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DEPARTMENT OF HEALTH AND SOCIAL SECURITY

Reports on Public Health and Medical Subjects

No. 123

Interim Report on Vitamin D
by the Panel on Child Nutrition

First Report by the Panel
on Nutrition of the Elderly

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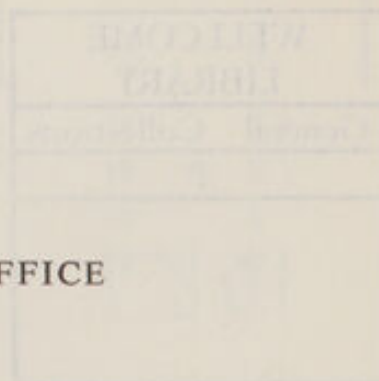
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PREFACE

This Grey Book contains two reports of expert Panels of the Committee on Medical Aspects of Food Policy, the Panel on Child Nutrition which examined our system of fortification of foods with Vitamin D, and the Panel on Nutrition of the Elderly which has evaluated the available evidence on the nutrition of elderly people living independently or with relatives. The two reports have in common that they deal with business which is still unfinished, each Panel having reached a stage where it is convenient to report interim findings rather than await the evidence of further extensive fieldwork. There however the resemblance between the two ends, for the Panel on Child Nutrition is dealing with a successful preventive method of long standing but supported by qualitative rather than quantitative evidence, whereas the Panel on Nutrition of the Elderly is studying a subject of increasing importance on which little research has been done.

The use of cod liver oil or Vitamin D concentrates for the prevention of rickets is of long standing—almost part of folk lore in Britain. But the addition of Vitamin D to dried and evaporated milks and to other milk-based preparations intended for babies and the fortification of cereal-based infant foods has become general in the last twenty years, and in 1957, because of a fear that idiopathic hypercalcaemia of infancy might be caused by consumption of excessive amounts of Vitamin D by sensitive individuals, steps were taken to limit the extent of Vitamin D supplements from all sources. Margarine, another fortified food, is also less often eaten than it used to be. Thus account has to be taken not only of new knowledge bearing on the amount of Vitamin D that can and should be consumed, but also of changes in the pattern of our diet. The Panel has clarified admirably the consequent complexities and finally poses a question which needs to be resolved by further research. There are pockets of overt rickets which the Panel feels can be dealt with by comparatively simple means but there may be a more widespread prevalence of "subclinical deficiency of vitamin D" which would require further modification of our present system for preventing deficiency. Here we enter a field where radiologists disagree one with another as to the interpretation—or indeed even the existence—of small departures from normal appearances on X-ray films, the situation being yet further complicated by the absence of any clear cut relationship between such findings and abnormality as it is detected by the biochemist. It might be said that if there is this disagreement among the experts, the condition, if it exists at all, cannot be very serious; but we know too little of the long term effects to accept such a facile conclusion without further investigation, difficult as that may be.

The Panel on Nutrition of the Elderly worked under the special disadvantage that too little research has been done throughout the world upon the ways in which malnutrition in the old and the young may differ. In particular, in ageing

tissues the effects of prolonged mild deficiencies might only clear up very slowly; also it may be that manifestations which are now regarded as inevitable concomitants of senescence may prove to be preventable by better food. There are few tasks more difficult than to evaluate evidence from which something may be missing without any clear lead as to what its nature might be, and the judicious and objective attitude of the Panel impels respect. The Panel leaves us with a triple recommendation—more research, more fact-finding and more practical trials of the various means by which old people can if necessary be better fed. Fact-finding nutrition surveys began in October 1967 and their results will give a sound basis for the consideration of practical trials and the formulation of policy.

Like the majority of reports of expert Panels of the Committee on Medical Aspects of Food Policy, these two reports result from much time and thought given freely and willingly by some of the leading experts of this country in their special fields, to all of whom we are much indebted. They are exploring an area in medicine where objective measurements have not been devised and too often assertions of opinion are made with unjustifiable confidence. This painstaking work may have great significance for the future and is steadily bringing us towards a more rational nutritional policy.

G. E. GODBER

Chief Medical Officer

PANEL ON CHILD NUTRITION

The terms of reference of the Panel are:—

“To consider such aspects of the nutrition of young children as are referred to them by the Committee on Medical Aspects of Food Policy or the Standing Medical Advisory Committee” and one of the first of these when the Panel met in June 1965 was “to take stock of events following the implementation of the advice of the Joint Sub-Committee on Welfare Foods (1957) and to advise on whether any changes are now indicated”.

The Members of the Panel on Child Nutrition are:

Chairman

Dr. J. H. F. Brotherston	Chief Medical Officer, Scottish Home and Health Department, Edinburgh
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Members

Dr. W. T. C. Berry	Department of Health and Social Security, London
Dr. W. F. J. Cuthbertson*	Glaxo Research Laboratories Limited, Greenford, Middlesex
Professor C. E. Dent	Department of Human Metabolism, University College Hospital Medical School, London
Dr. J. V. G. A. Durnin	Institute of Physiology, University of Glasgow
Dr. Patricia Herdman	Department of Health and Welfare, Buckinghamshire County Council, Aylesbury, Bucks
Miss D. F. Hollingsworth, O.B.E.	Ministry of Agriculture, Fisheries and Food, London
Professor J. H. Hutchison, O.B.E.	Department of Child Health, University of Glasgow
Dr. J. A. McEwan	150 Walworth Road, London, S.E.17

*Dr. Cuthbertson subsequently retired owing to pressure of work.

Dr. A. E. M. McLean	Department of Experimental Pathology, University College Hospital Medical School, London
Professor T. Oppé	Paediatric Unit, St. Mary's Hospital Medical School, London
Dr. R. Passmore	Physiology Department, University of Edinburgh
Dr. R. C. M. Pearson	Health and Social Services Department, Newcastle-on-Tyne
Professor C. E. Stroud	Department of Child Health, King's College Hospital Medical School, London
(Secretary) Dr. Edna LaC. Murphy	Department of Health and Social Security, London

INTERIM REPORT ON VITAMIN D

Historical

1. The system by which, up to 1957, Vitamin D was supplied in the diets of children was set out in detail in the Report of the Joint Sub-Committee on Welfare Foods (Central and Scottish Health Services Councils, 1957). Here, all that is necessary is a brief resumé with a more extensive consideration of subsequent events.

2. In 1940, Vitamin D was supplied free under the Welfare Foods Scheme in the form of cod liver oil, containing 400 i.u. per teaspoon dose and later (1942) 800 i.u. In 1945, following an investigation by the British Paediatric Association into the incidence of rickets, National Dried Milk was fortified to a level of 280 i.u. of Vitamin D per ounce of milk powder. At some stage which may have varied considerably between manufacturers, and presumably depended upon the availability of synthetic Vitamin D, rusks and cereal-based foods intended for infants were also in many instances fortified with various amounts of the vitamin.

3. After the war a further factor encouraged an increased intake of Vitamin D. Because of the difficulties and inaccuracies of assay methods it was hard for manufacturers to be sure that the amounts of Vitamin D which they declared upon their labels were still present after processing and storage, and, in order to make sure, an "overage" was added, not only to National and other Dried Milks but also to many brands of infant cereals and rusks. This "overage" could amount to 100 per cent of the declared vitamin content.

4. Lightwood (1952) then reported the occurrence of a syndrome of "idiopathic hypercalcaemia of infancy" which resembled intoxication through Vitamin D overdosage but often occurred in association with smaller doses than had hitherto been regarded as toxic. Other workers (for example, Stapleton, MacDonald and Lightwood, 1957) also encountered the condition, and in 1956 the British Paediatric Association, having circulated all its members, reported that in a thirty-month period from 1953-55 a total of 216 cases was encountered, i.e. a case-incidence of 7.2 per month.

5. Though the cause of "idiopathic" hypercalcaemia was (and still is) uncertain, there was circumstantial evidence in favour of Lightwood's view that it resulted from moderate overdosage with Vitamin D of individual children who were, for some reason, especially hypersensitive, and because of this, and of the often catastrophic effects of the disease, the Joint Sub-Committee on Welfare Foods was convened under the chairmanship of Lord Cohen of Birkenhead to review (*inter alia*) the system of fortification of infant foods with Vitamin D.

6. The Sub-Committee advised drastic reductions in the amount of Vitamin D added to Welfare Cod Liver Oil, National Dried Milk and all other fortified milks, and to rusks and cereals. Intakes of Vitamin D were approximately halved. An experiment on a national scale was thus begun to test the hypothesis that hypercalcaemia was due to excess of Vitamin D.

7. The report of the Sub-Committee was published in 1957 and already manufacturers had begun to act in the light of its advice. By the year 1959, it was felt that all the old products must virtually have been cleared from the retailers, and the British Paediatric Association once more canvassed its members as to the

number of cases of hypercalcaemia encountered. A negligible fall (6.8 cases per month as compared with 7.2 in 1953-55) was reported (British Paediatric Association, 1964).

8. To complement this information, the Ministry of Health undertook a survey of consumption of Vitamin D by infants. Though overall intakes were estimated to have at least halved, some were still high largely because certain proprietary preparations continued to provide 800 i.u. with no warning on the label that less should be given if a fortified milk was being consumed. Steps were later taken by the manufacturers to rectify this.

9. The British Paediatric Association repeated its enquiry and reported that in 1960-61 a substantial fall in hypercalcaemia (to 3.0 cases per month) had occurred. Though the reason for the delay in this fall in incidence is unclear, it does seem reasonable to infer that there is some relationship between "idiopathic" hypercalcaemia of infancy and Vitamin D overdosage.

10. Whereas in respect of hypercalcaemia, there was a national baseline of data collected before 1957 against which to assess the effects of the changes in Vitamin D, none such existed in respect of rickets. The Joint Sub-Committee on Welfare Foods collected evidence from a limited number of paediatricians in Britain who had during the previous two years, encountered some 22 cases of rickets under the age of 2 years; all had encountered at least one case.

