.
	s. d.	s. d.	s. d.	
0 to 5 years	4 6	5 3	9	17
5 to 10 ,,	6 0	7 5	1 5	24
10 to 14 ,,	7 0	9 9	2 9	39
14 to 15 ,,	7 6	11 0	3 6	47

The League of Nations diet would cost between 17 and 47 per cent. more than the figures given in the Report. There is something odd here. There is something odd also, to anybody who has compared the two diets, in the statement on page 85 of the Report: "Although the constituents of the League of Nations and the British Medical Association diets differ, there is no marked difference in their total cost".

It is worth while looking a little more closely at the way the Beveridge scale was arrived at. This can best be done by a consideration of Table 4.

TABLE 4

COMPARISON OF STANDARD BUDGETS FOR MAN, WIFE AND THREE CHILDREN

Item	Bowley "Poverty line" Oct. 1936	George July 1936	Rowntree "Human needs" 1936	Beveridge 1938
	s. d.	s. d.	s. d.	s. d.
Food	18 8½	27 2	20 6	30 9
Clothes	4 3½	3 5	8 0	5 6
Fuel, sundries ..	4 8	4 9	6 0	4 9
State insurance	1 6	1 6	—	—
Personal	—	—	9 0	—
Margin	—	—	—	2 0
Total less rent ..	29 2	36 10	43 6	43 0
Rent	8 5		9 6	10 0
Total	37 7		53 0	53 0
	Per cent.			
Food / Total .. .. =	50	—	39	58
Food / Total less rent .. =	64	74	47	72

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TABLE 4—*continued*
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	Urban community	Rural community
	Per cent.	Per cent.
$\frac{\text{Food}}{\text{Total}}$ .. .. =	40	48
$\frac{\text{Food}}{\text{Total less rent}}$ .. =	45	52

The Beveridge scale was drawn up with the assistance of a sub-committee including Professor Bowley, Mr. George and Mr. Rowntree, each of whom is the sponsor of a standard budget of his own. These budgets, priced in 1936, are shown in the Table, together with the Beveridge proposals. Bowley's poverty line is given as recalculated by Carr-Saunders and Jones (1937) for the price level in October, 1936. The first point inviting attention is that the total sum on the Beveridge scale agrees exactly with the "human needs" standard. But the relative distribution of expenditure is widely different. Whereas Rowntree postulates that 39 per cent. of the money shall be spent on food, Beveridge prescribes 58 per cent. Now they cannot both be right. If a family is given 53s., it will spend it in the way it thinks best, in accordance with taste and social custom. How the money will be apportioned cannot be worked out *a priori*, but can only be discovered by social inquiry. The result of one such inquiry is given at the end of the Table, and these figures accord closely with a mass of other factual data. The average working-class family of this composition spends just over 40 per cent. of its income on food. In this respect, the "human needs" budget is realistic, while the Beveridge scale is completely Utopian. A family receiving the Beveridge income would not in fact spend 30s. 9d. on diet but on the average only about 21s., and would be on a correspondingly lower nutritional standard. Far from getting the League of Nations diet, it would be well below the British Medical Association level, the cost of which is shown in the George budget.

It is easy to make a shrewd guess as to how the Beveridge scale was arrived at. The nutrition experts on the committee held out for an increased allowance for food. They achieved, not indeed the League of Nations level, but a substantial advance on the poverty line figure. But between postulating a sum for food and ensuring that this amount is actually spent, there is an important step. Adequate provision has to be made for other expenses, not according to an assumed irreducible minimum or the *a priori* ideas of the investigator, but in the proportion in which people actually spend their money. The concession gained by the advocates of better nutrition was nullified by the paring down of the other items, so that the end result, in cash to the recipient, is back to the old Rowntree level.

Incidentally, the Table exposes the essential lack of realism of the method of assessing poverty or nutritional levels by means of an artificially constructed budget. The George standard has been used in surveys, and the investigators have assumed that families at this income

level were getting an adequate diet according to the British Medical Association scale, or if not, it was their own fault. The "human needs" standard was used by Rowntree (1937) in his second survey of York. He assumed that families at this level were spending about 8s. a week on clothes, or if not, it was their own fault. Any assessment of malnutrition or deficiency of clothing or housing conducted on these lines must be grossly misleading, unless the allocation of expenditure in the standard budget corresponds with that which obtains in real life. The only safe way of assessing the incidence of malnutrition by a family budget method is that used by Orr (1936); find out what people actually buy, and at what income level the diet reaches the postulated nutritional standard.

