LEAGUE OF NATIONS

THE PROBLEM OF NUTRITION

VOLUME II

REPORT ON THE PHYSIOLOGICAL BASES OF NUTRITION

drawn up by the

Technical Commission of the Health Committee

at the meeting held in London (November 25th-29th, 1935), revised and amplified at the meeting held at Geneva (June 4th-8th, 1936).

LEAGUE OF NATIONS

Publications dealing with the Problem of NUTRITION

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THE PROBLEM OF NUTRITION

Vol. I. **Interim Report of the Mixed Committee on the Problem of Nutrition.** (Ser. L.o.N. P. 1936.II.B.3.)

Vol. III. **Nutrition in Various Countries.** (Ser. L.o.N. P. 1936. II.B.5.)

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Vol. IV. **Statistics of Food Production, Consumption and Prices.** Documentation prepared by the International Institute of Agriculture, presented to the Mixed Committee on the Problem of Nutrition, June 1936.

Published previously

Nutrition and Public Health, by Et. Burnet and W. R. Aykroyd. (Off-print No. 2 from the *Quarterly Bulletin of the Health Organisation,* Vol. IV, No. 2, June 1935.)
152 pages. Price: 2/- $0.50

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INTRODUCTION

For ten years, the Health Organisation of the League has been engaged in the study of nutrition in relation to public health. The following have been the main stages of the work:

In 1925, upon the proposal of the Yugoslav delegation, the Assembly (sixth session) requested the Health Committee to study " the methods to be recommended in the interests of public health for the regulation of the manufacture and of the sale of food products."

In October 1928, at the thirteenth session of the Health Committee, Professor Léon Bernard asked, on behalf of the French Government, for nutrition to be placed on the programme of work of the Committee.

In 1926, the Health Section published a collection of memoranda on the physiology of nutrition and its applications by Professor T. Saiki, Director of the Imperial Institute of Nutrition of Tokyo, and his assistants (" Progress of the Science of Nutrition in Japan ", document C.H.523).

In 1927, Professor T. Saiki, under the auspices of the Health Organisation, gave a series of lectures on nutrition in the United States of America, Argentine, Brazil and Chile. The same year, the Chief of the Department of Applied Science in the Institute of Tokyo came to study problems of nutrition in the United Kingdom with Professor Mellanby, and afterwards in different institutes and laboratories of Europe.

In 1926-27, the Health Section arranged for the visit of the late Professor Egerton Grey of the University of Cairo to the Tokyo Institute, and published in 1928 his valuable report entitled " The Food of Japan " (document C.H.861).

In 1931, the Health Committee organised a collective tour to study the supply of milk in the United States. Two of the participants, Professor R. Burri and Dr. G. S. Wilson, summarised their observations in memoranda published in the *Quarterly Bulletin of the Health Organisation*, Vol. I, Nos. 1 and 4. At the same time, the hygiene of milk was studied by Professor J. Parisot in the Department of Meurthe-et-Moselle (*Quarterly Bulletin*, Vol. III, No. 4).

In 1932, the Government of Chile requested the collaboration of the League of Nations in a study of popular nutrition in that country. The preliminary studies led to a double enquiry—economic and medical—which was begun in 1935.

In October 1932, at its nineteenth session, the Health Committee decided to undertake the study of the effects of the economic crisis on public health, with particular reference to conditions of under-nutrition produced by the crisis. In the *Quarterly Bulletin* was published in 1933 a study by Dr. Mackenzie on the administrative machinery by which the nourishment of the poor is assured in the United Kingdom (Vol. II, No. 2) and a study by Dr. W. R. Aykroyd on " Diet in relation to Small Incomes " (Vol. II, Nos. 1 and 2).

In 1932, two Conferences of Experts were convened in connection with the studies on nutrition. They did not only deal with the conditions brought about by the economic crisis, they also considered the fundamental data of the problem and dealt with the principles of an adequate diet.

(*a*) The Conference of Experts at Rome (September 1932) considered the question of dietary standards and drew up a scale of family co-efficients for inter-

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national use in order that the enquiries on the state of nutrition in various countries might be made comparable.

(*b*) The Conference of Experts in Berlin in December 1932 considered the physical standards and the clinical and physiological methods best calculated to detect states of malnutrition.

The reports of these two Conferences were published in the *Quarterly Bulletin*, Volume I, No. 3, and Volume II, No. 1. They may be considered precursors to the report of the London Conference which is published hereafter.

* * *

In 1934, in view of this work and of all the documentation collected, the Health Committee, when drawing up its three-year programme of work, decided that a general report on nutrition should be made (see document C.233.M.97.1934, page 12). The preparation of this report was entrusted to Dr. E. Burnet and Dr. W. R. Aykroyd, who carried out a series of enquiries in different countries (United Kingdom, France, United States, Denmark, Sweden, Norway, and the U.S.S.R.) on the special institutions of nutrition policies of these countries. This report was drawn up in the early part of 1935, and published in the *Quarterly Bulletin* (Vol. IV, No. 2, June 1935).