11. In 1960-61, the total of rickets (in non-immigrants) reported to the British Paediatric Association (1964) by all paediatricians in Britain was 1.5 per month and in 1961-62, 1.0 per month. Without prejudice, therefore, to the absolute prevalence of rickets in Britain, the advice given by the Welfare Foods Sub-Committee appears to have had the effect of more than halving the incidence of hypercalcaemia without any appreciable increase in rickets.

Work of the Panel

Evidence

12. The Panel sought evidence bearing particularly on the following:—

- (1) The prevalence of overt rickets.
- (2) The prevalence of Vitamin D deficiency without clinical rickets. A scarcity of overt rickets does not preclude a wider prevalence of a deficiency of a degree too mild to be detected by the clinician.
- (3) Dietary supplies of Vitamin D.
- (4) The question of hypercalcaemia. It was felt that much time might be spent if a countrywide enquiry, as in 1959-62, were repeated. Hypercalcaemia is considered later in this report on the basis of published work and of study of the case-reports made by the paediatricians in 1959-62, but fresh evidence was not sought.

Overt rickets

13. As said, the number of cases of rickets reported by paediatricians in the British Paediatric Association's enquiry of 1959-62 was only 1 to 1.5 per month in the entire country. The Ministry of Health (Bransby, Berry and Taylor, 1964)

reported that Medical Officers of Health were aware of a small number of additional cases, but still, it emerges that little was known of overt rickets. Arneil and Crosbie (1963), however, reported that between 1959 and 1962 thirty-two cases had been diagnosed at the Royal Glasgow Hospital for Sick Children as being florid rickets and in 1964, Arneil, McKilligin and Lobo (1965) reported twenty-four cases.

14. The cause appeared to lie, in part, in a tendency for mothers to feed their babies on liquid pasteurised milk which is, of course, not fortified with Vitamin D. In part, also, it arose (in the view of Professor Hutchison and Dr. Arneil) from a delusion of some mothers that among vitamin supplements vitamin C-containing preparations only were needed to secure health for their babies. This delusion appeared to arise from television advertisements for such products which stressed their virtues but (naturally enough) did not make the point that Vitamin D was also required.

15. Other Scottish paediatricians do not appear to have shared the Glasgow experience of rickets, either at the time or later, though all must subsequently have been very alert for rickets. In 1963 (and again in 1966) the Ministry of Health wrote to Medical Officers of Health of several industrial cities and these indicated that their experience of rickets continued to be low. In 1966, in nine cities with a total of about 58,000 births, thirty-four cases were known to the Medical Officers of Health. Despite the efforts made in Glasgow, Dr. Arneil and Professor Hutchison (personal communication to the Panel) encountered at least twelve cases of overt rickets in 1966 in Glasgow; of these, eleven were aged eighteen months or over, and this tendency for rickets, when it has been encountered, to be in older children is one of the features of rickets in Glasgow. In London one of our members, Dr. Stroud, found twenty-one cases of rickets with obvious X-ray findings and high alkaline phosphatase levels. Twenty of these were immigrant children.

16. The Scottish paediatricians on our Panel expressed the view that Glasgow, as a result of poor buildings, polluted atmosphere and other causes, represents a "special case" (as evidenced for example by its high infant mortality). The distribution of overt rickets in Britain appears to be in pockets, some geographical, some perhaps racial, existing in the midst of areas of apparent freedom from the disease. The report of the Glasgow paediatricians that rickets continues to be encountered in Glasgow is perturbing in view of the immense efforts made by the public health personnel of this city to reduce the incidence of rickets.

Sub-clinical vitamin D deficiency

17. The Panel decided that the most informative evidence would be from determinations of the serum alkaline phosphatase level in representative samples of children. During the spring of 1966 the Ministry of Health organised collections of blood from representative samples of children aged 12-24 months in rural Buckinghamshire and Newcastle, and alkaline phosphatase was determined by the Bessey Lowry method. In doing so, the Ministry reported that it had encountered difficulty in standardising its results and this was subsequently traced by the Ministry (MacWilliam, Moody and Silk, 1967) to a defect in the Bessey Lowry method. Hausamen *et al.* (1967) have independently reported the same experience. No doubt it will be gratifying for hospitals and field workers to know that the defect

has been detected, but the current position, in our view, is that there are no reliable norms for microdeterminations of alkaline serum phosphatase by this method. In 1963, the World Health Organization considered the problem of detecting sub-clinical deficiency of Vitamin D in populations and stated "The serum alkaline phosphatase level in groups of children is not a generally accepted criterion . . . the relationship of this enzyme in serum with lesser degrees of Vitamin D deficiency has not been established." (World Health Organization, 1963). This would still seem to be the case.

18. In the 1943 survey made by the British Paediatric Association, X-rays were the main source of evidence (British Paediatric Association, 1944); but in those days no issue of harm arising out of X-rays had been raised. The Ministry took opinion on a proposal to repeat a survey on a wide scale and accepted advice that on grounds of principle this was not desirable.

19. Ultimately, there may be evolved a system by which valid serum phosphatase tests are used as a screen, children with abnormal values being X-rayed. But preliminary trials of such a procedure using material from the Ministry of Health and other studies revealed disagreements between radiologists and between findings of the same radiologist on two occasions as to whether a marginal degree of rickets was or was not present; in addition, in material submitted to the Panel by Dr. Alwyn Smith of the Social Paediatric Research Group, Glasgow, the biochemical and radiological determinations appeared to conflict in that about half the cases diagnosed as marginal rickets by one radiologist had normal serum phosphatase levels (King Armstrong micro-method). Since active rickets is invariably accompanied by increased osteoblastic activity, which in its turn is reflected in an increased amount of phosphatase in the serum, this finding requires elucidation before it can be accepted without reserve. It is the Panel's view that before satisfactory ways can be evolved of determining the incidence of latent rickets in representative samples of children, a good deal of fundamental investigation will have to be done on the inter-relationships between the various tests that are indicative of Vitamin D deficiency. An expert group has been appointed to deal with this complex problem. In the meantime, the Panel is not in a position to produce evidence on the prevalence of sub-clinical deficiency. All that can be said is that insofar as it existed in Glasgow, Newcastle and rural Buckinghamshire, its manifestations were such that radiologists disagreed and biochemists disputed as to whether it was or was not present.

Dietary evidence

20. In 1960, as already stated, the Ministry of Health made an investigation through fifty local health authorities throughout England of the consumption of Vitamin D by children under the age of one year. These results have been reported (Bransby, Berry and Taylor, 1964) and are shown in the following Table which is taken from their paper.

Intakes of Vitamin D (i.u. per day) consumed by infants taking some dietary source in 1960, showing the average intakes for the lowest and highest quantities of intake in each age group

Age	Group	i.u. per day from				
		Milks	Cereals	Cod-liver oil	Prop. preparations	Total
0-3 months	Lowest quarter*	203	2	17	0	222
	Middle half	320	26	16	63	424
	Highest quarter	379	121	20	204	724
3 months	Lowest quarter	132	104	44	41	321
	Middle half	416	115	114	65	710
	Highest quarter	513	226	160	268	1,167
6 months	Lowest quarter	124	190	36	10	360
	Middle half	329	262	100	49	740
	Highest quarter	305	388	238	314	1,245
9-12 months	Lowest quarter	79	141	27	16	263
	Middle half	223	221	164	54	662
	Highest quarter	286	363	170	524	1,343

*That is, the average consumption of the 25 per cent of children aged less than three months with the lowest intakes of Vitamin D.

21. In 1963, the Ministry in a fresh survey studied the diets of children aged 9 months to 4 years 11 months, in Britain. That part of these findings (Ministry of Health, 1968) which was relevant to the Panel's work has been considered among the evidence. In addition, the Panel had evidence relating to May-June 1965 on the kinds of Vitamin D-containing foods eaten in Scotland at ages 3 months, 6 months and 1 year, obtained by the Scottish Home and Health Department, and in Britain in relation to 1963 collected by and made available to the Panel through the courtesy of a commercial firm. The latter two studies differ from the former in that an estimate of the quantity of Vitamin D consumed cannot be made, but are useful in indicating, for example, to what extent the practice of early feeding of liquid milk exists outside Glasgow (where, as already said, it was judged to be a factor in the development of overt rickets).

22. In considering such dietary evidence, it is always necessary to remember that the accuracy of the information is dependent upon the word of the mother. The hazard involved is illustrated in the two Ministry of Health surveys, which overlapped at ages 9-12 months (only) and in which the amounts of Vitamin D reported as consumed in the 1960 survey are substantially greater than in the 1963 survey. The information relates to different years (1960 and 1963) and the numbers are small, but it is unlikely that these are causes of the differences reported nor can the difference be ascribed to the reduction in the amounts of

Vitamin D in certain medicinal preparations referred to in paragraph 8, which occurred after the 1960 survey. Rather, the difference is likely to have arisen out of the different methods of investigation adopted; in the one, health visitors asked mothers questions directly related to a limited number of Vitamin D-containing foods and medicinal preparations and these, perforce, must have been leading in nature, whereas in the second, a record of *all* food consumed was kept under the supervision of lay investigators; thus, no special attention was drawn to Vitamin D-containing foods. (Also, though mothers were asked to record it, not all may have regarded the administration of vitamin preparations as part of *feeding*.) The truth as regards intakes may well lie somewhere between the two sets of findings. The most relevant findings are given as the Table in paragraph 20 and shown in the diagram. From these, and from the Scottish study and that made by the commercial firm, the impression emerges that *nearly* all babies receive variable but substantial amounts of Vitamin D during the first 6–12 months of life, but thereafter the intakes of some children must be well below the allowance of 400 i.u. put forward by most countries. The recommended allowance is not, of course, to be interpreted as synonymous with the requirement for Vitamin D. Rather, it is the amount above which it can with fair confidence be said that no benefit will accrue.

