A brief review of

FOOD AND NUTRITION

IN FIVE COUNTRIES

FIVE LECTURES BY
DELEGATES TO THE UNITED NATIONS FOOD CONFERENCE

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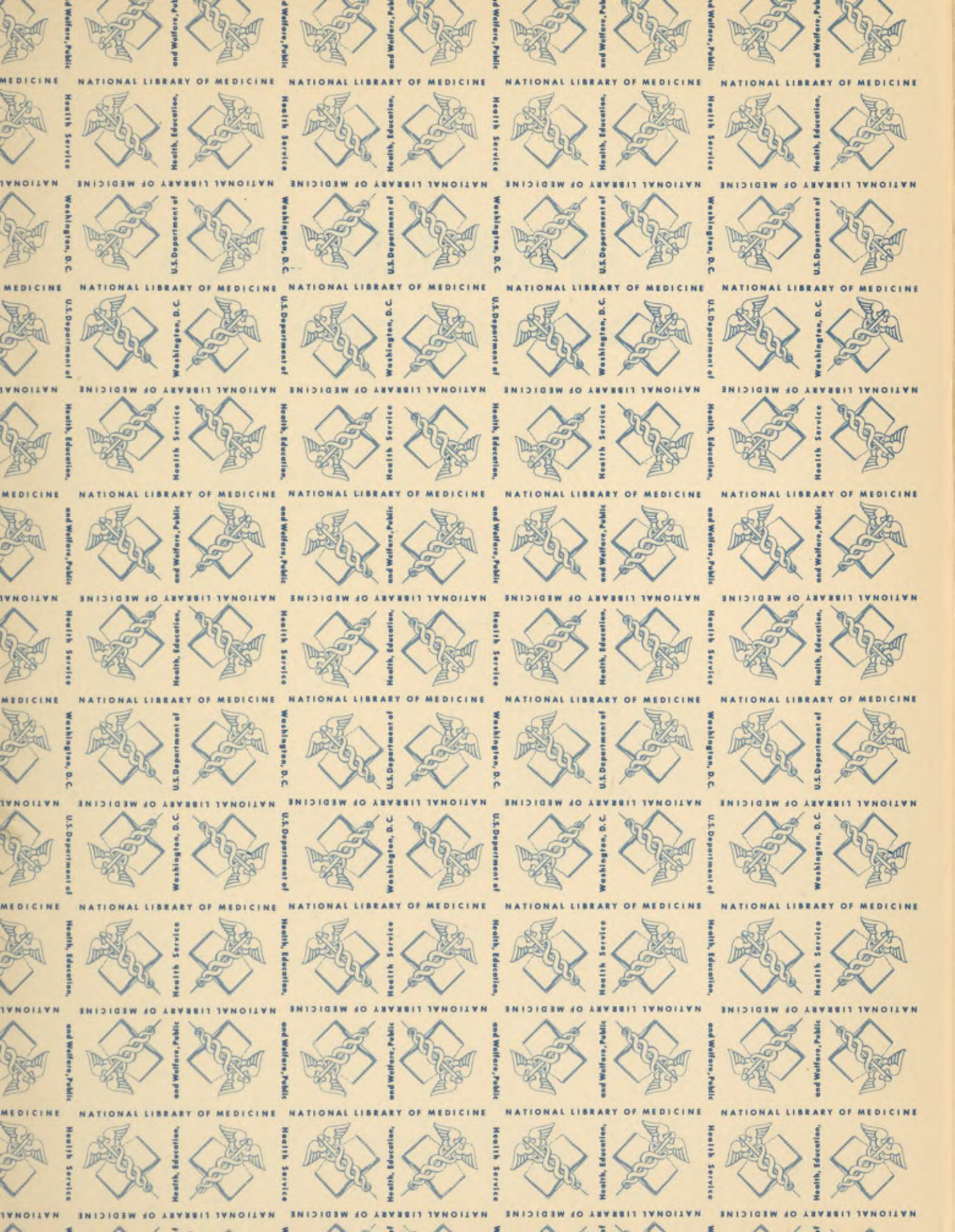
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INTRODUCTION

In 1942, to focus attention upon the necessity for a coordinated approach to food and nutrition problems, a series of eleven lectures was delivered at the United States Department of Agriculture, and later published as "The Food Front."

Immediately after the United Nations Conference on Food and Agriculture at Hot Springs, Va., in May and June 1943, we were fortunate to have six of the delegates from other countries speak to us in a continuation of "The Food Front" series of lectures. Their talks provide comparison between the nutritional problems of our own country and the countries from which these delegates came. They are particularly interesting as further evidence of the interdependence between the agricultural production of a country and the health of its people.

This series of lectures was opened by Prof. J. C. Drummond, the British representative to the National Food Conference, who spoke briefly about the wartime nutrition problems in England as an introduction to the British film "A World of Plenty" which featured Sir John Orr, one of the world pioneers in nutrition education.

M. L. Wilson, *Chief*,
W. H. Sebrell, *Associate Chief*,
Nutrition Programs Branch,
Food Distribution Administration.

THE ECONOMICS OF MEXICAN NUTRITION

By Dr. FRANCISCO DEP. MIRANDA

Miranda, Francisco DeP., physician; b. Mexico; graduate of the National University of Mexico City. Member of the Directing Council of the Pan American Sanitary Bureau; has occupied important positions in the National Department of Health of Mexico. Director of the National Institute of Nutrition of Mexico. Well known in the United States, where he has attended many medical meetings.

It gives me great pleasure to address you in the capital of your country. I did not think I would be so privileged as to speak to you at this time. I was prepared only for the Conference on Food and Agriculture. But this occasion gives me an opportunity to meet in person those who have been working here along the same lines that we work in Mexico, as well as those who are the leaders of the nutrition movement in the world.

You must understand what are and have been the conditions in my country, and you must understand that your work in the United States has been the inspiring thought that has led us in our work. We are grateful for this inspiration and we came here more to learn than to teach. We haven't anything to teach you. We only have to show you that we have accepted your teachings; that we are working very hard because the conditions that prevail in my country are so different from those that prevail here that an adaptation must be made in order to meet those conditions.

Mexico is a large country. It has a territory of nearly 2 million square kilometers and a population of nearly 20 million inhabitants, that is, 10 inhabitants per square kilometer. The number of inhabitants at the production and reproduction age (15 to 45 years) is 478 per thousand. The number of persons beyond the age of 45 is only 146 per thousand.

The area of cultivated land in 1934 was 14,517,699 hectares, approximately 36 million acres, or 2.16 acres per inhabitant, which ought to place Mexico among the nations with an abundant food supply. Notwithstanding, our figures for production, with some exceptions, are those of a low yield, owing to (1) primitive systems of land exploitation, (2) the fact that we have yet to develop our irrigation projects, and (3) the state of health of the rural laborer. His low capacity for work is the result of bad nutrition.