This report, which was specially intended for health administrations, deals with the position of nutrition in public health and preventive medicine.

Nutrition in relation to health is one of the most important aspects of preventive medicine, and the recent progress in the science of nutrition makes it essential for public health to develop along new lines.

Nutrition is put forward, not only as a physiological problem, but also as an economic—agricultural, industrial and commercial—problem.

Health workers are appealing to the economists for the realisation of their plans. Economists beginning to be guided by the lofty aims of preventive medicine. The time will soon be over when commercial agreements and Customs measures are applied without consideration for the requirements of the masses and of public health.

The plan indicated by the table of contents at the beginning of the report appears at first sight to be somewhat complicated. In reality it is very simple and hinges upon three main questions:

(1) *What are the nutritional needs of the human being ? How can they be recognised ? How can it be determined whether they are being satisfied ?* (Dietary standards and physical standards.)

(2) *What resources are available to meet nutritional requirements ?* (Food available; production; distribution; preservation.)

One chapter emphasises the relationship between nutrition and economy, based on examples taken with respect to four fundamental foods of great importance; meat, milk, bread and fats.

(3) *How best to utilise the resources available in order to meet these requirements ;*

Nutrition has already been recognised as a means of protecting maternity and childhood, of controlling the deficiency diseases (rickets, dental caries, anæmia, pellagra, beri-beri) and of ensuring the regular development of the human being in its various surroundings; in the urban centres, rural districts, or the colonies.

Certain countries, as, for example, the U.S.S.R., have already organised extensive public or collective nutrition, including preventive or curative diets.

In order to formulate adequate *diets*, it is necessary first to consider the various nutritional types.

It is no longer necessary to consider whether Governments should intervene in connection with nutrition because in point of fact such intervention has existed for a considerable time. The report gives examples of organised nutrition.

The report not only does not omit, but rather emphasises on each page, the economic conditions in relation to adequate nutrition. It concludes with this statement: " Production, distribution and consumption have hitherto been considered mainly as economic problems without sufficient regard to their effect on public health, but the effect of the economic depression has directed attention to the gap which almost everywhere exists between dietary needs as determined by physiology and the means of satisfying them under existing conditions. *The general problem of nutrition as it presents itself to-day is that of harmonising economic and public health development.*"

In another part of the report (see Chapter on Nutrition and Poverty), the authors have not overlooked the psychological aspect of the question. If salaries are, so to speak, the " iron law " in regard to nutrition, it is not sufficient to increase them in order to do away with all nutritional deficiencies which accompany poverty; it is also necessary (and not only amongst the poor) to develop *education :* education of medical men, of health workers, of mothers, and of the whole population from infancy upwards; the education of those engaged in teaching the public, and the education of the public itself.

The report by Drs. Burnet and Aykroyd was published at a time when the social problems of housing and nutrition were definitely occupying the foremost position in public health. Continuing the work carried out by the Rome and Berlin Conferences, it thereby met the preoccupations arising out of the protracted economic depression. It contained the essential elements for a general discussion of the practical problems of nutrition in relation both to public health and to economic recovery. It was therefore natural that it should be used as a basis of discussion when the delegations of twelve Governments at the sixteenth Assembly of the League (September 1935) requested that nutrition should be placed on the agenda.

The discussion in the Second Committee of the Assembly was introduced by Mr. Bruce (Australian delegate), who stressed the necessity for marrying agriculture and public health in the interests of the latter; of increasing the consumption of protective foods as a remedy for malnutrition and the agricultural crisis, and of changing the incidence of State protective subsidies so that they should serve to increase consumption rather than to restrict production. He pointed out the

necessity for reducing the wide gap between wholesale and retail prices and of reducing the costs of distribution.

The following points emerged from the discussion:

(*i*) An increase of production supplies the Governments with further means for improving public health;

(*ii*) This can be done by expanding the work that they have already begun in the field of nutrition;

(*iii*) This constitutes a direct and practical means of attacking the problem of agricultural surpluses and the consequent fall in prices.

On consideration of the report of Lord De La Warr (United Kingdom), the Assembly adopted the following resolution:

" The Assembly,

" Having considered the subject of nutrition in relation to public health and of the effects of improved nutrition on the consumption of agricultural products, urges Governments to examine the practical means of securing better nutrition and requests the Council:

" (1) To invite the Health Organisation of the League of Nations to continue and extend its work on nutrition in relation to public health;

" (2) To instruct the technical organisations of the League of Nationsl in consultation with the International Labour Office and the Internationa, Institute of Agriculture, to collect, summarise and publish information on the measures taken in all countries for securing improved nutrition and,

" (3) To appoint a Committee, including agricultural, economic and health experts, instructed to submit a general report on the whole question, in its health and economic aspects, to the next Assembly, after taking into consideration, *inter alia*, the progress of the work carried out in accordance with paragraphs (1) and (2) above."