23. During the first year fortified milks and fortified cereals supply important amounts of Vitamin D. From the second year on this is no longer so. Once the foods which are specially intended for infants are no longer consumed, the only fortified food in the diet is margarine, of which the consumption is variable and in any case less than it once was. As the histograms show, intakes of Vitamin D are substantially lower in the second year of life and subsequent years.

24. The Scottish survey of feeding practices was analysed differently from the British (commercial) study and it is not easy to compare the two. In Scotland 2.7 to 27.7 per cent of all children under 3 months were fed liquid milk depending on the locality (Arneil, 1967). In the British survey 2.8 per cent of children aged 0–3 months had been given cow's milk on the previous day; by 3–5 months and 6–8 months, these figures had risen to 16 and 33 per cent respectively. Both reports indicate that most of those who did not drink fortified milk received some additional Vitamin D, for example in infant cereals consumed in unstated amounts.

"Idiopathic" hypercalcaemia of infancy

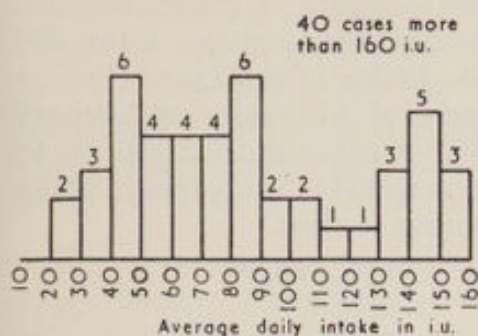
25. The British Paediatric Association's Report (1964) "Infantile Hypercalcaemia, Nutritional Rickets and Infantile Scurvy in Great Britain" stated that 80 per cent of cases of hypercalcaemia occurred in the first six months of life. Although the reported cases could not clearly be divided into "mild" or "severe" types it appeared that at least 8 per cent were "severe". Twenty-eight per cent of fifty cases reported between 1960 and 1961 were stated to have received no Vitamin D supplements before the onset of the disease. Nearly all of the fifty cases had had fortified milk and at least 40 per cent were receiving some additional form of Vitamin D supplementation. It was impossible to be sure from the records of the extent to which excess of Vitamin D might have been a cause of the hypercalcaemia. It is probable that an excessive post-natal intake of Vitamin

Number of children per 10 i.u. intake group given at the head of each column

9 months and under 1 year

Mean 222 i.u.

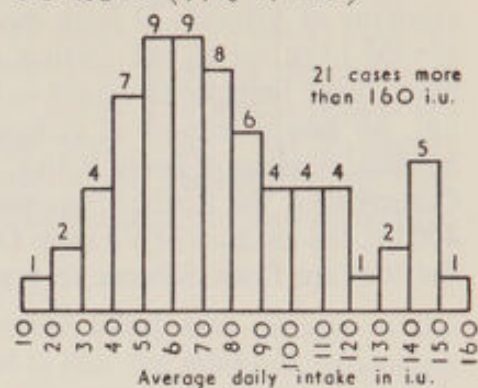
S.D. 221 i.u. (100% of mean)



1 and under 2 years

Mean 134 i.u.

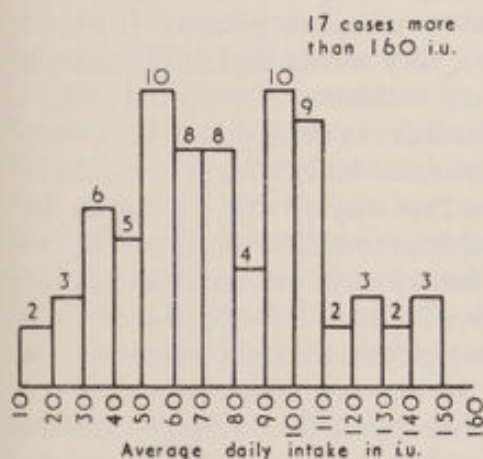
S.D. 132 i.u. (99% of mean)



2 and under 3 years

Mean 110 i.u.

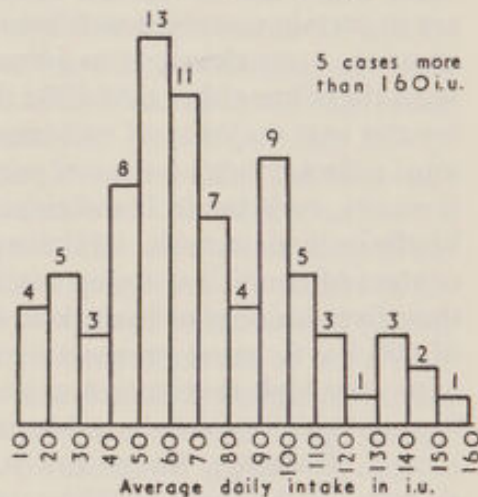
S.D. 88 i.u. (80% of mean)



3 and under 4 years

Mean 88 i.u.

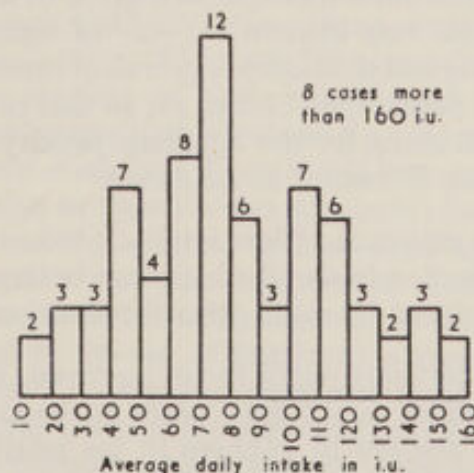
S.D. 80 i.u. (91% of mean)



4 and under 5 years

Mean 98 i.u.

S.D. 62 i.u. (63% of mean)



Frequency distributions of average daily intakes of Vitamin D (excluding supplements), taken from Ministry of Health survey in 1963 (Ministry of Health, 1968).

D is not the cause of the "severe" form of infantile hypercalcaemia but the possibility still exists that high intakes of Vitamin D may be an important factor in the pathogenesis of the mild form (Fraser *et al.*, 1966). If this is so, the action taken by manufacturers, on the advice of the Ministry of Health, to reduce the amounts of Vitamin D from medicinal preparations fed in the first year of life should have led to yet further reduction in the incidence of hypercalcaemia. Since these reductions would not have the effect of reducing intakes below 400 i.u., no added hazard of rickets arises. On the advice of the Committee on Medical Aspects of Food Policy, and with the approval of the Standing Advisory Committees, the further step was taken, in 1966, of reducing from 800 i.u. to 400 i.u. the amount of Vitamin D in the Vitamin A and D tablets supplied under the Welfare Food Scheme to pregnant and lactating mothers.

Discussion

The drawbacks of the current fortification system

26. From the evidence, it would appear that whereas the intakes of Vitamin D are in certain instances well below the 400 i.u. daily which is commonly recommended, overt rickets is to a considerable degree confined to pockets. It would seem therefore either that 400 i.u. must include a very substantial safety margin for the vast majority of children, or the very low incidence of reported rickets must reflect either a failure of paediatricians and others to recognise rickets when it occurs, or Vitamin D deficiency when it occurs must be in a form too mild to be clinically detectable. Of these possibilities, the first may be true, at least in the context of conditions today in this country in which most children spend less of their lives indoors or in dark streets beneath a smoky sky; moreover the figure of 400 i.u. is based presumably on the need to safeguard the occasional child with very high requirements, and upon the concept that maximal retentions of ingested calcium are desirable, which may not be the case. With regard to the second, Richards, Sweet and Arneil (1968) have stated that among cases of rickets seen by them in Glasgow some 90 per cent had not been recognised by their doctors; though insofar as failure of recognition can be a matter of not bearing in mind the possibility of rickets as a diagnosis, this ought to be much less likely in 1966 than it was in, say, 1964 as a result of the publicity given to rickets. Yet despite the attention that has been given to the disease the Ministry of Health enquiry yielded very little in the way of reports of overt rickets in England. Whether sub-clinical deficiency is prevalent cannot at this stage be said, for reasons apparent in paragraphs 17 and 19, so that the extent to which the third explanation may account for the apparent paucity of rickets in the face of low intakes of Vitamin D cannot be estimated.

27. Nevertheless, the existence of low intakes warrants consideration of the existing system of fortification to see whether it can be improved, or alternatively either augmented or replaced by some other fortification system.

28. On one count, it certainly ought to be improved. The practice of feeding young babies on unfortified cow's milk needs to be countered. This, in the Panel's view, has been assisted by changes in the relative prices of National Dried and liquid Welfare Milk in 1968 so that it is now economically advantageous to use the former.

29. It would also help if the purchase of National Dried Milk were made more convenient. At present National Dried Milk is sold at centres which are not always conveniently placed and whose hours make it difficult for some mothers to buy milk there. Finally, National Dried Milk is, in the experience of some of the Panel's members and that of the Consumers' Association (1961), liable to present difficulties in mixing, and attention needs to be given to improving its miscibility. Health visitors and midwives need to advise *specifically* against the practice of feeding young babies on unfortified cow's milk. The possibility should not be ignored of devising some scheme by which National Dried Milk might be replaced by proprietary brands of other dried milks made available at low cost under the Welfare Foods Scheme.

30. These measures would not however greatly affect two defects in the current system of fortification. The first of these is that the amounts consumed of fortified milks, rusks and cereals can and do vary widely from child to child, with the result that the intakes of Vitamin D range from amounts which are too low to be useful (unless rectified on subsequent occasions) to levels which are unnecessarily high. This is no reflection on the advice of the Joint Sub-Committee on Welfare Foods, which obviously under the circumstances had to use the tools to hand. The second drawback is that from the second year onwards intakes are low because, with the exception of margarine, none of the foods which are fortified is commonly eaten. The Ministry of Health's dietary survey of 1963 provided rather limited information on the extent to which the contribution made by margarine might be increased (because the extent to which margarine is used in retailed pastries and cakes is unknown), but even if the current level of fortification were doubled, and made applicable not only to retailed margarine but to that used in commercial pastry and cake making (which it is not at present), it seems doubtful whether an average increase of more than 30 i.u. per child per day would result. The use of dried milk in puddings etc. up to the third year of life and an increased consumption of rusks and cereals might increase the effectiveness of the present fortification system; advice to consume more eggs might lead to a modest increase in Vitamin D consumption. But those most likely to be at risk of rickets are also the least likely to take heed of advice on all these points.