The Chairman would quite rightly pull me up if I tried to discuss the pros and cons of the Beveridge proposals as a whole, or of the legislation based upon them now before Parliament. Whether we have a scheme at all, and, if so, how much the contributions and benefits shall be, depend on many considerations other than ideal optimum standards of nutrition and other human needs, especially in a time of acute shortages such as the present. But it seems to me that a Society like this may and should discuss one thing, whether scales of food and other human needs widely believed to be scientifically determined optima, really are what they purport to be. The Beveridge scales, or the scales of benefits in the National Insurance Bill of 1946, may or may not be the most advisable, taking everything into consideration. But it would in my opinion be wrong and harmful to let them be accepted without critical and authoritative examination as scientific measures of optimum human needs.

References

Beveridge, W. H. (1942). *Social Insurance and Allied Services.* [Cmd. 6404]. London: H.M.S.O.

Booth, C. (1889). *Labour and Life of the People of London,* Vol. 1. London: Macmillan and Co.

Bowley, A. L. and Hogg, M. H. (1925). *Has Poverty Diminished?* London: P. S. King and Son, Ltd.

Bowley, A. L. and Hurst, A. R. B. (1915). *Livelihood and Poverty.* London: G. Bell and Sons, Ltd.

British Medical Association (1935). *Family Meals and Catering.* London: Brit. Med. Ass.

British Medical Association (1939). *Nutrition and the Public Health.* London: Brit. Med. Ass.

British Medical Association Committee on Nutrition (1933). *Brit. med. J. Suppl.* Nov. 25.

Carr-Saunders, A. M. and Jones, D. C. (1937). *Social Structure of England and Wales.* London: Oxford University Press and Humphrey Milford.

George, R. F. (1937). *J. R. statist. Soc.* **100,** 74.

International Labour Office (1938). *The Worker's Standard of Living.* Geneva.

League of Nations Health Committee. Technical Commission (1936). *Quart. Bull. Hlth Org. L.o.N.* **5,** 391.

Ministry of Labour (1940). *Minist. Labour Gaz.* **48,** 300.

Ministry of Labour (1941, 1). *Minist. Labour Gaz.* **49,** 7.

Ministry of Labour (1941, 2). *Minist. Labour Gaz.* **49,** 28.

Orr, J. B. (1936). *Food, Health and Income.* London: Macmillan and Co.

Rowntree, B. S. (1901). *Poverty: a Study of Town Life.* London: Macmillan and Co.

Rowntree, B. S. (1918, new ed. 1937). *The Human Needs of Labour.* London: Longmans, Green and Co.

Stiebeling, H. K. (1933). *Misc. Publ. U.S. Dep. Agric.* no. 183.

Smith, H. L. (1930). *New Survey of London Life and Labour.* London: P. S. King and Son, Ltd.

Discussion

Dr. B. Woolf: Professor Cathcart referred to the difficulties which would arise if there were an increase in the height of the masses of the people, as for instance in bench heights, but it does appear quite certain that a marked increase in height has already taken place. Thus it has been shown that over the last 100 years the height of working-class boys and girls in England and Wales has shown an average increase of $5\frac{1}{2}$ inches.

I agree that it is necessary to do more experiments with human subjects, and much more could be done by the correct application of well established statistical methods.

Professor Cathcart: According to the records of heights of men in the American Civil War and in the first World War, very little change has occurred during the period between these two wars. An increase in the height of children is not the same thing and has not the same implication as an increase in the height of adults.

Professor G. M. Wishart (Institute of Physiology, University of Glasgow): Is the condition of toddlers better today than it was before the war?

Dr. N. Wattie: The condition of small toddlers has undoubtedly improved, but the improvement is not so great as with infants.

Sir Alexander Russell (Hazelwood, Chalton Road, Bridge of Allan): I do not know whether it is due to the shortage of rations or not, but the general tone of the papers today has been one of acute depression, and probably Dr. Thomson has had more reason for this than the other speakers. I have been in India for 32 years, and during the last 8 years of that period I saw some of the conditions there at close quarters as Public Health Commissioner for India. To my mind Dr. Thomson has given a most excellent summary of the conditions in India, both military and civil, one of the finest summaries I have heard for many a long day.