In order to have a picture of individual food consumption, it must be realized that national consumption figures are very unequally divided among the population, chiefly according to the economic status.

Roughly speaking, the population of Mexico could be divided, from this point of view, into four groups:

	Percent
Very poor economic status	25 to 30
Poor economic status	22 to 26
Adequate economic status	32 to 36
Ample economic status	14 to 18

This economic situation is the result of the history of the country. It can be said that now all our national policy has been directed toward bettering the standards of life of the population, which have been very low since the Aztec and Maya period, through the colonial and the economic liberalism eras.

A great part of the population passed from a system of slavery to one of "peonage" (which systems were very much alike)—from the Spanish "encomienda" to the massing of great fortunes, which in our country chiefly meant the monopolization of lands by a capitalist minority. There was really no great change.

But today the aim of all branches of the Government is to give all the people an opportunity to satisfy at least the necessities of life.

A great part of the population of Mexico is composed of pure Indians. We have 4 to 6 million pure Indians in Mexico, mostly employed in agriculture. We have a large mixed population (white and Indian). From 16 to 20 percent of the population is white. For a long time the Indians were in a state of slavery or peonage, with very little for the necessities of life. They were exploited by existing conditions—producing only raw materials—and the country was without any industrialization.

This year is considered to be one of importance to Mexico because the curve of our agricultural production—even though it has gone up every year—has been met by the upward movement of the industrialization curve; this year, 1943, gives us larger income figures from industrial than from agricultural resources. Our agricultural resources and our industrial resources are now equally divided. There is a greater tendency to develop industry than agriculture. But agriculture still needs development, and the Government has made great effort in this direction.

A little more than 50 percent of the inhabitants have incomes insufficient for the necessities of life. The total yearly income of the population has been estimated at 7 billion pesos, an average of 350 pesos per inhabitant. It would not give a correct picture of the situation to translate 350 pesos by the rate of exchange to $70 a year, because the cost of living in Mexico is much lower than in the United States. If we are to compare the cost of living in Mexico City with the cost of living in the United States, the

rate of exchange would be considered as 2 pesos for $1. Then we could translate 350 pesos a year to $175.

Examining the consumption figures we have the average daily per capita consumption for vegetable foods as follows:

	Grams	
Corn	279	
Wheat	70	
Beans	22	
Potatoes	13	(10 grams, net)
Sweetpotatoes	8.6	(6.6 grams, net)
Chickpeas	7	
Faba	2.7	(1.7 grams, net)
Sugar	56	

This gives a total of 330 grams of carbohydrates, 38.4 grams of proteins, and 15.5 grams of fats—1,651 calories per day per person, from vegetable foods.

Corn is chiefly eaten by low-income groups, whereas wheat is chiefly eaten by high-income groups, beans by all groups, and potatoes and rice chiefly by high-income groups.

Animal foods have a very low consumption in Mexico. The average per capita consumption of meat, for 1934 was:

Mexico (entire country):	Kilograms
Beef	7.5
Mutton	.2
Pork	2.5
Goat	.4
Total	10.6
The Federal District:	
Beef	27.4
Mutton	1.1
Pork	10.4
Goat	.9
Total	39.8

The per capita consumption has increased. In 1933 it was 10.1 kilograms per capita; in 1934, 10.6; in 1935, 11; and in 1936, 11.4.

We have no data on fish and fowl consumption, but we know it also is very low.

Milk is consumed in the Federal District at the rate of 250 grams a day per capita. Outside the Federal District the consumption is lower, but it has not been determined.

The higher consumption of milk and meat in the Federal District is explained because the Federal District with 1,700,000 inhabitants, of whom 1,600,000 dwell in cities, has from 18 to 22 percent of the "more than sufficient" income group and from 38 to 42 percent of the "adequate income" group.

The consumption of fats is very low. Butter is only used by the high-income groups. The same is true of eggs. Though Mexico is a producer of fruits, the consumption of them is not high. Part of the crop is exported, a part goes to industry, and a part is lost because of lack of transportation facilities. In cities, prices at retail are high and only high- or medium-income families can afford to buy fruit.

A summary of more recent data on the consumption levels of 80 families (565 persons) is taken from a survey made under the direction of Dr. W. D. Robinson, of the Rockefeller Foundation, collaborating with our organizations. These families are inhabitants of a marginal zone of Mexico City and are representative of 2 percent of the population of this zone. The data are on a 7-day basis. The values are presented in the following tabulations as edible portions of foods and are calculated as consumption per adult man per day, by using Bigwood's consumption coefficients.

	Grams
Meat, fish and fowl	Mean consumption, 80. Median, 72.
Eggs, per week	Mean, 2.1. Median, 1.6.
	Cubic centimeters
Milk, per day	Mean, 395. Median, 359.

There is a definite relation between the quantity of the above-mentioned products and the economic status of the family.

	Grams
Butter	Mean, 1.6. Median, too low to be considered.
Other fats, such as bacon and vegetable fats	Mean, 28. Median, 25.

The consumption of significant quantities of butter is limited to higher economic levels. There is a tendency for the consumption of "other fats" to be higher among higher economic levels.

	Grams
Total cereals	Mean, 599. Median, 562.
Corn products	Mean, 318. Median, 286.
Wheat products	Mean, 318. Median, 217.
Other cereals [1]	Mean, 21. Median, 17.

[1] "Other cereals" are rice and, occasionally, oats.

Dry leguminous grains (mostly beans and occasionally chickpeas, lentils, and dry peas) are preferred by all income groups; there is no immediate apparent relation between the consumption of these foods and economic level. Their daily per capita consumption is:

	Grams
Dry leguminous grains	Mean, 53. Median, 49.
Green and yellow vegetables	Mean, 48. Median, 46.
Tomatoes	Mean, 64. Median, 59.
Potatoes (white)	Mean, 35. Median, 28.
Other vegetables	Mean, 17. Median, 14.

There is a tendency toward increased consumption of vegetables at high economic levels.

Consumption of citrus fruits and bananas follows:

	Grams
Citrus fruits	Mean, 24.
Bananas	Mean, 38. Median, 18.

There are other significant fruits like the pepper (chile).

Consumption of chile is as follows:

	Grams
Fresh	Mean, 6. Median, 3.
Dry	Mean, 2.5. Median, 2.

In summarizing, I would say that the diet of the low-income group of the population of Mexico (which is more than 50 percent) is insufficient in terms of calories, according to accepted standards. It is insufficient in protective foods, chiefly those of animal origin. It is unbalanced because of the preponderance of carbohydrates. The insufficiency correlates clearly with the low economic level of the population.