* * *

At the same time, the International Labour Office, which had been informed of the general plan of the Burnet-Aykroyd report, had given proof of its interest in the report. The Mixed Advisory Agricultural Committee (which ensures liaison between the International Labour Office and the International Agricultural Institute of Rome), the International Committee for Inter-co-operative Relations (which is a private organisation for liaison between agricultural and consumers' co-operatives, under the chairmanship of the Director of the International Labour Office), had expressed their desire to co-operate in studying the question of the nutrition of workers. When the nineteenth International Labour Conference was held in June 1935, its attention was drawn to the problems of nutrition in the report by the Director of the International Labour Office, and by statements by Sir Frederick

Stewart, Miss Paterson and Miss Grace Abbot (Government delegates of Australia, New Zealand and the United States of America. The following resolution was unanimously adopted:

" Seeing that nutrition adequate both in quantity and in quality is essential to the health and well-being of the workers and their families;

" And seeing that, in various countries, evidence has been brought forward to show that large numbers of persons both in town and country are not sufficiently or suitably nourished:

" Seeing, moreover, that an increase in the consumption of agricultural foodstuffs would help to raise standards of life and relieve the existing depression in agriculture:

" The Conference welcomes the attention drawn by the Director in his report to the problem of nutrition and requests the Governing Body to instruct the Office to continue its investigation of the problem, particularly in its social aspects, in collaboration with the Health and Economic Organisations of the League of Nations, the International Institute of Agriculture and other bodies capable of contributing to its solution, with a view to presenting a report on the subject to the 1936 session of the Conference."

* * *

At its twenty-second session (October 1935), the Health Committee considered the report by Drs. Burnet and Aykroyd and specifically discussed the hygienic aspects of the problem. It was decided that members of the Committee should forward and recommend the report to their national administrations. After having stressed the necessity for educating medical practitioners, public health workers and the public in the field of nutrition, the Health Committee adopted the following resolution:

" The Health Committee,

" Being of opinion that these studies may be a useful contribution to public health progress, and would be the logical development of its former activities in this field:

" Requests the Bureau to constitute an expert committee of twelve members at most, with the following terms of office:

" (1) To consider the suggestions contained in the Health Organisation's report, or formulated when this report was examined by the Health Committee and during the Assembly discussions on the matter (document A.61.1935);

" (2) To select such questions of practical importance as might usefully be studied internationally and to classify them by order of priority;

" (3) To submit a first report to the Co-ordination Committee set up in accordance with the third paragraph of the Assembly resolution of September 25th, 1935. This report would be the basis for the work to be carried out in co-operation by the technical organisations and international institutions mentioned in the above resolution."

* * *

In accordance with this resolution, a list of questions for investigation, arranged in order of priority, was drawn up on the basis of the report for submission to the Technical Commission.

The discussions of the Assembly and of the Health Committee made it appear that health experts were to be asked to take the first step by defining the nutritional needs of the human being in the course of its development from conception to the adult age —*i.e.*, the physiological basis for adequate nutrition. It would then be the duty of the Health Organisation and of the other technical organisations, to consider the appropriate means for their practical application.

The Technical Commission appointed by the Health Committee is composed as follows:

Austria.

Professor A. DURIG, Professor of Physiology at Vienna University.

United Kingdom.

Professor E. P. CATHCART, Professor of Physiology, Glasgow University;

Professor E. MELLANBY, Secretary-General of the Medical Research Council, Professor of Physiology at the Royal Institution, London;

Sir John Boyd ORR, Director of the Imperial Bureau of Animal Nutrition, Rowett Institute, Aberdeen.

France.

M. J. ALQUIER, Secrétaire général de l'Institut scientifique d'hygiène alimentaire, Directeur de l'Institut national agronomique, Paris;

Professor André MAYER, Professor of Physiological Chemistry at the Collège de France;

Professor L. LAPICQUE, Professor of Physiology at the University of Paris, Faculté des sciences, Sorbonne, Paris.

Italy.

Professor Filippo BOTTAZZI, Member of the Royal Academy of Italy, Professor at the University of Naples.

Scandinavian States.

Professor A. HÖJER, General Director of Health Services, Stockholm;

Professor C. SCHIÖTZ, Professor of Hygiene at the University of Oslo;

Professor L. S. FRIDERICIA, Professor of Hygiene at the University of Copenhagen.

Union of Soviet Socialist Republics.

Professor B. SBARSKY, Director of the Central Nutrition Institute, Moscow.

United States of America.

Professor E. V. MCCOLLUM, Professor of Biochemistry, Johns Hopkins University, Baltimore;

Dr. Mary SWARTZ ROSE, Department of Nutrition, Columbia University, New York;

Dr. W. SEBRELL, Chief of the Department of Nutrition, National Institute of Hygiene, Washington, D.C.

* * *

Dr. Harriette CHICK, Lister Institute, London, Technical Secretary of the International Conference on the Standardisation of Vitamins, was invited to take part in the Commission's work.