The one thing that stands out beyond all others in the Indian problem is that of population. In 10 years between the census of 1931 and 1941 the population increased by 50 millions, and the Government had therefore to provide food for an additional population greater than that of the British Isles. There is already some indication of a reduction in the birth rate, and I agree with Dr. Thomson that the rate will go down as the standard of living increases.

About 20 years ago, in Madras City, I investigated the birth rate of 20 castes over a period of about 3 years. There are some 200 castes in all. The high caste Brahmins had the lowest birth rate, 15·5 per 1000, and the Pariahs had the highest, 72 per 1000. The birth rate of Europeans in Madras City was 13·3 per 1000. This very low figure for the Europeans can be attributed to a number of causes. The Europeans were, after all, a selected group and were not truly representative. Their average age was high and many of them returned to Europe for the birth of their children. Compared with more typical European standards, the figure for the Brahmins is low and that for the Pariahs is very high. With such a figure for the birth rate as 72 per 1000 the death rate is never sufficiently

high to prevent a relatively rapid increase in population. I agree with Dr. Thomson that the only way to improve conditions is by education.

So that I may not close my remarks on a depressing note, I may say that in my long experience, which has been spread over 35 or 36 years since 1907, the standard of village life has markedly improved. Extensions of the present irrigation schemes may not now achieve much further in this direction, but progress in education is bound to lead to improvement.

It is often assumed that the standard of living in India is poorer than almost anywhere else, but I found the standards of village life in the European country of Yugoslavia lower than anything I saw in India.

Dr. A. M. Thomson: I have discussed the problem of population with Dr. W. R. Aykroyd of the Nutrition Research Institute, Coonoor, and we wondered whether we were right in meeting the population problem by improvements in the standard of living, since improvement in this direction may lead to a greater population followed again by a lowering in the general standards, a vicious circle being thereby created.

With regard to the rise in the standard of living which Sir Alexander Russell has observed during the last 35 years, is this in any way due to better nutrition and better housing, or is it not simply an apparent improvement caused by the greater availability of certain goods and the development of the cotton industry? Nutrition after all is still in its infancy. Dietary surveys show neither an improvement nor a deterioration.

Dr. G. Dunlop (Auchincruive, Ayr): Regarding Dr. Woolf's paper I wonder if it would be possible to have standardization of the various minimum nutritional standards. Perhaps The Nutrition Society might urge the United Nations Organization to obtain and establish some such standardization.

Dr. B. Woolf: It will always be difficult to get a standardization of this type. The one variable which can be fixed is total income, but one cannot fix how it will be spent. One cannot lay down the proportion to be spent on the different items such as food and clothes and expect people to abide by it. They will not do so unless the standards laid down happen to coincide with what they are accustomed to.

The way to obtain a standard for different countries is to find out in these countries, as Sir John Orr did here, at what level of income people do actually buy an adequate diet, and make sure that they have this amount, but to say what ought to be bought and how much money ought to be spent on different items simply will not work.

Dr. J. Pemberton: Under the present system of rationing we do get a certain amount of standardization throughout the population.

Dr. B. Woolf: I agree that it can be done in this way but not by postulating a certain sum per head. Education is one of the chief factors which can influence the way in which money is spent.

Dr. A. M. Thomson: I agree with Dr. Woolf that standards will vary from time to time and from place to place. We can have standards

established on a physiological basis for vitamin requirements when we know enough about them, but not on a financial basis.

Dr. B. Woolf: In the papers by Dr. Wattie and Dr. Pemberton the difficulty of disentangling the effect of such factors as overcrowding, low wages and size of family from nutrition by statistical methods has been mentioned. This disentanglement can be done, however, by the use of appropriate mathematical techniques.

In social medicine it is not often possible to experiment with human subjects to obtain the required information, but from the many records that are kept much valuable information can be obtained by the application of appropriate statistical methods. For Greater London, for example, where overcrowding and other factors are very serious in some places and not in others, the effect of each of a number of factors has been elucidated. Statistics do work!

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