As regards the costs and consequences of malnutrition and undernutrition in Mexico, the low consumption of foods such as I have outlined to you has many bad results. Diseases of the digestive tract are most common in Mexico. Diarrhea and enteritis caused 46.4 deaths per 10,000 inhabitants in 1939. Infectious diseases which increase human requirements are also common. In 1939 we had 13.1 deaths per 10,000 inhabitants from malaria.

Industrialization is not an important factor in malnutrition in Mexico as the low-income groups use more of the whole grains, and the high-income groups, which use more polished rice, wheat flour, and sugar, eat more meat and other protective foods.

Corn "masa" is prepared in a different way from corn meal and polenta. Probably more of the niacin is conserved for pellagra is less frequent in Mexico than among other corn-eating populations. The Mexican Indian takes the whole grains of the corn, softens them overnight with lime water, and then boils them to soften their cuticles. After the corn has been thoroughly softened, it is ground either in the primitive way on a stone grinder or carried to the grinders or millers. And thus is formed what they call the "masa." This the Indians employ for tortillas or tamales or other corn dishes. Tamales or tortillas and beans are the principal foods. We think that the amino acids contained in the corn, added to the proteins of the beans, give a diet which, if not completely acceptable, comes as near as practicable to containing the amino acids needed for proper nutrition.

Ignorance is an important factor in malnutrition, but before trying to change the food habits of our people, attention must be given to the wise composition of mixtures used in the country. Corn is deficient in certain amino acids, but the addition of beans is wise, as they complement the missing amino acids of corn.

Frugality is dangerous when carried to an extreme; but, judiciously observed, it may mean freedom from certain diseases now increasing among highly civilized nations. Dr. Chavez finds more cases of hypertension, arteriosclerosis, and coronary disease among the well-to-do who attend his private office than among the patients in the wards of charity hospitals. My own experience shows the higher frequency of obesity and diabetes among the well-to-do. Rheumatic fever, rheumatic heart disease, etc., are, on the contrary, more common among low-income groups. Undoubtedly not only food is important in this respect; psychological factors are also important in modern life. As Dr. Chavez has said: "The Mexican Indian is an impassive spectator of civilization."

Ignorance is common in all walks of life, if all meanings of the word are considered.

Poverty is the predominant reason for malnutrition. Some of the causes of poverty among the rural workers are: Low yield of harvests because of primitive methods of agriculture, scarce irrigation, few routes of communication, temporary or itinerant occupation, and low selling prices for crude agricultural products for exportation.

Among city dwellers the reasons for poverty are: Underdevelopment in industry, low salaries escaping Government control, predominance of unskilled laborers, great development of petty commerce, unremunerative arts and crafts. Added to these are social conditions such as disorganization of family life, a high proportion of illegitimate unions and temporal unions, diminished sense of responsibility, and, among city dwellers, dissipation of money for nonessentials.

Alcoholism is a very important factor. Alcoholics exhibit the most advanced picture of malnutrition. Miserable conditions of life frequently result.

The number of victims of malnutrition easily recognized as such is not very high in Mexico, except in certain regions where special conditions of production prevail. As in other countries, most cases can only be detected by special diagnostic methods which have been introduced recently.

Among the most common types of malnutrition diseases we find: Pellagra, in all its evolutionary phases; beriberi, frequently disguised as alcoholic polyneuritis, diabetic polyneuritis or myocarditis; nutritional edema, frequently called "dropsy"; hyperchromic anemias, chiefly in infancy and in pregnancy; xerosis and cutaneous signs of "A" avitaminosis; riboflavin deficiencies; rickets found only in the mildest form, as in other tropical countries.

Among the consequences of malnutrition, one of the most prevalent and far-reaching is the lessened working capacity of the population. This can be seen even in children in relation to school work. The psychological attitude of lack of ambition and stamina to overcome the obstacles of life is to be taken into special consideration.

The effect on physical development is marked during infancy and childhood. Many characteristics which used to be considered as racial are only the effects of malnutrition.

The decrease of resistance to infections and the high infant mortality are, to a great extent, the result of malnutrition. Our infant-mortality rate is 145 per thousand births. There is a high mortality from tuberculosis, 5.6 per 10,000 inhabitants; it used to be 14. Our general mortality is 232.1 per 10,000 inhabitants.

Summarizing these results, we can see that the chief cause of malnutrition is of economic origin

and consists mainly in the fact that a large part of Mexico's population works under conditions that do not allow the satisfaction of its physiological needs of food consumption. Ignorance of the basic principles of nutrition is common at all economic levels of population. The frequency of infectious tropical diseases, such as malaria, is also a factor of malnutrition. Nutritional diseases are not so common as is sometimes supposed. The consequences of malnutrition are incapacity for work, disorders in growth and development, and high infant, general, and special mortality.

Public Health and Public Assistance Measures To Improve Consumption Levels

The Department of Public Health has followed with special interest the development of scientific studies of the problem of nutrition. As in all countries, it began with the sanitary control of foods in an effort to prevent adulteration and alterations which would endanger health. The critical economic conditions of 1929–30, with all their consequences of "overproduction" and unemployment, brought forth an investigation of the effects of such conditions on the health of the nations involved. This was the starting point of the splendid work achieved by the health organization of the League of Nations.

Mexico created its National Food Commission in 1936. This commission, formed by representatives of the several interested branches of the Government, under the auspices of the Department of Health, has initiated some measures which have been carried out with success.

At the beginning of this year, the Department of Public Health took another forward step in this direction, creating the National Institute of Nutrition, which I have the honor to direct. This is still in the process of organization and of obtaining the necessary equipment— which, because of priorities, is very difficult. Notwithstanding, we have initiated our work under a general program that includes the following subjects:

(1) Research on malnutrition in the human being and the composition of foods used in the country. The first will comprise social and economic, clinical, anthropometric, and laboratory studies. Laboratory determinations now in use are carotene and vitamin A, vitamin C, protein and its fractions in blood. Attention is being given to the employment of the slit lamp in clinical examinations. For the orientation of these studies and training of personnel we have had the valuable cooperation of Dr. W. D. Robinson, of the Rockefeller Foundation. Other possibilities of cooperation are now being contemplated and discussed, especially the training of chemists for the determination of vitamins in foods.

(2) An educational program comprising superior, intermediate, and popular education. Superior education will be given doctors planning to become nutriologists, and persons having had previous training in home economics who are training to be dietitians and nutritionists. Popular education uses the radio, home demonstrations, booklets, posters, and other means of spreading information to the public.

(3) Nutrition clinics. The Institute has a staff of nutriologists who have done postgraduate work in the United States and Argentina. When sufficient trained personnel is available, we will establish nutrition clinics throughout the Republic with a view to detecting malnutrition in its initial periods and checking its progress to the more evident stages of diseases.