The Technical Commission held its first meeting in London from November 25th to 29th, 1935. Professor Edward MELLANBY was elected Chairman. The outcome of its discussions was the report known as the London Report (C.H.1197, December 6th, 1935).

As contemplated in the third paragraph of the Health Committee's resolution (mentioned on page 7), the report was communicated to the Mixed Committee for the Study of the Problem of Nutrition, appointed by the Council of the League (under the third paragraph of the Assembly resolution of September 25th, 1935, see above, page 6).

At the first session of the Mixed Committee, Professor MELLANBY and Professor MCCOLLUM, delegates of the Technical Commission of the Health Committee, commented on the report. As regards nutrition and public health, the report served as a basis for the discussions of the first two sessions of the Mixed Committee (February 10th to 16th and June 4th to 7th, 1936) and for the chapter on "Nutrition and Public Health" in the preliminary report drawn up by the Mixed Committee for the next Assembly of the League of Nations.

Furthermore, since the report will have to be applied in different countries and to be adapted to varying geographical, economic and social conditions, the Commission communicated it for study to representative learned societies and social studies institutions in different countries, with a view to procuring through them the advice of specialists and administrators interested in the various

aspects of nutrition—internal medicine, public health and social medicine, pediatrics, school hygiene, etc.

These institutions are of three kinds:

1. Academies of Medicine, Academies of Science and Scientific Commissions:

Belgium:	Royal Academy of Medicine.
United Kingdom:	Medical Research Council.
France:	Academy of Medicine.
Italy:	National Research Council.
Netherlands:	Academy of Science.
Spain:	Madrid Academy of Medicine.
U.S.S.R.:	Scientific Research Council.
United States of America:	National Academy of Science.

2. Commissions whose competence covers nutritional problems:

United Kingdom:	Advisory Committee on Nutrition, responsible to the Ministry of Health and the Secretary of State for Scotland.
Denmark:	Advisory Committee on Nutrition.
Norway:	Norwegian Committee on Nutrition.

3. National Councils specially set up for the study of nutritional problems and for co-operation with the League of Nations:

France: National Committee for the Study of the Problem of Nutrition.
Sweden: Royal Committee on Nutrition.

Some of these institutions have set up commissions and sub-commissions, each with its own rapporteur, and have divided the problems recommended for further study among them, according to the relative importance of such problems within the national sphere and to the work already undertaken by the Health Services and national laboratories.

The report was also communicated to the health administrations of all countries, who were informed at the same time of the place and importance of the report in the general scheme of the work undertaken by the League of Nations to improve nutrition, as well as of the studies recommended to the national institutions.

The report was submitted to the Health Committee (twenty-third session, April-May 1936) and to the Council (May 1936) of the League of Nations. In its report to the Council, the Health Committee expressed the opinion that the Mellanby Commission

should meet again to take note of the conditions in which the report could be applied in the different countries and to take the necessary steps to continue the studies. Among the new problems recommended for consideration, it mentioned the following as of special importance for the continuation of the studies: (*a*) assessment of the nutritional state particularly in children; (*b*) nutritive food requirements during the first year of life. It felt that these two questions should be examined by experts (school medical inspectors, pediatrists, etc.), and it requested the Director of the Health Section to arrange for a consultation on each of these points.

Through information communicated in the academies and published in their bulletins, through direct contact with the various institutions mentioned and with many members of public health services, through numerous articles in medical reviews as well as in the general Press, the Commission has received much evidence of the importance universally attached to the London report and of the desire that the Commission's work should be pursued. The main idea underlying the report, the expression of the new science of nutrition, in regard to protective foods and supplementary energy-yielding foods, special requirements during maternity and growth, and the adoption, not of the indispensable minimum, but of the optimum diet as the standard now held to be necessary has met with general approval.

The various reports contained observations either on certain details, or on matters of doctrine. The latter are as follows:

(1) *The basic caloric allowance:* The 2,400 calories per day for adults not engaged in manual work with supplements reckoned per hour according to the type of work;

(2) The *coefficients* for calculating calories and proteins according to age and sex, particularly as regards maternity (pregnant and nursing women), infancy, growth;

(3) Special requirements during *puberty*;

(4) The question of official control of fish-liver oils and vitamin preparations.

The observations communicated were examined at the Technical Commission's second session, held at Geneva from June 4th to 8th,

1936 under Professor Mellanby's chairmanship. The following attended (see pages 8 and 9): Professor E. P. CATHCART, Miss Harriette CHICK, Professor L. S. FRIDERICIA, Professor A. HÖJER, Professor L. LAPICQUE, Professor André MAYER, Professor E. V. MCCOLLUM, Sir John BOYD ORR, Professor B. SBARSKY, Dr. W. SEBRELL and Dr. M. SWARTZ ROSE.

While maintaining and confirming its fundamental principles, which were unanimously approved, the Commission examined all the observations most carefully.