31. This last consideration applies equally to the use of medicinal preparations. Although in Glasgow great efforts have been made by the health authorities to increase the consumption of Vitamin D preparations (as well as fortified milks and cereals) the number of cases encountered in 1966 by Professor Hutchison and Dr. Arneil (paragraph 15) shows that the problem of florid rickets has not been satisfactorily contained. Even had it been contained any system of fortification which is liable to impose extra demands upon, for example, health visitors should be avoided if it can be, because there are nowhere too many health visitors, nor have they too little to do; nor do mothers have an unlimited capacity for health education which they can absorb and will act upon. There is one further drawback to the use of medicinal preparations which deserves to be mentioned. A need to use one medicinal preparation to supplement the diet may encourage the use of other preparations which may not be needed. It should be possible to devise a system whereby optimal nutrition can in most circumstances be assured entirely by foods of a sort which are customarily eaten. This would not of course be practicable in certain situations, e.g. when the child

obtains most of its sustenance from the breast; and some alternative to cod liver oil ought in the Panel's view therefore to be provided under the Welfare Foods Scheme. Though cod liver oil has enormously improved in palatability over the years, the odium of its earlier taste remains. The Ministry of Health in conjunction with two local health authorities made a trial of mint flavoured cod liver oil, but the results were not outstandingly encouraging.

Possible alternative fortifications

32. Obviously, the systems of prevention in other countries are of some interest. In some, no food is fortified. Protection is presumably usually available by means of medicinal preparations, and it may well also be that where it is thought that this will be inadequate, "Stosstherapie"* is sometimes employed on the grounds that the probable benefit to the child outweighs the possible hazard of hypercalcaemia. This panel is not prepared to recommend Stosstherapie. U.S.A., Canada, Holland and West Germany to our knowledge make use of fortification systems, but in some countries the foods eaten by children may differ too much either in amount or nature for their experience to be directly applicable to the U.K., or there have either been or are under consideration changes in the amounts or sorts of foods fortified, presumably because of the difficulties of steering a course between rickets and hypercalcaemia. Time must pass before their systems can be evaluated. In the U.S.A. and in Canada, however, the fortification of liquid milk is, we believe, regarded as having been important in the prevention of rickets.

33. The vitaminisation of liquid milk, as well as dried and evaporated, under the Welfare Foods Scheme might be one way of overcoming drawbacks to the existing system of fortification. There are however a number of practical problems which would have to be considered before such a policy were implemented. Further, liquid milk is by law rigidly protected from any form of adulteration no matter how beneficial. Our investigations may well reveal the prevalence of sub-clinical Vitamin D deficiency to be so small as not to require action on such a scale; other measures (paragraphs 28, 29) might suffice.

Conclusion

34. Finally it must be emphasised that this is an interim report. Any consideration of the existing scheme of fortification to see whether it can or should be improved, or alternatively either augmented or replaced, must depend upon what the prevalence of sub-clinical Vitamin D deficiency is found to be. As stated in paragraph 19, the Panel will undertake the research that is in its view necessary. Whilst this may take some time, it needs to be remembered that the condition of sub-clinical Vitamin D deficiency which is being investigated is very mild, and that bowing of the legs and other symptoms associated with rickets proper are not present.

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*Administration, parenterally, of two massive doses of Vitamin D in the first and second months of life; there is then apparently no further need for the vitamin in the succeeding years.

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PANEL ON NUTRITION OF THE ELDERLY

The terms of reference of the Panel are:—

“to evaluate the evidence on the nutritional state and diets of the elderly”.

The members of the Panel on Nutrition on the Elderly are:—

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PANEL ON NUTRITION OF THE ELDERLY

FIRST REPORT

Introduction

1. Since nutritionists have never been able to define accurately the nutritional needs of the elderly, much of the approach has been by way of a search for evidence on malnutrition. Though the evidence is not as comprehensive as we would wish, it is in agreement with the supposition that overt malnutrition in the elderly is not common; there may however be a greater prevalence of subclinical malnutrition, and it is possible that a number of elderly may be at risk of being precipitated into malnutrition if their normal body-regulating mechanisms are upset by the onset of non-nutritional disease.

2. There are in addition a number of situations which may render old people peculiarly vulnerable to malnutrition, such as bereavement; unavailability (for any reason) of suitable foods or facilities; physical disability especially if coupled with lack of support from others; and severe stress or acute disturbances of mind or severe mental confusion affecting the will to self help—again coupled with lack of support. Such situations are particularly dangerous for the aged because of their low incomes compared with the rest of the population. In addition to these more general predisposing conditions, there should be mentioned a more specific one, the lack of, or ineffectiveness of, sunlight falling directly on the skins of certain old people, and predisposing them to osteomalacia, a condition which can be prevented by Vitamin D.

3. Nevertheless, there unquestionably emerged from the evidence of the consultant physicians to geriatric departments the impression that malnutrition, as the general public envisages it, is not at all common among the elderly. Indeed, there is still doubt as to the meaning and clinical importance (if any) of some of the manifestations which we studied under the head of "specific investigations". There is a very real need for comprehensive research of a fundamental nature into many aspects of the nutrition of the elderly.

4. The fact-finding nutrition surveys recently undertaken under the aegis of the Department of Health and Social Security and the Scottish Home and Health Department should provide a very useful basis for long-term planning upon the feeding of old people. Meanwhile this report is published to stimulate discussion and provide a preliminary basis on which those responsible for the social services can consider what measures for the elderly might practicably be developed.

Nature of Evidence

5. (a) Published and unpublished material from dietary surveys with or without medical or other information.
- (b) Evidence from consultant physicians to geriatric departments of hospitals.
- (c) Published and unpublished special investigations.

Scope of Report

6. This report deals only with the elderly living in their own homes either alone or with relatives and friends, over the period commencing about the age of 65 and ending either with death or inability to maintain independent existence at home. The elderly living in institutions present different sorts of problems which have not been considered in this report.

Definitions

Malnutrition

7. We define malnutrition as disturbance of form or function due to lack or excess of calories or of one or more nutrients. This implies a knowledge of normal values and their range by age and sex, and in the absence of this, a diagnosis of malnutrition can hardly ever be made on dietary evidence alone. Similarly, malnutrition can rarely be diagnosed solely on the basis of the levels of nutrients found in blood or tissue.

Overt and subclinical degrees of malnutrition

8. Malnutrition can be overt or its manifestations may be undetectable by the clinician, requiring to be revealed by special tests. Thus, for example, a patient with nutrititional osteomalacia may have no symptoms until he or she develops pain due to compression of vertebrae, fractures or sometimes deformities; yet in the asymptomatic phase the diagnosis might be made on the radiographic changes in bone, and the abnormal levels of serum calcium, phosphorus and alkaline phosphatase, together with their response to increased Vitamin D intake. It must not be supposed that because its manifestations may be difficult to detect, subclinical malnutrition is any the less important. Malnutrition, whether overt or subclinical, may arise primarily from the consumption of nutrients in amounts less than the subject requires, or be secondary to impaired absorption or utilisation, or to increased requirements, for example of iron due to bleeding. Malnutrition may also arise from reasons which can vary from inability to obtain the right food to mental confusion.

Marginal nutrition

9. We define marginal nutrition as a state wherein malnutrition as defined above is not present under normal circumstances but may result from stress. Because of the frequently impaired or precarious homeostatic mechanisms of some old people, infections or traumata may precipitate malnutrition which was apparently absent before.

Evidence

Dietary evidence with or without medical or other information

10. From surveys which have included a greater or lesser amount of dietary

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It needs to be remembered that the process of imparting to strangers sufficient detail about food habits imposes upon elderly people a considerable mental strain. Thus to some extent the methods used in some surveys might operate selectively upon the sample in that those who are capable of keeping a detailed record of their diets are likely also to be able to provide for themselves a reasonable diet, given adequate facilities. When studying the elderly, therefore, methodological problems arise to a greater degree than with other age groups.

13. Where the material permits comparisons to be made there is in general a decrease in caloric consumption with age. This is an accepted phenomenon (see for example the Report of the Committee on Calorie Requirements, Food and Agriculture Organisation, 1950). Part of this may be due to disease (e.g. arthritis) which may limit activity; part may however represent a reduction in active cell mass occurring as a result of ageing. The intake of nutrients when expressed as a percentage of calories consumed is in general fairly consistent at different ages (King's Fund Survey); i.e. the major reduction was in quantity rather than quality of the diet. The older subjects in the King's Fund Survey tended to be thinner; this is in accord with what has been reported in experimental animals fed *ad libitum* into old age (Widdowson and Kennedy, 1962).

14. A relationship between the percentage of calories derived from protein and the "general condition" assessed by the clinician was reported in the King's Fund Survey. "This is not to say that the diet must have affected the health. The reverse might equally be true" (Report, p.35). Though the average intake of protein was of the order of 1 g per kg body weight and the percentage of calories derived from protein was 12 per cent, the scatter of values around the mean was wide (36-93 g daily) at least during the week of the dietary investigation, so that it is not possible to exclude, from the dietary evidence alone, the existence of a deficiency of protein as being a cause of some of the clinical impairment observed. A negligible relationship between iron intake and haemoglobin level was found in the King's Fund Survey but there was a fairly firm indication that a part at least of the bone rarefaction which was encountered in 12 subjects contained an element of osteomalacia. In the studies by the Ministry of Health the least satisfactory diets were among the mentally ill and this is in accord both with expectation and with clinical experience. Kataria, Rao and Curtis (1965) found low white-cell ascorbic acid levels in the elderly, though those from elderly subjects living in their own homes were on average higher than for those resident in institutions. Apart from these findings, clinical examinations revealed little that could be interpreted as malnutrition.