We are contemplating in the future an organization composed of three institutes: The National Institute of Nutrition, the Institute of Economic Studies, and the Institute of Agricultural Studies, coordinated by the National Commission to plan the National Food Policy.

At the same time, we shall continue to watch the development of international organizations, such as the Health Organization of the League of Nations and the International Labor Office of the same organization, which in the past have rendered great services to the world and we hope will continue to do so after the war. We shall also follow with great interest the work of the Pan American Sanitary Office, which has also done excellent work in promoting nutrition advances in America, especially since the 1938 Sanitary Conference, held at Bogota.

The activities of the Secretary of Public Assistance in trying to solve the nutrition problem in Mexico are growing in importance. As a part of the Commission of Studies of the Secretary, a Commission of Foods was created, which is in charge of study of the technical direction of food services in all the Institutions of public assistance, in which are grouped the feeding of children and hospital inmates, and feeding in public dining halls.

The feeding of children is going on in homes for children, collective homes, and substitute homes, which are taking the place of the old orphanages and asylums for children. In Mexico we have considered that there is no real replacement of the home atmosphere. We are doing away with asylums and orphanages which are so far from the spirit of the home. We are seeking women who have a good background and giving them the opportunity to head groups of 8 to 20 children in their private homes. We are paying for all the assistance to these children. The results already attained are very favorable.

The population of collective homes, which in 1941 was only 272, increased to 1,179 in 1942 in the Federal District alone, and that of substitute homes, which was 201 in 1941, grew to 579 during 1942 in the Federal District.

The "Milk Provision" gave milk to 2,570 infants in the Federal District. The total number of children receiving assistance in food, not including the inmates of hospitals, was 16,020, including 3,625 children who receive school lunches in Mexico City.

The first act of General Avila Camacho the day he took office as President of the Republic was to order the Secretary of Public Assistance to erect public

dining rooms for the benefit of the low-income families. Family dining hall No. 1 was opened in November 1941 and serves 3 meals a day to 1,200 persons, of whom more than half are children of preschool and school age. The service is paid for in part by the family, but only one-fourth of the cost is thus recovered. Social workers and dietitians study the applications received for this kind of service. The second family dining hall will be opened this year. The benefits of this type of organization will be extended to other parts of the country.

Special mention must be made of the work of the Secretary of Public Assistance in promoting private organizations which are cooperating in the school-lunch program.

We know that our work for the improvement of nutrition in Mexico is just beginning. We have accepted all the views expressed in the Conference on Food and Agriculture at Hot Springs, and we are going to carry on our program to extend the benefits of these ideas and policies. We know that Mexico is underdeveloped in its natural resources. We have the future before us. We know that guided by the United States and other nations that are far advanced in their nutrition programs, Mexico has a greater future.

NUTRITIONAL PROBLEMS OF EGYPT

By Prof. Ali Hassan

Hassan, Ali, professor of biochemistry, University of Fouad I, Cairo; b. Egypt. B. S. London University, M. D. University of Cairo. For the past 10 years intimately concerned with nutritional problems in Egypt.

I must thank Dr. Sebrell for giving me this opportunity to talk to you about nutrition in Egypt.

Though for a long time our nutritional problems in Egypt were many, our interest in nutrition is of recent origin. The attention of the Government and peoples of Egypt has been forcibly drawn to the problem of nutrition, in its modern sense and its fundamental importance in the development of the country, only during the last few years.

Soon after joining the League of Nations, the Egyptian representatives, from 1937 onward, began to be aware of the widespread activity of the Health Organization and the State members of the League in matters of health. The Egyptian Government was advised by the League at that time to set up a National Nutrition Committee to study and assist in the solution of nutrition problems in Egypt and to cooperate in the general effort to improve the nutritional status of the world as a whole.

In 1938, I represented the Egyptian National Nutrition Committee at the meeting of the representatives of the national nutrition committees held in October at Geneva. There I met for the first time Miss Sybil L. Smith,[1] representing the United States of America, who impressed me by her knowledge and experience. I also met many other famous nutrition experts, some of whom represented their countries in the United Nations Food Conference held at Hot Springs lately. To me, this meeting was both a lesson and a stimulus.

It was early in 1939 that the Egyptian Nutrition Committee began its activities, and it has ever since been trying to help the Government to carry out its nutrition program. Other Government departments are contributing in a varying degree to the solution of the problem, either directly or indirectly. These are:

(1) The Biochemistry Department and the Department of Hygiene and Preventive Medicine, both of the Fouad I University.
(2) The Chemical Department and the Departmnt of Animal Husbandry, Ministry of Agriculture;
(3) Some departments of the Faculty of Agriculture, Fouad I University;
(4) The Ministry of Social Affairs, the Ministry for Pious Contributions, and the Ministry of Interior.

We have in Egypt the Ministry for Pious Contributions, of which you have no counterpart here. Some people, before they die, give some of their possessions to charity. A ministry has been formed to look after such contributions, which are usually left for churches or mosques, for the poor, or to build hospitals and similar institutions. The Ministries of Social Affairs, Interior, and Pious Contributions are concerned primarily with the social and economic aspects of the gifts; the organizations listed under (1), (2), and (3) are more interested in the technical aspects.

Before going any further, I should like to tell you something about the food habits and the food consumption of the country and explain the food situation, which, to my mind, is influenced by the geographical peculiarities of our location. For this purpose, we can divide Egypt into five zones. But, to start with, Egypt is divided into two parts, what we call Lower Egypt and Upper Egypt; the latter extends practically from Cairo down to the northern boundary of the Sudan.

The Delta represents the first or northern part or zone. Then I shall divide Upper Egypt further into three more zones. The part from Assouan in the south, to Wady-Halfa, i. e., to the northern boundary of the Sudan; then, the part from Assouan to Cairo may be divided into two zones. The division is necessitated by the difference in the mode of irrigation.

In ancient times Egypt was flooded by the Nile, and immediately after the flood seed was sown, and one crop only was raised during the year. Now, because of a very complicated system of irrigation, many parts of the land of Egypt are under irrigation all the year round, and sometimes we can raise two or three crops a year. But, some parts of Egypt still follow the same system of irrigation that was followed in earlier times. The land is flooded, and, during the flood, the whole area looks just like an immense lake. This is what we call the Basin area, and in this area only one crop a year is obtained.

The other part of Upper Egypt is under perennial irrigation. So we have perennial irrigation in two places: In Lower Egypt, that is, the Delta, and in the major part of Upper Egypt with the exception of about half a million acres which are still under Basin irrigation. The remaining zone (I have just discussed four zones—the Delta, Upper Egypt, the Basin area, and the area south of Assouan, where the Nubians live) is formed of the scattered cultivated areas in the desert which are dependent on well

[1] Office of Experiment Stations, Agricultural Research Administration, U. S. Department of Agriculture.

water and are known as the oases. The population of the oases and that of Nubia is only 170,000 persons, one-hundreth of the whole population. The population at present is 17 millions. Egypt, by the way, is a very thickly populated country. It has 1,200 persons to the square mile; and in Menufia, one of the central Provinces of the Delta, it is still more densely populated.