It believes that all were discussed and even answered. A certain number ceased to be relevant by reason of the Commission's findings on fundamental points.

One question of primary importance concerning milk was added to the problems recommended for further study.

The outcome of the work is the second edition of the London report, printed below.

This document was communicated to the meeting of the Bureau of the Health Committee held at Moscow on June 22nd, 1936, and was transmitted to the Mixed Committee, which added it to the documentary material submitted to the Assembly.

It was sent, like the first report, to the health administrations and scientific and technical institutions, academies, commissions and national councils mentioned on page 10.

The next session of the Technical Commission will be held at the beginning of 1937, when studies of these national institutions and laboratories carried out in accordance with the programme recommended in the report, will be examined.

The London report, revised and amplified as provided for at the Commission's first session, constitutes the technical basis for the work to be undertaken or pursued in co-operation by the technical organisations of the League of Nations and the other international institutions mentioned in the Assembly resolution.

PART I.

ENERGY, PROTEIN AND FAT REQUIREMENTS.

All the figures on which the Commission has agreed are average values and it is essential that they should be interpreted in the light of this fact.

1. Calorie Requirements.

(*a*) An adult, male or female, living an ordinary everyday life in a temperate climate and not engaged in manual work is taken as the basis on which the needs of other age-groups are reckoned. An allowance of 2,400 calories net [1] per day is considered adequate to meet the requirements of such an individual.

(*b*) The following supplements for muscular activity should be added to the basic requirements in (*a*): [2]

Light work:	up to	75 calories	per hour of work.
Moderate work:	,,	75-150 ,,	,,
Hard work:	,,	150-300 ,,	,,
Very hard work:	,,	300 calories and upwards	per hour of work.

(*c*) The energy requirements for other ages and for mothers can be obtained from the following table of coefficients:

Age (years)	Coefficient	Calories
1-2	0.35	840
2-3	0.42	1,000
3-5	0.5	1,200
5-7	0.6	1,440

[1] The term " net calories " refers to the amount of energy available from the food actually assimilated.

[2] For statistical purposes, to be comparable with previously adopted standards, 600 calories may be taken as an avearge supplement for muscular work.

Age (years)	Coefficient	Calories
7-9	0.7	1,680
9-11	0.8	1,920
11-12	0.9	2,160
12-15 [1]	1.0	2,400
15 and upwards . . .	1.0	2,400

The muscular activities characteristic of every healthy child and adolescent necessitate additions to the basic requirements shown in (*c*). It is suggested that the activities of children of both sexes from 5-11 years be considered as equivalent to light work, of boys from 11-15 years as moderate work and of girls from 11-15 upwards as light work.

Women:	Coefficient	Calories
Pregnant	1.0	2,400
Nursing	1.25	3,000

Allowance must also be made for women engaged in household duties, whether pregnant or not; these have to be reckoned as equivalent to light work for eight hours daily.

The requirements for babies under 1 year are difficult to specify except in terms of body-weight; the following allowances are considered adequate:

Age (months)	Calories per kilogramme of body-weight
0-6	100
6-12	90

2. Protein Requirements.

In practice, the protein intake for all adults should not fall below 1 gramme of protein per kilogramme of body-weight.

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[1] The needs of puberty are covered by giving the child of 12-15 years a calorie allowance corresponding to a coefficient of 1, with appropriate supplements for muscular activity and a protein allowance of 2.5 grammes per kilogramme of body-weight.

The protein should be derived from a variety of sources, and it is desirable that a part of the protein should be of animal origin.

During growth, pregnancy and lactation, some animal protein is essential, and in the growing period it should form a large proportion of the total protein.

The following allowances of total protein are recommended:

Age (years)	Grammes per kilogramme of body-weight
1-3	3.5
3-5	3.0
5-12	2.5
12-15 [1]	2.5 [1]
15-17	2.0
17-21	1.5
21 and upwards	1.0
Women:	
Pregnant — 0-3 months	1.0
4-9 months	1.5
Nursing	2.0

3. Fat Requirements.

Fat must be a constituent of the normal diet, but the data at present available do not suffice to permit a precise statement of the quantity required. The high content of vitamins A and/or D in certain fats justifies their use in liberal amounts.

4. The Influence of Climate on Dietary Requirements.

In cold climates, the energy-content of the diet may need to be increased. Where climatic conditions or social customs do not permit of exposure to sunshine, vitamin D should be supplied in the diet.

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[1] See footnote 1, page 14.

PART II.

MINERAL AND VITAMIN REQUIREMENTS.

5. The Commission recognises the fact that the deficiencies of modern diets are usually in the p r o t e c t i v e f o o d s (foods rich in minerals and vitamins) rather than in more strictly e n e r g y - b e a r i n g f o o d s (rich in calories).

The term p r o t e c t i v e f o o d denotes a foodstuff which is especially rich in those nutrient principles, "good" protein, vitamins or minerals, in which the principal foods of any geographic area are deficient.