15. In terms of dietary pattern also, whilst poor diets were encountered, "the popular idea that many old people who live alone exist almost entirely on bread, butter, jam, biscuits, and cups of sweetened tea was not borne out by this (King's Fund) enquiry". This is in harmony with the impression gained by Kataria (personal communication) and by the Ministry of Health's investigator.

Evidence from consultant physicians to geriatric departments of Regional Hospital Boards

16. Twenty-six consultant geriatric physicians throughout Britain supplied information on all patients admitted under their care from a given date. The

names and places of the consultants, and a specimen form of the enquiry are to be found in Appendix B (Table I). In all, returns from 1,367 elderly persons widely scattered over Britain were received.

17. In the preceding section the evidence relates to persons who, with more or less assistance, are able to maintain an independent existence. Some of the characteristics of the group of patients reported upon in this section need to be considered. Obviously, they are more liable to be malnourished than are the subjects who participate in dietary surveys, for whilst, in some, accident or acute disease has supervened upon a normal existence, in others the condition has been more protracted with a corresponding reduction in their ability to manage for themselves. Moreover, there are diseases such as cancer which can produce in the sufferer the effects of malnutrition no matter what foods may be to hand; the questionnaire to the consultant geriatricians was designed to enable these diseases to be distinguished where this was possible. For these reasons a prevalence of malnutrition was to be expected in this group greater than among the elderly in their own houses; but it is possible that malnutrition might be even more prevalent in a third group, namely, those about to be admitted into local authority welfare accommodation or to mental hospitals. In this group are individuals who may have become progressively less and less able to carry on in their own homes in the face of increasing physical or mental infirmity until some form of residential care has become unavoidable. Indeed, on the Panel's experience, when overt severe deficiency disease is encountered, it is frequently found that the subject is well known to the local authority whose efforts to keep the subject in good condition at home have in these instances proved unavailing. We took no special evidence from the doctors caring for people admitted to welfare accommodation, partly for reasons of practicability and partly because an independent study of the elderly awaiting admission to institutions has been carried out in Southwark by the National Institute for Social Work Training under the sponsorship of the Ministry of Health. It considered, amongst other aspects, dietary assessment.

18. In other words, a worse picture is to be expected from the consultant geriatricians' replies than would emerge from a sample of the elderly population at large, but not as bad as that which might be found in a sample taken at the time of admission to mental hospitals or welfare homes. An analysis of these findings is given in Appendix B, Table II. It includes two cases of overt scurvy. Among the cases of anaemia reported 7 were found to be due to deficiency of folate and/or vitamin B₁₂. In 35 cases anaemia was diagnosed as nutritional in origin, often as a result of an iron-deficiency in conjunction with a history of poor diet. The haemoglobin values (Table III) show a higher proportion of low values than is normally found, as might be expected in a sample of patients suffering from conditions sufficiently serious to warrant hospitalisation. It also includes a proportion of minor manifestations which may well have been indicative of malnutrition of a subclinical, or at least not obvious, nature. Oedema was common, but in the majority of instances was associated with some non-nutritional condition such as cardiovascular disease. This does not necessarily mean that the oedema was wholly non-nutritional, and it is of interest that in 50 cases the prime diagnosis was of cerebral arteriosclerosis, dementia, or similar disease which may have predisposed to malnutrition through neglect and apathy. But in general most hospitals reported very little in the way of malnutrition. This

point is raised again in the discussion, and details of the findings of this enquiry are set out in Appendix B, Tables II-VIII. In order to test the possibility that undernutrition might be specifically related to, for example, living alone, the proportion of thin people in relation to various social characteristics was also considered. There was some indication that persons living alone were more often thin but no relationship emerged between thinness and social class.

Special Studies

19. Of these there are a large number. Many of them relate to selected populations, for example admissions to hospitals or other institutions; the biochemical methods are by no means always comparable, and often the clinical significance of the findings is not clear. Nevertheless, out of findings of this sort the probable *character* of any deficiency disease which appears can be discerned, even though its *prevalence* cannot. The following findings seem to us to be of particular interest.

Bone rarefaction

20. Overt osteomalacia has been reported in 4 per cent of a series of routine admissions to hospitals of elderly women and in 16 per cent of others admitted with symptoms indicative of bone disease (Anderson *et al.*, 1966). An element of bone rarefaction related to deficiency of Vitamin D also appeared in the findings of the King Edward's Hospital Fund Survey (Exton-Smith, Hodgkinson and Stanton, 1966).

21. Chalmers and his colleagues (1967) describe the clinical features of 37 recently recognised cases of osteomalacia and they consider that the disease is not uncommon in elderly women, among whom it is liable to be confused with senile osteoporosis. The aetiology in their cases is believed to be dietary deficiency of Vitamin D, limited exposure to sunlight and mild degrees of malabsorption occurring either alone or in combination. They emphasise that treatment of osteomalacia with Vitamin D is rapidly and consistently successful, and well justifies a thorough screening of all elderly patients presenting with weakness, skeletal pain, pathological fractures or with diminished radiographic density of bone.

22. To what extent osteoporosis, as opposed to osteomalacia, is due to nutritional deficiency is uncertain; further research is needed. Elderly people may be at risk from Vitamin D deficiency due to lack of sunlight for two reasons: (a) many are house-bound, (b) they tend to be more completely covered by clothes than the younger age group.

Iron deficiency anaemia

23. In women, haemoglobin level is more closely correlated with menstrual loss than with diet (Elwood, 1968a). It is not surprising therefore that in Cardiff, Davis, Jacobs and Rivlin (1967) found that of 57 menstruating women 9 had haemoglobin levels below 12.0 g/100 ml, compared with 1 out of 41 post-menopausal women. Nevertheless other losses of blood are liable to affect the elderly of both sexes and iron deficiency is not uncommonly reported from the various investigations that have been made (Hobson and Blackburn, 1953;

Semmence, 1959; Parsons, Withey and Kilpatrick, 1965). Because of the frequency of iron losses from one cause or another, the extent to which iron deficiency is due primarily to diet is not easy to assess. However, Elwood (1968b) found intake of meat, but not of vegetables and bread, correlated to a statistically significant degree with haemoglobin in samples of women aged 30 to 39 years and 50 to 64 years. Other work (Hussain *et al.*, 1965; Moore and Dubach, 1956) using radioactive iron has indicated that the iron from meat or blood is about three times as well absorbed as is the iron from wheat or vegetable, and the possibility exists that a part of the anaemia present in some old people is a reflection of a low intake of meat. Against this there must be set the fact that, in a survey by Hobson and Blackburn (1953) in Sheffield, no special gradient of haemoglobin level was apparent in the elderly of either sex.

Deficiencies of folate and/or vitamin B₁₂

24. There have been reports of low serum folate or vitamin B₁₂ levels in the elderly in or about to be admitted to institutions (Read *et al.*, 1965; Batata *et al.*, 1967; Hurdle and Williams, 1966; Girdwood, Thomson and Williamson, 1967; Mollin and Ross, 1952) and of nutritional megaloblastic anaemia (Gough *et al.*, 1963; Varadi and Elwis, 1964; Forshaw, Moorhouse and Harwood, 1964, 1965). Although Girdwood *et al.* (1967) found no significant difference between folate levels in the young and old living at home in the working class area of Edinburgh, Hurdle and Williams (1966) found that 28 patients out of 72 over 70 years of age had serum folate levels of less than 5 $\mu\text{g/ml}$ and Batata *et al.* (1967) found that 75 patients out of 99 over the age of 60 had serum folate levels of less than 6 $\mu\text{g/ml}$. Such levels are often present without megaloblastic bone marrow changes but may be evidence of subclinical malnutrition; more research is needed. A relationship between deficiency of folate or B₁₂ and dementia has been reported (Strachan and Henderson, 1967) and it is possible that lack of either of these nutrients may be associated with part at least of the mental deterioration so common in the elderly.

Deficiencies of highly heat-labile water-soluble vitamins

25. The preparation of hot meals is not always achieved without destruction of substantial amounts of ascorbic acid and thiamine and consequently loss of palatability and acceptability (Platt, Eddy and Pellett, 1963). This is especially a problem of large-scale catering where food may unavoidably have to be kept hot for a time before serving, and therefore of institutional catering, meals services and the like. Levels of blood—or white-cell—ascorbic acid are consistently reported to be lower among the elderly than among other groups. (Andrews and Brook, 1966; Kataria, Rao and Curtis, 1965; Griffiths *et al.*, 1967.) That this is not a natural effect of ageing is indicated by the work of Bowers and Kubik (1965), Andrews, Brook and Allen (1966) and Griffiths *et al.* (1967) showing that by feeding with increased ascorbic acid the levels were restored to those of younger subjects.

26. Despite these low values, frank scurvy is not common (though most geriatricians encounter occasional cases during a year). Research is currently under way into indications that conditions short of frank scurvy exist among the elderly as a result of low intakes of Vitamin C and it would be wrong to anticipate its outcome.

27. Among elderly subjects living at home, as well as in hospital admissions, Griffiths *et al.* (1967) have reported that the effect of thiamine pyrophosphate upon the red cell transketolase activity (T.P.P. effect) was greater among the elderly than among younger volunteers, indicating a thiamine deficiency. Whilst this may technically meet the requirements of our definition of malnutrition, as being a manifestation of impairment of a function (of or in red cells), the clinical significance of this finding has still to be determined.