Now, these areas differ in their food consumption. In the Delta, you have cereals, wheat, maize, rice, and legumes; these are the staple articles of food. You have milk, fish, especially in the northern parts, and also vegetables and fruits. Little meat is consumed.

In Upper Egypt, which is under irrigation, you find the same products, but more legumes, less fish, less milk. That is very important when we talk of rickets and examine its relation to milk consumption. But in Upper Egypt there are plenty of dates. Dates are important, especially in the Basin area, and the area down south. In Nubia they have no vegetables, no fruits (except dates, which are plentiful) but milk is available; also eggs. In the Basin area and in Nubia, they eat millet. That, again, is important when we discuss pellagra, which is a common deficiency disease. Pellagra is common in the Delta; you find it also in Upper Egypt, where the land is under constant cultivation, i. e., irrigated perennially. In both districts maize is cultivated, and the people have pellagra. In the Basin area and Nubia maize is not cultivated, but instead millet, and there are plenty of dates, and the people have no pellagra.

In the oases the people live on cereals, grown either locally or imported from the Nile Valley; they have no milk; they don't know what fish is, but they have plenty of fruits and vegetables. Their only fat material is olive oil. They grow olives and consume a large amount of olive oil. They don't eat fish or milk. Egyptians in the north, except those in the towns, drink little fluid milk. The custom of making butter and selling it is universal. What is left, that is, the skimmed milk, is used locally or made into cheese which is highly nutritious and to my mind makes the peasant independent of meat. As long as he gets that milk, I think he doesn't need meat, which he doesn't get because usually meat is obtainable only in big villages, and there only once a week. They kill their cattle once a week and at festival times. But in big towns you can get meat daily.

In the country the cooking is not complicated. The habit of boiling things and throwing the water away is not very common, since, when vegetables are cooked, meat is put into the pot with them and a sort of stew made of the whole. This is true especially among the poorer classes, who have a hot meal in the evening. What is left from the evening meal is eaten hot in the morning. The two big meals are dinner and breakfast; lunch is taken casually in the fields. The peasants are in the habit of consuming large amounts of green leafy vegetables, raw.

Wilson's work on pellagra in Egypt has always been an excellent guide to those interested in the nutritional state of the country. Except for this, however, no systematic nutritional studies have been undertaken.

In 1932, I paid a visit to two of the oases in the desert, Baharia and Farafra, and I was struck by the difference in the nutritional state of the people there. There was practically no anemia among the children, no gingivitis, very little dental caries, no pellagra, and no rickets. In the oases area the people live on cereals, dates, vegetables, and fruits, with practically no milk. My visit was in winter, in February and March. In Baharia, they had about 5 cows, very lean, and I am sure these did not give more than about a pint of milk a day, every one of them. There was practically no feeding stuff for these animals, and, in Farafra, there were no hogs; there was only 1 cow, and to serve it, they had to travel 4 days to Baharia and 4 days back.

In 1937 Professor Ellinger was sent by the Lister Institute to Cairo, and we both made a tour of Upper Egypt. We made sure of two things that were already known: That pellagra was practically absent in the Basin area where millet was eaten, although the people of this Basin area were undernourished. The wages were incredibly low, a man getting what corresponds to 2 cents in your money per day; and whereas in the north the women help their husbands by doing field work beside them; in the south they are not allowed to do so, and the man has the whole burden of keeping the family and looking after it. But regardless of these facts and the definite undernourishment, the people in the Basin area are free from pellagra. In the other areas, where there is perennial irrigation, pellagra had begun to show itself. Two things follow water in Upper Egypt, maize cultivation and parasitic infections. There the picture is in many ways similar to what one sees in the Delta.

In 1939 I visited Nubia. When the Assouan dam was built to enable us to store enough water for the summer, this caused the land of the Nubians to be flooded. Now they have only 4 months to cultivate their land. During these 4 months, they cultivate either millet or some legumes for their own consumption, using the dried stalks as food for their goats. They are very fond of tea, and drink it with milk, and to make sure that they get enough milk, they keep goats. I have been informed that some Nubians drink as much as 900 cubic centimeters of milk daily—something none of the people in the north do. Everyone drinks tea, even children, sometimes as often as six times a day. These people, like those living in the oases, show less anemia, no rickets, no pellagra. In addition to drinking milk, they eat dates, and they have fish as well. The immense dam, behind which the water is stored, is swarming with fish most of the year.

In the Delta most of the nutritional diseases are found. Pellagra is prevalent, also rickets, night blindness, and possibly some other ill-defined deficiency illnesses which we have not yet been able to

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study. But you will have an idea about the prevalence of pellagra when I tell you about its incidence in Shebin El Kanater, where I visited the hospital to investigate what was thought to be an epidemic of pellagra. It wasn't an epidemic at all.

The hospital had a doctor who showed a keen interest in pellagra, and it did not take the people long to know that and to flock to the hospital to be treated. His chief, making his usual round, found that the hospital contained more pellagra cases than any other hospital in the district. This, as I said, was due to the unusual interest in pellagra shown by this particular medical man.

I studied the situation because the question arose of combating pellagra there by mixing nicotinic acid with the maize as it was milled. It was a very expensive procedure, and I was asked to investigate the case. I found, that the pellagra affected from 1.1 to 6.5 percent of the population of the different villages—on an average, about 2.5 percent. This average includes only cases showing the typical rash. When the cases of pellagra that don't show a rash are included, this figure goes up to about 6 percent. The women in that area and in Egypt as a whole, are less susceptible to pellagra than men. Among the cases examined, 30 percent were women and 70 percent men.

I said that no systematic nutrition studies on a large scale were undertaken, that is, none of the type which you perform here in America. There are many reasons for this. The first reason, to my mind, is that we started late, and another is the difficulty of obtaining trained staffs. It is possible to get men to help you, but in Moslem countries, Moslem families do not like to mix with strange men, and it took us some time to train women to do the investigating. Women, in my view, are most suited for these investigations, whatever may be the qualifications of the men. They can get from the housewife more information than can a man assistant.

Recently, we were so fortunate as to find an American woman, the wife of an Egyptian, who a few years ago started a school for social studies. She is still training quite a large number of workers, and we are in a position now to start an investigation.

Before I came away, the Ministry of Health, under whose direction all these things are done, was contemplating the formation of special units to go around the country making food surveys, etc. However, on a very small scale, some investigations have been carried on by the Biochemistry Department and also by the Department of Hygiene and Preventive Medicine—by the Biochemistry Department among about 76 in Cairo poor families, and by the Hygiene Department, among university students and also among the pupils of the Ministry of Education.