Thus—e.g., in the United States of America, where the chief constituents of the daily diet are usually white bread and other foods made from white flour—sugar and muscle meats, milk and the leafy vegetables form the most important protective foods.

In other regions where the protein content of the diet is either too low or of poor quality (e.g., Asiatic diets consisting chiefly of polished rice or soja bean, with a small quota of green vegetables), meat would provide a highly valuable protective food.

In yet other areas where the diet consists almost exclusively of cooked or dry foods, fresh fruits and/or vegetables might be the most important protective food.

Among the protective foods are, first and most important, milk and milk products (including butter), eggs and glandular tissues; then green-leaf vegetables, fruit, fat, fish and meat (muscle). Among the energy-bearing foods of little or no protective power are sugar, milled cereals and certain fats.

Of energy-giving foods, unmilled cereals are not rich in protective nutrients and the more they are refined the less is their protective power. Many fats, especially when refined, possess little or no protective constituents. Refined sugar is of value only as a source of energy; it is entirely devoid of minerals and vitamins.

The increasing habit in certain countries of large sugar consumption tends to lessen the amount of protective foods in the diet and is to be regarded with concern.

In cases where energy values are equal, protective foods should always be preferred.

6. Requirements of Pregnancy and Lactation.

The Commission has attempted to define the quantitative needs of protective foods for perfect nutrition in terms of the requirements for the pregnant and nursing woman. She should be regarded as the member of the population needing the greatest "protection" in order to ensure adequate physical endowment for the child at birth and optimum nutrition during infancy.

The greatest difficulty in arranging such a diet is to provide adequate calcium, phosphorus, iron and vitamins B_1, B_2, C and D.

7. Milk, whole or skimmed, is a rich source of calcium salts and phosphates and of vitamin B_2, also a good source of vitamin B_1; milk fat is an excellent source of vitamin A. Eggs contain vitamins A, B_1, B_2 and D and are rich in iron. The proteins of milk and eggs are not only themselves of the highest nutritive value, but also improve the utilisation of the protein contained in cereals and vegetables. Milk has an additional advantage in that the abundance and availability of its calcium salts and phosphates enhance the effect of any vitamin D derived from other articles of diet or from sunshine. Milk, although itself poor in iron, renders more effective the iron contained in the diet.

8. Ordinary diets are usually inadequate in vitamin D and, except in sunny seasons and sunny countries, a small daily ration of cod-liver oil or other fish-liver oil rich in vitamin D is to be recommended in the diet of the pregnant and nursing mother and in that of the growing child. Fish-liver oils are also the richest known natural sources of vitamin A and are important sources

of iodine. In goitrous regions, where sea-fish are not available, the provision of extra iodine in the form of iodised salt or in some other way is recommended.

9. An extended dietary use of the potato is recommended to replace part of the sugar and highly milled cereals in the ordinary diet. Potatoes provide extra vitamin C and more readily available calcium and phosphorus than are present in cereals. Potatoes also yield more iron and B vitamins than milled cereals.

The above paragraph applies to countries where potatoes are abundant, but it is of general application, due account being taken of local resources.

10. Requirements of Other Adults and Children.

In Tables I-VI, some simple schedules have been prepared to show how a selection of common protective foods will ensure safe intakes of the necessary protein, minerals and vitamins for a pregnant and nursing woman and for infants and children of ages up to 14 years. These are based on investigations made in the United Kingdom, the United States and Scandinavian countries, and are put forward to indicate how the dietary principles set forth in this report could be put into practice where these foods are available. In every locality, it will be necessary to discover the selection of food materials which is best adapted to national dietary habits and resources, and at the same time conforms to the needs of pregnancy, lactation and growth.

No attempt is made to lay down a detailed dietary programme, or to suggest the wide choice of protective and energy-yielding foods, whose selection will be influenced by availability, appetite and economic cost. Attention should, however, be directed to the value of the lightly milled cereals as a further source of iron and vitamin B_1, and of butter in preference to other common fats, because of its rich content of vitamin A.

The protective foods in Table I are arranged to yield approximately 1,400 calories without inclusion of cereals, fats or sugar;

these can be added as required to satisfy the energy requirements of any individual. For adults other than the pregnant and nursing woman, the amount of protective foods might be reduced, if necessary, for economic reasons. For growing children, however, the maintenance of a high proportion of protective foods should be the aim.

In Tables II-VI, schedules are drawn up on the above basis for age-groups 0-1, 1-2, 2-3, 3-5, 5-7 and 12-14 years. Since the rate of growth of a child decreases with advancing age, it will be noted that the amounts of protective foods are not greatly increased for the older groups.

11. General Recommendations.

A. Although a simplified diet may be so constituted from a few protective foods as to be satisfactory, it is a general principle that variety in diet tends to safety, provided it contains a sufficiency of the protective types of food materials.

B. White flour in the process of milling is deprived of important nutritive elements. Its use should be decreased and partial substitution by lightly milled cereals and especially by potatoes is recommended. The consumption of an excessive amount of sugar is to be condemned, as it tends to lessen the proportion of protective foods.