Deficiencies of nicotinamide and riboflavine

28. Overt deficiencies are rarely reported. Research on less obvious manifestations is in progress on patients in hospital (Brocklehurst *et al.*, 1968). One of the reasons why such deficiencies can arise is because old people sometimes do not consume the diet that is available for them. For example, milk contains substantial amounts of riboflavine but may not be consumed because a high fluid intake aggravates incontinence; in other instances meat may not be eaten because there is no one to cut it up and coax the old person to eat it.

Deficiencies of protein

29. The amounts of protein required by the elderly (or for that matter by younger adults) are still very much a subject of speculation, so that there can in fact be little if any firm evidence arising out of dietary studies. The proven clinical effects of protein deficiency in the elderly are usually limited to rather dramatic manifestations such as oedema arising either out of very low intakes of protein or, more frequently, as a phenomenon secondary to undernutrition (shortage of calories) wherein protein is burnt as energy. Undernutrition itself may occur among the mentally confused. Serum albumen is thought to be a more valuable index of protein deficiency than the total serum protein, but one of our members (E. W-W.) found that in a small group of malnourished and undernourished elderly people the mean serum albumen was at, but not below, the lower limit of normal.

The interpretation of evidence from special studies

30. The range and distribution of normal biochemical values are rarely known, even in younger subjects, quite apart from any effect upon these of the ageing process. Further, the relationship of biochemical findings to other possible manifestations of malnutrition is often not at all clear. Because of this it is very difficult to interpret much of the evidence from studies cited above. But it can be said that there is a general tendency for at least some groups of the elderly to have values which are on average lower than they are in younger persons.

Discussion

31. Whilst the evidence is too patchy and unrepresentative to enable a comprehensive picture to be obtained of the nutritional state of the elderly throughout Britain, there is a measure of harmony between the various sources which justifies certain generalisations. First, out of the three sorts of evidence there emerges consistently the fact that there is a small number of individuals who are obviously malnourished. All geriatricians are familiar with these. The Panel has listed (Appendix C) the conditions which particularly predispose old

people to malnutrition. They include such conditions as poverty, bereavement, mental deterioration, and social isolation.

32. But apart from this limited problem of overt malnutrition, there is a further more common group in which doubt arises as to whether a state of subclinical malnutrition may exist. In the dietary surveys the percentage of calories derived from protein is on average satisfactory but those in whom it was less than average were in less good "general condition" as judged by the clinician, though which was cause and which effect remains in doubt. Again the consultant physicians in geriatric departments found little malnutrition but those of them who had a particular interest in certain special aspects such as the levels of plasma proteins, or changes in the tongue papillae, reported a proportion of abnormal findings, and it could well be that a similar search by others would also have revealed these; the significance of the latter is currently the subject of investigation. Similarly, the special search made by Anderson *et al.* (1966) revealed much more osteomalacia than emerged from the enquiry of geriatricians, and it could well be that in many instances the special tests necessary might have been made at some later stage by these geriatricians.

33. Though the special investigations in many instances relate to levels of nutrients rather than to the disturbances of form (such as nutritional megaloblastic anaemia) or of function (such as altered enzyme activity) which are fundamental to our definition of malnutrition it is clear that more research is needed into the significance of low levels of nutrients in fluids or cells as indicators of marginal nutrition. It is worth remarking that no simple means is available to test the hypothesis that a substantial part of the changes which are commonly accepted as normal manifestations of ageing might be delayed or prevented by nutritional means. In sum the evidence indicates that malnutrition as the public understands it (and, for that matter, as a consultant physician detects it) is not common, but what may be more common are the small departures from normality which the nutritionist or biochemist may or may not be able to detect. Of these forms of subclinical malnutrition the one which on current evidence is likely to be of most practical importance is osteomalacia. Although this is preventable by dietary means, it is a reflection of either deficiency or ineffectiveness of sunlight falling on the skin as much as, or more than, of a true dietary deficiency. In the meantime, whilst generalisations about the elderly as a whole are difficult because of the variety and complexity of the problems which they present, a fair statement might be that there is often little, and sometimes no, margin. What is likely to be useful at this juncture is the collection of evidence adequate to form a basis for any long term plans to maintain good nutrition of the elderly. The problem is likely to increase in magnitude because of their increasing numbers.

34. Though it was not strictly within the terms of reference of the Panel, one of the first problems put to it was to advise upon the formidable methodological questions involved. The appropriate surveys began on 1st November 1967 under the aegis of the Department of Health and Social Security and the Scottish Home and Health Department, in collaboration with certain regional, local and other organisations, and with the active participation of some of the members of the Panel.

35. In 1950 the British Medical Association's Committee on Nutrition commented on the scarcity of evidence relating statistics of mortality and morbidity to biochemistry, anthropometry and clinical investigation. Since then the amount of evidence has greatly increased (e.g. Berry and Hollingsworth, 1963; Berry, 1968; recent Reports of the National Food Survey Committee) and there is little doubt that more is known of the nutritional state of the people of our nation than of any other in the world. Nevertheless, in relation to the elderly the evidence is, as we remarked in paragraph 31, still inadequate. The B.M.A. Committee put much hope in "new and still relatively undeveloped" methods of assessing nutrition, and advised that they be the subject of more investigation and research. Although much research has subsequently been carried out, limitations and fallacies in many of the methods have subsequently been revealed. Some of the methods may be of value on patients who are prepared to endure much in order to get well, but are likely to be unsuitable for application to a community of free individuals who may not be eager to submit to manoeuvres which are not obviously in their interest.

36. Yet it is very important that further methods of assessment suitable for the elderly should be developed, and that research in depth be made in relation to individual nutrients, because the rectification of minor degrees of deficiency may prove of value in the prevention of some of the degenerative changes which are at present accepted as part of the ageing process. In the Panel's view one important measure would be to set up longitudinal studies of the nutritional states of various groups so that trends in deterioration or improvement may be quickly assessed. The interpretation of this would necessitate basic research into individual nutrients, correlating clinical, nutritional and biochemical data.

37. Finally, even were this gap in knowledge to be filled, the practical solutions by the social services to the problem of securing that elderly people at risk are adequately nourished raise complex questions on which we as a Panel do not think it appropriate to comment. We draw attention, however, to points which have arisen in our discussion. The most obvious method of helping is by the provision of meals. Since 1962 when local authorities as well as voluntary bodies entered the field, there has been rapid expansion of the services, but the estimated numbers receiving meals, at home or in luncheon clubs, by any reckoning fall far short of the numbers who could benefit and meals are not available on every day of the week. Townsend and Wedderburn (1965) estimated that just over 1 per cent of the population over 65 received a cooked meal at least once a week from the mobile meal services; another 5 per cent said that they would like to receive them. In a Social Survey study over half the recipients of meals on wheels said they would like to receive more meals than they were presently getting (Harris, 1960). Development has taken place and the official 1967 figures of persons in England and Wales receiving meals on wheels is 95,381 (1½ per cent). As the services expand, catering techniques will need to change and develop if nutritious and palatable meals are to be provided for large numbers. We understand that the Ministry of Health has completed a study of the experiences of a number of local authority and voluntary meal services as a contribution to future development.

38. Public interest has often turned to the provision of welfare milk in the same way as for mothers and children. Evidence from Dr. Bender and Miss

Louise Davies indicated that 46 per cent of the individuals questioned would buy more milk were it cheaper, but this view was expressed as often amongst those who took one or more pints of milk daily as amongst those who took less. The evidence from the King Edward's Hospital Fund Survey, the National Food Survey and the work of Kataria and Rao is that the amounts of milk currently consumed by the elderly are not very different from those drunk by other groups, suggesting that taste and habit are the main limiting factors. This is not to say that they should not be encouraged to drink more. However, milk, unless appropriately fortified, does not provide all the nutrients which might be needed, neither does it protect against the more general danger of which malnutrition is often only a manifestation, of the severing of contacts between the old people and society. Our list of conditions which make the elderly vulnerable (Appendix C) is relevant here. In securing the retention of old people within their society the luncheon clubs and day centres deserve fuller recognition and exploration.

39. In short, there appear to us to be three requirements in order that long-term policy for the aged may be soundly based.

- (i) Field surveys, on which the Department of Health and Social Security with its collaborators has already embarked. In our view these deserve to be complemented by longitudinal studies of the elderly designed to detect trends using various parameters.
 - (ii) Research, which in our view is not yet at the stage where the findings of surveys can be interpreted as completely as they might be, and which for this purpose require, for example, research in depth into individual nutrients and combinations of these.
 - (iii) Practical experimentation with various measures in the field.
- These three could run concurrently.

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APPENDIX A

Mean Daily Intake of Elderly Subjects Surveyed in Different Areas

	Calories	Protein (g)	Calcium (mg)	Vitamin C (mg)	No. of subjects	Ages
King Edward's Hospital Fund, Islington & Hornsey 1965 P.64	1890	57	860	37.6	60	70-80+
Durnin, Paisley 1961a	1894	62.4	845	31.0	17	60-69
Kataria & Rao, Camberwell 1967	1924	56.3		31.3	63	65-91
Bransby & Osborne, Sheffield 1953	1746	67.0	800	21.0	178	60-75+
Ministry of Health, Camberwell 1965 (Unpublished)	1245 (inc one 707)	46.1 (inc one 16.3)	650 (one 53.7)	28.7 (inc one 83.2, one 5.7)	8	74-94
Durnin, Glasgow 1961b	1944	61.7	758	—	21	60 (mean)
Ministry of Health, Islington 1966 (Unpublished)	1662	55.2	700	35.5	11	65-78
<i>Men</i>						
Bransby & Osborne, Sheffield 1953	2096	71	900	21	125	60-75+
Kataria & Rao, Camberwell 1967	2043	61.3	—	22.3	42	65-91

Survey Where Results Not Divided by Sex— i.e. Men and Women

Old Age Pensioners, Cardiff 1961 (mainly women)	1974	55.1	745	26	21	—
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APPENDIX B

Enquiry into the prevalence of malnutrition in elderly patients on admission to hospital

1. Twenty-six consultant geriatricians agreed to report particulars about all patients coming under their care, other than those admitted from other wards of the same hospital or from other institutions. Originally the aim was to obtain about 50 records from each but some reported more, some less, depending on the volume of patients admitted under their care. Whilst this effected a measure of weighting of the sample, it needs to be made clear that the consultants were not selected by any random process; rather, they were persons widely scattered over Britain who were known to members of the Panel to be particularly interested in the problem and willing to co-operate. The resultant sample of patients is thus far from being statistically impeccable but for the purposes of a reconnaissance such as in this Report, the data are felt to be adequate. The names of the geriatricians, and the hospitals in which they served, are given in Table Ia and a specimen of the enquiry form they used in Table Ib.