All these investigations show that there is malnutrition and undernourishment, especially in the young. The students who were examined were a representative group from Fouad I University, who number about 9,000. Similar results were also obtained in the schools of the Ministry of Education. These results caused great alarm in the country because of the poor nutritional state of the young, and at once steps were taken to improve the situation.

I think I made it clear that we have pellagra and that we have rickets, too. The distribution of rickets, as I said at the Food Conference in Hot Springs, is very interesting. It is less in the north, where milk consumption is greater, than in the south, and the percentage of rickets in children attending the child-welfare centers increases as one goes southward, until it attains a maximum in Assouan. Assouan is the upper border of Nubia. The Nubians definitely consume more milk than the people of the Assouan area, and this may explain the relative absence of rickets there. Getting feed for milk animals in summer is a very big problem with us; feed becomes very scarce, especially in the Basin area, where only one crop is raised. This difference in milk consumption explains the unequal distribution of rickets. In the oases, although they don't drink milk, they don't show signs of rickets. It seems to me that they get plenty of sunshine and enough calcium from the large quantity of vegetables and fruits which they consume, which are not available in the Basin area. There are not enough vegetables and fruits in the Basin area. This is most probably the cause of night blindness which appears especially before the flood.

I can only hurriedly go through the methods for improving nutrition in Egypt. Some of them were undertaken by the Government; some were undertaken by the people. I shall discuss them all together. We all agree that education is a very important factor in any nutritional program. Education in Egypt is developing at a very rapid rate. You can learn a good deal about the rate at which it is developing by comparing the number of schools in 1922 and 1937.

The difference is very great in all the schools, both those for boys and those for girls. But the most important factor has been the introduction of compulsory education. To supply the compulsory education, we have, at present, about 3,348 schools working 2 shifts. The number of pupils attending these schools is now 1 million boys and girls. Of course, education in nutritional matters is also progressing. This education is being carried on in the training college and all the higher schools and the secondary schools, where the pupils get the facts about nutrition and enough knowledge to help them in the choice of foods. The Ministry of Agriculture is encouraging the cultivation of vegetables and fruits.

We have definitely more vegetables and fruits now than we had 10 years ago. I remember 4 years ago buying 25 tangerines for 2 cents, and 10 oranges for about 4 cents. Now, during war, that is not possible; everything has gone up, with so many troops in the country.

The Department of Animal Husbandry is also getting much attention from the Ministry of Agriculture. I left them trying to improve the breed of the buffalo, which is the milking animal par excellence because it gives more milk than the cow—milk

that is much richer than cow's milk in butter. Buffalo milk has about 7 percent fat, on an average. That is why, at present, Egypt chooses the buffalo for butter production.

The introduction of small industries to improve the economic situation and increase the purchasing power of the public is also being tried.

The Ministry of Health has done a great deal toward the improvement of the nutritional state of the population. In 1922 we did not have a single center for child welfare. Now, we have many of these child welfare centers, and at present they are looking after one-seventh of all the infants born in the country. We get about 600,000 newborn every year; these centers look after about 95,000. They take care of the mother before and after parturition. The center supplies milk for the baby, clothes, etc., and educates the mother in the management of the baby and of herself. They have a propaganda section where they exhibit educational films and give short talks on the value of hygienic methods, etc., for the rearing of healthy babies. They also, on occasion, give prizes to mothers for the cleanliness and for the care they give their young. The Ministry of Health keeps an eye on foods to insure their quality and their freedom from injurious substances. The sale of foodstuffs is controlled by the Government.

As to other measures, I should like to read you a report of one of the experts of our delegation which describes the activities of other ministries. Dr. A. Hussein, who represents the Ministry of Social Affairs, presented this report to the Food Conference at Hot Springs:

1. Elementary public schools in Egypt teach about 1,000,000 boys and girls from the age of 7 to 12. A large number of these boys and girls are undernourished, owing in the first place to the very limited resources of their parents.

Some experiments have been made in the last few years in providing pupils of a number of these schools with a daily meal. The physical and mental development of these pupils exceeded very remarkably the development of those in other schools.

Last year an act was passed whereby the State undertook to give a daily meal in all public schools. The State alone finances the scheme. All the pupils whether rich or poor get their meal free, as any differentiation would have a bad moral effect.

The meals given are planned by a qualified dietitian. They are meant to make good the deficiencies in the ordinary diet of the pupils which is normally poor in protective foods. The meals given consist mainly of milk, eggs, cheese, legumes, fresh vegetables, and fruits. They are cheap and easy to prepare.

The execution of this scheme started at the beginning of this year; 185,000 pupils are getting their meals now, and it will not be long before all the other boys and girls get their meals.

2. Public kitchens are being opened in poor city districts, where hot luncheons are supplied at a very low price (2½ cents, which is only 25 percent of the cost). An investigation is made in each district by a social worker. Poor families are selected and given cards which permit them to take meals from these kitchens to their homes. As in the former case, the meals were planned by a dietitian to enable these poor families to get the protective foods they lack. These kitchens are financed either by the State or by benevolent societies or private individuals.

3. Similar kitchens are being established inside factories, giving hot luncheons at half cost to workers. The factories pay the difference.

4. Poor families, examined by social agencies, get help either from State funds or from charitable societies subsidized to a great extent by the State. Relief is provided either in money or in goods, such as flour, sugar, cloth, shoes, etc.

5. Consumer cooperative societies are spreading rapidly all over the country, especially in poor districts and in factories; they are having priority to dealers in getting, through the ministry of supplies, controlled commodities like sugar, oil, cloth, etc.

The members of these societies get their commodities at very low prices, almost wholesale prices.

6. Rural welfare centers, which started work in 1941, have been very successful in educating and inducing farmers to grow more and better foods for their own consumption; the area of vegetables expanded remarkably; chickens and egg-laying hens have increased in number and improved in quality.

Very poor families have been given chickens, goats, and sheep. They are taught and helped to cultivate a small vegetable area or start on their own some side industry like beekeeping, cloth and carpet weaving, etc.

These efforts were very successful in increasing the income of these poor families and, in time, enable them to produce a large part of their food and clothing.

7. A minimum wage has been fixed for laborers in industry and commerce. Its extension to agriculture is being considered.

8. A bill for social insurance against old age and invalidity has already been drafted by the Government and will be shortly presented to the Egyptian Parliament for consideration.

You will see from this summary that we have started late, but I think you will agree that we have made a good beginning and that there is definite evidence that at least the general health of the country is improving.