C. Milk should form a conspicuous element of the diet at all ages. The Commission commends the tendency manifested in some countries to increase the daily intake up to one litre per day for pregnant and nursing women, as well as to provide an abundant supply for infants, children of all ages and adolescents. The practice of providing milk either free or at a reduced price to these groups is highly recommended.

The ration of milk indicated in Tables I-VI provides from 100-75 % of the total calories during the first years of life, decreasing to about 50% at 3-5 years and to about 25% at the age

of puberty. For the older groups, some portion of the milk or meat may be replaced by cheese.

The Commission desires to draw attention to the high nutritive value of skimmed and separated milk, which, although deprived of its vitamin A through removal of the fat, retains the protein, the B and C vitamins, the calcium and other mineral elements. The Commission deplores the large wastage in many countries of this valuable food.

D. Fresh vegetables and/or fruit should always be constituents of the normal mixed diet. Adequate provision of the vitamins other than vitamin D can be readily accomplished by inclusion in the diet of optimum amounts of protective foods.

E. The Commission emphasises the need for provision of extra vitamin D, wherever and whenever sunshine is not abundant, especially in the period of growth and during pregnancy. Where the appropriate rich foods are not available, only such vitamin preparations as are officially controlled and approved should be permitted. The indiscriminate use of irradiated foods, except in the case of milk, is deprecated.

12. Problems recommended for Further Study.

A. Assessment of the nutritional state of children.

B. Nutritive food requirements during the first year of life.

C. Minimum vitamin and mineral requirements.

D. Minimum fat requirements.

E. The nutritive and "supplementary" values of the different protein-containing foods, to determine to what extent and in what forms animal protein is necessary for growth and health.

F. The relative nutritive value of different cereals according to the degree of milling.

G. The extent to which the increasing consumption of sugar is detrimental to health.

H. Influence of climate on food requirements.

I. The extent to which diets in common use fall below the standards recommended in this report.

J. The optimum amounts of milk required at different ages.

TABLE

DIETARY SCHEME FOR THE

A. Protective Foods.

Food	Amount	Protein	Calcium	Phosphorus	Iron	Iodine
	Grammes				Milligrammes	
MILK	1,000	32	1.2	0.9	2.4	0.02-0.05
MEAT (or fish or poultry)	120(*a*)	22	—	0.3	$\frac{5.0}{2(a_1)}$	—
EGGS (one)	50	6	—	0.1	1.5	—
CHEESE (*c*)	30	8	0.3	0.2	0.4	—
Green and Leafy VEGETABLES	100(*d*)	1	0.1	—	1.2	—
POTATOES	250	6	—	0.2	2.0	—
LEGUMES, Dried	10(*e*)	2	—	—	0.2	—
COD-LIVER OIL	3.5	—	—	—	—	Richest source
An available source of Vitamin C (from raw fruits and vegetables)						
Total yield		77	1.6	1.7	10.2	Adequate

B. Supplementary energy-yielding foods by means of which the individual's

CEREALS as needed:						
Highly milled	250(*f*)	28	—	0.2	2.5	
or						
Whole grain	250(*g*)	—	0.1	0.9	9.0	
FATS as needed.						
SUGAR as needed.						

[1] The estimates are based on data in SHERMAN's "Chemistry of Food and Nutrition", fat. The figures for vitamins, however, are converted to international units and must be

1

REGNANT AND NURSING WOMAN.

Vitamin A	Vitamin B_1	Vitamin B_2	Vitamin C	Vitamin D	Calories	Remarks
International Units			International Units			
Rich 1,000-3,000)	Good (50-75)	Rich	Poor	Poor	660	(*a*) Calculations for lean meat.
Poor	Poor (*b*)	Rich	Poor	None	240	(a_1) One-half calculated as available iron.
Rich 1,000-1,300)	Good (about 15)	Rich	None	25-40	70	(*b*) Except glands (liver and kidneys) and pork muscle.
Rich (800-1,000)	Poor	Good	Poor	Poor	125	(*c*) Calculated as cheddar cheese.
Rich 1,000-1,500)	Good	Good	Poor	None	30	(*d*) Estimated on basis of $^1/_3$ cabbage, $^1/_3$ lettuce, $^1/_3$ spinach.
Poor	Good	Good	Good	None	250	
Poor	Good	Good	None	None	35	(*e*) Calculated as beans.
Rich 1,800-3,500)	None	None	None	Rich (about 300)	30	
			To yield 250-500			
Over 5,000	Over 150	Adequate	Over 500	About 300	1,440	

nergy requirements can be met.

	Rich (about 250)				1,000	(*f*) Calculated as white flour.
					1,000	(*g*) Calculated as whole wheat.

th edition, 1933. The figures for milk are calculated for a content of 3.2% protein and 3.5% garded as rough approximation only.

Infants 0 to 1 year.