2. In Table II there are listed some of the conditions noted by the physicians with special reference to possible manifestations of malnutrition whether primary or secondary (see paragraph 8). Anaemia (Hb level of less than 10 g per cent) is the most common of these, but this was in the majority of cases secondary to some obvious cause of blood loss. In 35 (2.6 per cent) cases the anaemia was ascribed primarily to a poor diet. In a further 25 cases the cause of the anaemia was not stated and some of these may also have been nutritional in origin. The distribution of haemoglobin levels (Table III) is presumably much affected by the diseases from which most patients suffered, but it is of interest to note that the values for men are higher than those for women though the latter have long ceased to menstruate.

3. At the foot of Table II there is an item, "other forms of malnutrition". These included some indefinite diagnosis, but consisted in effect of 9 cases of undernutrition with clearcut predisposing causes such as cardiovascular disease or carcinoma, etc., but also 7 in whom intercurrent disease where present could have been caused by undernutrition rather than the reverse. There were also 2 individuals with angular stomatitis (and concurrent non-nutritional disease). Four individuals had either mild anaemia or none but associated with low serum-folate and/or serum-B₁₂ levels and psychotic change.

4. On the one hand there was no case in which oedema was reported as being due to a poor diet alone (i.e. in the absence of important non-nutritional disease) and on the other, the majority of patients with oedema also suffered from conditions which are known to be capable of causing oedema no matter how good the diet. There were for example 173 cases of cardiovascular failure, plus 6 of obesity in which some measure of circulatory failure may well have existed, and 16 of genitourinary disease; there were also 29 cases of carcinoma-tosis. Nevertheless among all these there were 2 cases where it was specifically stated that the diet was poor, and where serum protein values were reported in association with cardiovascular failure the levels were sometimes low. Four cases of cirrhosis with oedema were encountered. In 50 instances cerebral arteriosclerosis or dementia were reported as the prime diagnosis, associated with oedema;

in these instances it may well be that mental changes have rendered the subject vulnerable to malnutrition whilst at the same time leading to his isolation from society. Seven cases of oedema were apparently secondary to gastrointestinal diseases ranging from hiatus hernia to malabsorption state, and 6 were associated with megaloblastic anaemia sometimes in association with other conditions. Of the remainder, some were due to local causes, and in others the prime diagnosis was not of a sort that might be expected to cause oedema by itself, but on the other hand there was no indication from the clinicians report that malnutrition was involved. Probably the most interesting pointer arising out of this analysis was the association between mental disease and oedema.

5. In order to assess more fully the role of undernutrition, i.e. caloric shortage, all patients were categorised as light, medium, or heavy on the relation of their height/weight index to the distribution of height/weight indices in the whole sample. More very old women were light, as indeed might be expected from actuarial experience, but this did not show up among the men (Table IV). Persons living alone tended slightly more often to be light than those who were with spouse or other relatives, and in these two categories more heavy men were found (Table V). There was no clear indication of an effect of social class upon lightness or heaviness. The bedridden were rather more often light (inactivity presumably leads to muscle wasting) (Table VI), and out of 503 persons classed as mentally confused, or depressed, or both, 151 (30 per cent) were "light" (Table VII). Of the 84 (6.5 per cent) patients listed under the conditions shown in (f) (g) (h) (j) (k) and (m) to (p) of Table II (i.e. those in whom some element of malnutrition primary or secondary may have existed) about half were "light".

Discussion

6. Many old people leave hospital rehabilitated and able to resume their independence. Nevertheless for many, admission to hospital marks the moment when the load of chronic disease finally renders an independent existence impossible. Therefore the geriatrician sees many patients at a highly vulnerable point in their lives, and is constantly alert for signs of malnutrition. Nevertheless not very much was reported at least of overt malnutrition, though it could well be that more intensive investigation might have revealed more of subclinical nutritional deficiencies. Certainly the picture as reported by the geriatricians is not alarming. Overt disease, not overt malnutrition, has brought his patients to the geriatrician's care.

TABLE Ia

List of Selected Geriatricians

Dr. J. N. Agate
East Suffolk Hospital
Ipswich
Suffolk

Dr. J. P. Arnold
The H.M. Stanley Hospital
St. Asaph
Flintshire

Dr. J. D. Bankier
Vale of Leven Hospital
Alexandria
Dumbartonshire

Dr. J. C. Brocklehurst
Sidcup and Bromley Hospital
Bromley
Kent

Dr. W. Davison
Chesterton Hospital
Union Lane
Cambridge

Dr. H. Droller
St. James' Hospital (North)
Leeds, 9

Dr. A. N. Exton-Smith
University College Hospital
London, W.C.1

Prof. W. Ferguson Anderson
Stobhill Hospital
Glasgow

Dr. W. Fine
Newsham General Hospital
Liverpool, 6

Dr. H. M. Hodgkinson
St. Ann's General Hospital
Tottenham, N.15

Dr. R. E. Irvine
St. Helen's Hospital
Hastings, Sussex

Dr. M. S. Kataria
St. Francis Hospital
Constance Road,
Dulwich, S.E.22

Dr. W. MacKenzie
Ryhope General Hospital
Ryhope
Co. Durham

Dr. E. V. B. Morton
Sherwood Hospital
Hucknall Road
Nottingham

Dr. M. S. N. Pathy
St. David's Hospital
Cardiff

Dr. D. M. Prinsley
Hemlington Hospital
Middlesbrough
Yorks.

Dr. P. L. Robinson
Clatterbridge General Hospital
Bebington
Wirral, Cheshire

Dr. T. Rudd
Southampton General Hospital
Southampton

Dr. O. Taylor Brown
Maryfield Hospital
Dundee

Dr. P. S. Tweedy
St. Thomas' Hospital
Stockport, Cheshire

Dr. S. M. Vine
Battle Hospital
Reading, Berks.

Dr. J. Wedgwood
West Suffolk General Hospital
Hospital Road
Bury St. Edmunds, Suffolk

Dr. J. Williamson
Eastern General Hospital
Seafeld Street
Edinburgh, 6

Dr. L. Wollner
Cowley Road Hospital
Oxford

Dr. L. A. Wilson
Glenburn Wing
Woodend General Hospital
Aberdeen

Dr. E. Woodford-Williams
General Hospital
Chester Road
Sunderland
Co. Durham

TABLE 1b
MINISTRY OF HEALTH
PANEL ON ELDERLY

For Office
Use

Enquiry into Incidence of Malnutrition on Admission to Hospital

Name of Hospital.....

M.O.H. Record Number.....

PART A

GENERAL PARTICULARS

Please complete this section either by ringing the number in the "for office use" column (which is opposite the appropriate answer) or by entering the answer as indicated.

1. Patient's hospital number (not name).....		
2. Admitted from Old Peoples' Home*		1
Admitted from community e.g. own or relation's home, lodgings etc.		2
3. Age (years)	4. Sex	
	Male	1
	Female	2
5. Single		1
Married		2
Widowed or divorced within last 6 months		3
Widowed or divorced within 6 months to 1 year		4
Widowed or divorced longer than 1 year		5
6. If admitted from community		
Lives with spouse		1
Lives with other relatives		2
Lives alone—or alone in lodgings		3
Other—please state		4

*Exclude patients discharged from other wards or hospitals during the previous 4 weeks.

7. Occupation or previous occupation (for married women this should be the occupation of their husbands, but for those widowed over 10 years, their own occupation should also be given).....		
8. <u>Diagnosis</u>		
	Primary	
	Secondary	
	Tertiary	
9. <u>Mobility</u>		
	Fully ambulant	1
	Limited	2
	Bedridden	3
10. <u>Mental State</u>		
	Normal	1
	Depressed	2
	Confused	3
11. <u>Weight</u>	lb or Kg	12. <u>Height</u> ins or cms
13. <u>Hb. level (gm/100 ml)</u>		
14. <u>Oedema</u>		
	Absent	1
	Present—ankle	2
	Present—generalised	3

PART B

PARTICULARS OF SELECTED CONDITIONS

1. <u>Anaemia</u> (Hb less than 10gm/100ml blood)	No	1
	Yes	2
Give particulars of cause etc.....		
.....		
.....		

2. <i>Fracture</i> Present or healing at time of admission (Kyphosis need not be included).	No	1
	Yes—not due to bone rarefaction	2
	Yes—due to bone rarefaction	3
If due to bone rarefaction, please give particulars of any investigation made, particularly distinguishing osteomalacia from osteoporosis		
3. <i>Scurvy</i> (answer yes only if gross bleeding into skin, joints or gums)	No	1
	Yes	2
4. Other signs associated or thought to be indicative of malnutrition	
If patient died before information was completed please state time after admission that death took place.		