I mentioned at the Food Conference that measurements taken for the recruits in 1939 showed definite increase in height and chest figures over those of recruits in 1929. Dr. Shawky Bey, who is in charge of the Children's Hospital in Cairo, said to me before I came here, "I don't see now the rickets cases that I used to see 20 years ago." So we are improving. Thank you very much.

Dr. Sebrell: Would anyone like to ask Professor Hassan some questions?

Question: I should like to ask Professor Hassan a question concerning the population problem of Egypt. We understand that within the past 50 years or so the population has doubled and that the rate of increase is going on so that today there are about 400 people per square kilometer of cultivated area. What is the outlook for the future?

Professor Hassan: We have done nothing so far. I personally calculate that the question will become acute when our population reaches 25 millions. The inhabited land is only one-thirtieth of the total area of the country—in other words, about 8 million acres. We can still reclaim an extra million acres of land, and also if we get the Basin area under perennial irrigation we can afford to increase without becoming crowded very soon. In addition, though the Egyptian farmer is very active and works hard to get the best out of his land, there is still a big scope for improving production. This will also help. In

a discussion of this problem with a gentleman from Poland, he said: "Why not develop the desert?" This again is a possibility but a very expensive one. We may, however, be forced ultimately to emigrate and I think our chief outlet is down south in the Sudan. So I think Egypt may accommodate up to 25 millions; we are now about 17 millions; we increase at the rate of a quarter of a million every year; and this rate will increase as the number increases.

Question: Is the feeding of the population on an adequate nutritional basis?

Prof. Hassan: The amount of food available at present is adequate. I believe we have enough food, but the distribution is poor; however, if it is well distributed among the population it can raise the general standard immensely. But now it is not distributed well among the population.

Question: Would Prof. Hassan indicate how the war has affected the food-supply situation in Egypt?

Prof. Hassan: I should be glad to, but with your permission I shall invite our Under Secretary of State for Supplies, who is with us here to talk about this problem.

Mr. Enan: Ladies and gentlemen, I did not expect to come here except to listen to my colleague, Mr. Hassan, but I am delighted to answer a question which appears to be a little foreign to his field. As a matter of fact, we are producing sufficient cereals and sufficient meat and vegetables and fruit for the consumption of the population on the basis of the standard established by our nutrition experts. The exigencies of the war and certain difficulties of transportation and cases of emergency have made it necessary to call upon the Egyptian Government to help, in particular with regard to perishables, such as fruits and fresh vegetables.

We did our very best to accede to these requests, and, I think it is safe to say, that we have placed at the disposal of the forces of the various nations who are living on Egyptian territory, more than 10 percent of the vegetable crops which we grow.

With regard to other foods, we have also placed food in sufficient quantities, cereals, flour, etc., at the disposal of the forces whenever we have been asked to. As a matter of fact, however, they have always tried to get their supplies from other sources whenever they could, owing to the fact that with the lack of fertilizers in our country there was some fear that the supply would not meet the demand. But it was just very lately, that is to say, a few days before we left Egypt to come to the United States, that the Egyptian Government put at the disposal of the military authorities some 60,000 or 70,000 tons of cereals.

Now, with regard to milk, eggs, and meat, I think you might be interested to know that many of the officers who are working in the headquarters in the Middle East are stationed in towns such as Cairo and Alexandria. Almost all of them get their daily supplies of green vegetables, milk, eggs, meat, etc., from local supplies. I think that this has had, to some extent, a certain effect upon the nutrition of the country, but it wasn't by any means objectionable, because we don't consider that it would have any detrimental results as to the feeling of the public. That is, from one point of view, because the people were rather pleased to be of some help to the forces. We think that after the clearing out of the Axis forces from North Africa, a little less food will have to be supplied to the troops stationed in Egypt. The food thus released will help, we think, to cover the expected shortage in some of the supplies because of the lack of fertilizers. Thank you.

INFLUENCE OF THE BELGIAN AGRICULTURAL PATTERN UPON THE NUTRITION HABITS OF THE COUNTRY

By Prof. E. J. Bigwood

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May I say before beginning this lecture that it is a very great satisfaction for me to have the occasion of coming again to this country. I say "again" because I lived in this country some 22 years ago while doing postgraduate work. In fact, it was in this country that I became interested in biochemistry. After that, I went back to Belgium and later on had the opportunity of coming again to this country in 1929 for the International Congress in Physiology, which took place in Boston. Now this is the third time that I enjoy the privilege of coming here. If you consider also that my family is in this country and that I have not seen them for a little over 2 years, you can well imagine that to a certain extent I had the feeling of coming back home when I came here. It is a very great privilege that I appreciate, this opportunity of saying a few words on the question of food problems in my country.

Belgium, as you know, is a very small country, not quite 8½ million people, chiefly engaged in industry. It is also a very densely populated country, some 30 thousand square kilometers (I think that corresponds to something like 11,736 square miles), which makes an average density of population of about 280 people per square kilometer (716 people per square mile).

But that is not the whole story as far as the density of the population is concerned: 38 percent of the total population, namely, 3.1 million people are concentrated in 12 large urban and industrial centers occupying less than 15 percent of the total surface area of the country. Those centers range between 50,000 and 950,000 in population. Seven hundred thousand people live in 29 semirural and semi-industrial centers having from 15,000 to 50,000 inhabitants, and finally a rural population of 4.4 million people live in 2,446 centers of less than 15,000 inhabitants. On the other hand, we have only 17 to 18 percent of our people who are living on agriculture. That is about 1 person out of 6 of the total population engaged in farming.

Let us now consider the total amount of food available in Belgium (I am speaking of normal prewar conditions); at first glance, one might think the situation was fairly satisfactory. The amount of food available, whether home-produced or imported, supplies some 2,900 calories per head a day, on an average. About 45 to 50, nearly 50 percent, of that was imported, and 50 to 55 percent was home-produced. In terms of cost, the figure was different. Our deficit was of the order of something like 25 to 30 percent; in calories, however, it was about 50 percent. But, if we take into consideration the amount of feeding stuffs that we had to import in Belgium in normal times in order to be able to produce the amount of dairy products and meat that we did, the proportion of the calories which were imported, corresponded to something like 70 percent.

Now, how is it—and this is a point I would like to emphasize, because I think it is rather interesting—how is it, that a country like mine was so largely dependent upon importing foreign agricultural products, and was it a normal condition? Was it right, or was it wrong? I intend to show you that in peacetime it was a very satisfactory condition although in wartime, of course, it leads to a situation which is catastrophic.