Breast-feeding is strongly recommended during the first 8-9 months of life. Even when the mother's diet and condition of life are suited for satisfactory lactation, the infant should receive supplements of (i) fresh fruit and or vegetable juice to provide antiscorbutic vitamin C and (ii) whenever abundant sunshine is not available, a small daily ration of cod-liver oil of good quality, increasing gradually to 6 grammes daily, to provide vitamin D.

Artificial feeding. When breast-feeding is not possible, the basis of the infant's diet should be milk supplemented by an adequate amount of substances rich in vitamins A, C and D. In cases where only partial breast-feeding is practicable, the supplementary diet should consist of milk and other suitable protective foods. Milk should always be pasteurised or raised to the boil to obviate the risk of milk-borne infections.

Prevention of anæmia. The infant's reserves of iron salts being small and usually exhausted before the sixth month and milk being deficient in this essential dietary element, the addition to the diet of all infants of small amounts of foods rich in iron is advocated from an early age. Foods recommended are egg yolk, if tolerated by the infant, or purées of green vegetables or carrots; in special cases, direct administration of iron salts may be ordered by the physician.

Premature infants, whether breast-fed or artificially fed, have even greater need than normal infants for supplementary vitamin and mineral additions to the diet. These should be begun in the first days after birth. Artificial vitamin D concentrates should only be given under medical supervision, in order to avoid the risk of over-dosage.

Cereals. The practice of giving cereal foods before the age of 6 months is not advised; after this age, the use of potatoes, suitably prepared, is advocated, as a partial or complete substitute for cereals.

Fat. Milk containing 3-3.5 % fat is recommended as most generally suited for infant feeding, since large amounts of fat tend to interfere with digestion and to cause fat intolerance.

TABLE II.

Children, age 1-2 years (840 calories).

Food	Amount (grammes)	Calories	Protein (grammes)
A. Protective Foods.			
MILK	750	490	24
1 EGG (or equivalent, as 30 grammes meat or fish or liver, if available)	48	70	6
Green leafy VEGETABLES	30-60	15	—
POTATO (or CARROT)	30	30	—
COD-LIVER OIL	3	30	—
		635	30
B. Supplementary Energy-yielding Foods.			
FATS (butter, if possible)	7	50	—
CEREALS (calculated as bread)	50	150	7
Total		835	37

TABLE III.

Children, age 2-3 years (1,000 calories).

Food	Amount (grammes)	Calories	Protein (grammes)
A. Protective Foods.			
MILK	1,000	660	32
1 EGG (or equivalent, as 30 grammes meat or fish or liver, if available)	48	70	6
Green leafy VEGETABLES	30-60	15	—
POTATO (and other root vegetables)	50	50	1
COD-LIVER OIL	3	30	—
A source of vitamin C (raw vegetable or fruit).			
		825	39
B. Supplementary Energy-yielding Foods.			
FATS (butter, if possible)	10	75	—
CEREALS (calculated as bread)	50	150	7
Total		1,050	46

TABLE IV.

Children, age 3-5 years (1,200 to 1,300 calories).

Food	Amount (grammes)	Calories	Protein (grammes
A. Protective Foods.			
MILK	1,000	660	32
1 EGG (or equivalent, as 30 grammes meat or fish or liver, if available)	48	70	6
Green leafy VEGETABLES	60-100	20	2
POTATO (and other root vegetables)	100	100	2
COD-LIVER OIL	3	30	—
A source of vitamin C (raw vegetable or fruit).			
		880	42
B. Supplementary Energy-yielding Foods.			
FAT (butter, if possible)	15	110	—
CEREALS (calculated as bread)	75	225	11
Total		1,215	53

TABLE V.

Children, age 5-7 years (1,400 calories).

Food	Amount (grammes)	Calories	Protein (grammes)
A. Protective Foods.			
MILK	1,000	660	32
EGG	48	70	6
MEAT, FISH, LIVER or CHEESE	30	40	6
Green leafy VEGETABLES	100	30	3
POTATO (and other root vegetables)	150	150	3
COD-LIVER OIL	3	30	—
A source of vitamin C (raw vegetable or fruit).			
		980	50
B. Supplementary Energy-yielding Foods.			
FATS (butter, if possible)	20	150	—
CEREALS (calculated as bread)	100	300	14
Total		1,430	64

TABLE VI.

Children, age 12-14 years (2,600 calories (girls), 3,200 calories (boys)).

Food	Amount (grammes)	Calories	Protein (grammes)
A. Protective Foods.			
MILK	1,000	660	32
1 EGG	48	70	6
MEAT or FISH or LIVER or CHEESE	90	120	18
Green leafy VEGETABLES	250	75	7
POTATO (and other root vegetables)	300	300	6
COD-LIVER OIL	3	30	—
A source of Vitamin C (raw vegetable or fruit).			
		1,255	69
B. Supplementary Energy-yielding Foods.			
FATS (butter, if possible), cereals and other foods to furnish total calories as required.			

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