TABLE II

Type of Malnutrition Diagnosed by Consultants

		Total	Male	Female
No mention of items (d) to (p) below	(a)	1367	542	825
No mention of (d) to (p) but patient died before form completed	(b)	961	409	552
No indication, but form incomplete	(c)	20	12	8
Anaemia ascribed to some non-nutritional cause	(d)	121	37	84
Anaemia cause unknown	(e)	94	40	54
Nutritional anaemia	(f)	25	5	20
Mixed nutritional and non-nutritional anaemia	(g)	35	11	24
Obesity and anaemia	(h)	3	—	3
Obesity	(i)	3	—	3
Scurvy	(j)	53	13	40
Fracture (osteomalacia)	(k)	2	1	1
Fracture (osteoporosis)	(l)	2	—	2
Fracture (cause not known)	(m)	9	3	6
Osteoporosis (no fracture)	(n)	2	—	2
Tongue abnormalities	(o)	10	3	7
Other forms of malnutrition	(p)	5	1	4
		22	7	15

TABLE III

Distribution of Hb Levels

Hb levels g/100 ml.	Total			Male			Female		
	All cases (No. of nutritional anaemia cases shown in bracket)	% total	No answer	All cases (No. of nutritional anaemia cases shown in bracket)	% total	No answer	All cases (No. of nutritional anaemia cases shown in bracket)	% total	No answer
Total	1302 (35)		65	513 (11)		29	789 (24)		36
Under 7.0	36 (5)	3	—	14 (2)	3	—	22 (3)	3	—
7.0- 9.9	127 (30)	10	—	44 (9)	9	—	83 (21)	10	—
10.0-10.9	91	7	—	31	6	—	60	8	—
11.0-11.9	169	13	—	45	9	—	124	16	—
12.0-12.9	266	20	—	79	15	—	187	24	—
13.0-14.9	439	34	—	200	39	—	239	30	—
15.0 and over	174	13	—	100	19	—	74	9	—

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TABLE VI

Physique (Based on Height/Weight Ratio) and Mobility

Mobility	Total	Light		Medium weight		Heavy	
		(a)	(b)	(a)	(b)	(a)	(b)
All persons	1191	306	26	584	49	301	25
Fully ambulant	348	77	22	180	52	91	26
Limited	588	152	26	276	47	160	27
Bedridden	255	77	30	128	50	50	20
Males	461	91	20	241	52	129	28
Fully ambulant	132	24	18	73	55	35	27
Limited	217	41	19	106	49	70	32
Bedridden	112	26	23	62	55	24	22
Females	730	215	29	343	47	172	24
Fully ambulant	216	53	24	107	50	56	26
Limited	371	111	30	170	46	90	24
Bedridden	143	51	36	66	46	26	18

(a) Number of persons

(b) Percentage of mobility groups

TABLE VII

Physique (Based on Height/Weight Ratio) and Mental State

Mental state	Total	Light		Medium weight		Heavy	
		(a)	(b)	(a)	(b)	(a)	(b)
All persons	1191	306	26	584	49	301	25
Normal	688	155	22	336	49	197	29
Depressed	118	32	27	64	54	22	19
Confused	375	116	31	179	48	80	21
Depressed and confused	10	3	30	5	50	2	20
Males	461	91	20	241	52	129	28
Normal	263	47	18	136	52	80	30
Depressed	47	13	28	24	51	10	21
Confused	149	31	21	79	53	39	26
Depressed and confused	2	—	—	2	100	—	—
Females	730	215	29	343	47	172	24
Normal	425	108	25	200	47	117	28
Depressed	71	19	27	40	56	12	17
Confused	226	85	38	100	44	41	18
Depressed and confused	8	3	37	3	38	2	25

(a) Number of persons

(b) Percentage of mental state groups

TABLE VIII

Physique (Based on Height/Weight Ratio) and Oedema

Oedema	Total	Light		Medium weight		Heavy	
		(a)	(b)	(a)	(b)	(a)	(b)
All persons	1191	306	26	584	49	301	25
Oedema absent	900	245	27	432	48	223	25
Oedema present	274	55	20	143	52	76	28
No answer given	17	6	35	9	53	2	12
Males	461	91	20	241	52	129	28
Oedema absent	367	77	21	193	53	97	26
Oedema present	88	14	16	43	49	31	35
No answer given	6	—	—	5	83	1	17
Females	730	215	29	343	47	172	24
Oedema absent	533	168	31	239	45	126	24
Oedema present	186	41	22	100	54	45	24
No answer given	11	6	55	4	36	1	9

(a) Number of persons

(b) Percentage of oedema groups

APPENDIX C

Groups of Old People who are liable to Malnutrition

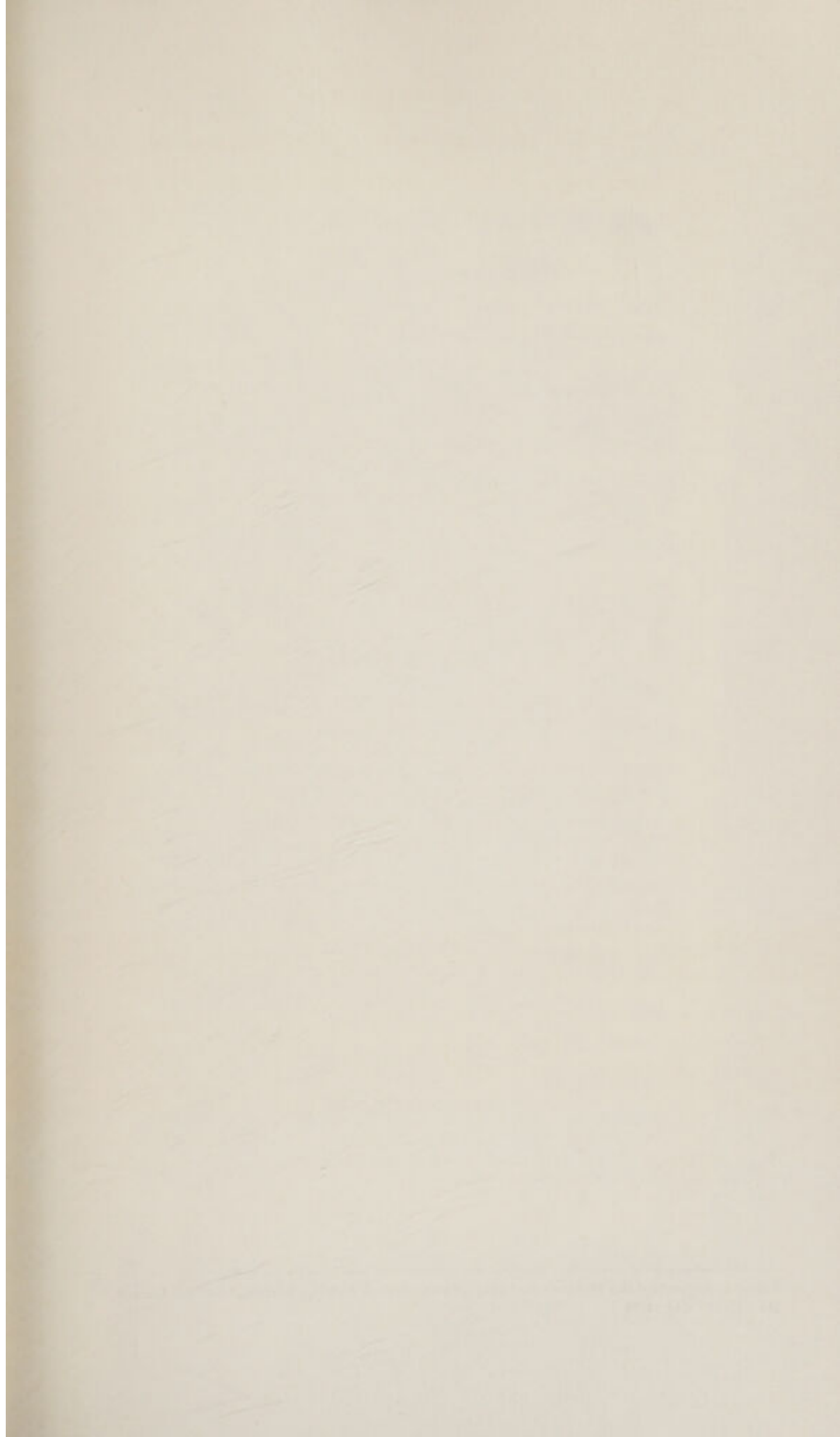
The following factors, usually in combination, make the elderly especially vulnerable:—

Apathy, ignorance and/or disinterest
Excessive intake of alcohol
Food faddism
Limited mobility
Loneliness and social isolation
Mental disturbance
Poverty
Teeth—ill-fitting dentures or poor dentition.

These categories, listed in alphabetical order only, are of course over-simplified; none is discrete and many are not easy to define. The following amplifications are useful:—

1. Poverty may become significant when the old person is unaware of, or unwilling or unable to apply for, supplementary benefit. When this is associated with other factors the margin remaining is very small, and this combination makes the elderly especially susceptible.
2. Many of the factors operate particularly when support from family, friends or community is not available. It seems that lack of social contact often leads to apathy, depression and the impairment of appetite. Although those living alone fare worse than those living with relatives or other people, it is of course possible to feel isolated even when surrounded by a family if they are not providing the right environment. Nevertheless, being housebound becomes less important if efficient help is available.
3. Depressive illness has a high incidence in the elderly population, especially in those recently bereaved and the socially isolated. Apathy and depression in these lonely old people leads to a disinclination to get and to prepare food; the ensuing malnutrition leads to further apathy so that a vicious circle is established.
4. Following the death of the wife, old men who have little knowledge of the cooking of food tend to eat a poorly balanced diet consisting of foods which require little preparation.
5. Although digestion is not likely to be seriously impaired by lack of teeth, a poor state of dentition or ill-fitting dentures can lead old people to select certain types of food and they may avoid the more nutritious foods which require mastication.





ANNEXURE A - THE STATE OF THE NATION

The following figures are for the year ending 31st March 1970.

1. GROSS DOMESTIC PRODUCT

£1,000 million

1969-70

1970-71

1971-72

1972-73

1973-74

1974-75

The following figures are for the year ending 31st March 1970.

2. PUBLIC SECTOR DEFICIT

3. PUBLIC SECTOR DEFICIT

4. PUBLIC SECTOR DEFICIT

5. PUBLIC SECTOR DEFICIT

6. PUBLIC SECTOR DEFICIT

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