Let us first examine how the surface area of our country was used. The following tabulation shows what the situation was in 1938. Something like 62 percent of the surface area of the whole of the country formed our agricultural domain, and this was divided as follows: Nearly 50 percent of this domain was used as pastures, and at least three-fourths of it, that is to say the pastures and fodder crops, were used for the production of meat and dairy products. I shall refer to them as indirect food, that is to say, food that is not directly consumed by human beings but is consumed by animals and converted into dairy products, meat, and animal fat. Scarcely 25 percent of the agricultural domain was used for growing crops, that is, for direct foodstuffs. Our uncultivable lands, parks, and heaths occupied only 4 percent of the total surface area of the country; woodland, about 18 percent; and all other types of lands, houses, gardens, factories, roads, railroads, water, and sand took up something like 16 percent of the total surface area of the country. Our urban and

industrial centers, in which the largest part of the country's activities took place and where about 40 percent of our people were concentrated, occupied about 10 percent of the total surface area of the country.

Areas of land in the various uses follow:

	Hectares	*Percent*
Agricultural land (1 hectare=2.47 acres)	1,883,000	61.7
Wheat crops	173,000	9.2
Sugar beets	50,000	2.6
Potato crop	150,000	8.0
Pastures	900,000	47.8
Various products (including chiefly fodder crops and vegetable crops)	610,000	32.4
Total	1,883,000	100.0
Uncultivable land, parks, heaths	125,000	4.2
Woodland (deforestation has already gone too far in Belgium)	541,000	17.7
All other types of lands, namely, houses, gardens, factories, roads, railroads, water, sand, etc	501,000	16.4
Total surface area of the country	3,050,000	100.0

Only one person out of six engaged in agricultural production, and yet 62 percent of the surface area of the country was used for agricultural production. Nevertheless, we depended very considerably on our imports in order to meet the requirements of the population in food.

Certainly, this cannot be explained exclusively by the fact that we were an industrial country before anything else. The point which must be emphasized is that our agriculture had developed towards the production of indirect food, meat and dairy products, and this is what rendered the country ever so much more dependent on its imports for its calorie requirements. This has taken place in my country ever since we had a very severe economic crisis between 1883 and 1896 when the large producing countries started to produce large amounts of cereals and when on account of the fact that they had developed mechanical means of agricultural production, they could sell on the world market at very much lower prices than those that our agricultural producers could afford. They could sell, therefore, on the international market large amounts of cheap breadstuffs. The amount of wheat that one of their farmers produced required the labor of 20 of our farmers and the quality of grain they could produce was better than ours. Moreover, at that time, the mechanization of agriculture was not applicable on the small farms we had in our country.

It is since that time that our farmers have oriented their activities towards the production of dairy products—milk and butter, not very much cheese—and meat and eggs. In other words, the country was gradually engaging more and more in the production of perishable types of foodstuffs which were of the protective group, whereas the country depended very considerably on its imports for cereals. The surface area of our country which was used for cereal crop production gradually fell from something near 935,000 hectares to 600,000, and the fodder crops increased from 575,000 to 828,000 hectares. That was between 1880 and 1930, and ever since there has been some gradual change in that same direction. In 1938, 900,000 hectares, something like 2¼ million acres, or about half of the total surface area of the country's agricultural domain, were used as pastures and we had some 2 million cattle on these pastures—about 1 million milk cows producing some 3,100 million liters of milk a year (average yield per cow of 675 gallons of milk a year). In other words, our country was not only very densely populated with human beings but also very densely populated with livestock. In addition to that, we also had about 1 million pigs in the country.

This explains why Belgium, more than any other country, was importing such huge amounts of feedstuffs. The requirements of our country for concentrates such as oilcakes alone, for instance, corresponded to something like 450,000 tons a year. We depended more on these imported concentrates for feeding our animals than did countries like Holland or Denmark, because the surface area of our pasture per head of livestock was very much smaller. The consequence of this orientation of agricultural production in Belgium with regard to the calorie yield of food in our country can be summarized as follows:

Of the total surface area of the agricultural land, 12 percent was used for crops of direct food (breadstuffs, part of the sugar-beet and potato crops) corresponding to human consumption of potatoes. This small fraction of agricultural land provided about 34 percent of the calorie requirements of the Belgian population.

Over 65 percent of the surface area was used for food indirectly produced by land (pastures and fodder crops including part of potato crops used as fodder. The pastures alone covered about 50 percent of the total surface area of Belgium's agricultural land). This large fraction of the agricultural land provided only about 16 percent of the calorie requirements of the Belgian population.

Thus 50 percent of the energy requirements of the population was provided by the agricultural land; the other 50 percent had to be provided by imported food.

You will see that in 1938 only about 12 percent of the surface area of the agricultural domain in Belgium was used for direct food production and that yielded about 34 percent, a relatively large proportion of the calories required for the population; whereas a very much larger proportion of the surface area, 65 percent, was used for indirect production of food, that is, foods of animal origin (the pastures alone covered 50 percent out of the 65 percent) and they yielded only 16 percent of the calories. Those two fractions together make up the 50 percent of the total calorie requirements of the population, the other 50 percent being provided by imported foodstuffs. One of the very interesting points that arises from this study is, I think, that there is a very small surface area with a high calorie yield for direct food, a very large surface area with a low calorie yield for the foods of animal origin; but, on the other hand, that the latter are foodstuffs which yield a large proportion of the protective nutrients that our population needs.

Belgium, before this war, was thus self-supporting as far as the actual consumption of indirect food was

concerned. I am not speaking of what the requirements were, of what the consumption of indirect food should have been, but what it actually was. In this sense, the country was approximately self-supporting in meat, milk, and butter. Belgium imported most of its cheese from Holland; on the other hand, it also imported very large amounts of cereals, chiefly wheat. Our consumption was nearly 1,300,000 tons of wheat grain, 1,000,000 of which was imported and only 300,000 home-produced.

This situation led to a food supply of which I am going to give you the main characteristics. I am speaking of the average diet of the population considered as a whole. The available amount of food corresponded to something like 80 grams of protein, 80 to 100 grams of fat, and 350 to 430 grams of carbohydrates, making up about 2,800 calories a day per head of the population. On an average the amount of calcium provided was low, about 0.6 gram per head a day, which was, in fact, the very minimum of what we considered as being necessary, with no safety margin whatsoever.

The average calorie supply was nearly sufficient, but not quite. If we calculate the weighted average of the requirements in calories in Belgium, taking into account the proportion of the different age groups of the children and the different groups of workmen and their requirements according to their work and the requirements of expectant mothers, and so forth, the weighted average of the requirements in Belgium corresponds to something very close to 2,700 calories per head of the population and the amount of calories in the available amount of food is something close to 2,800. Now this difference of 100 calories between available food and requirements is certainly too small. In other words, in our country, the inevitable waste—household, industrial, and commercial—represents a larger margin than that given by the above-mentioned difference between requirements and supply. So, one can see that there is a certain small shortage in calories, but there is a very considerable shortage in the average diet of the population in certain protective nutrients. Such is the case for calcium.

The amount of iron which is taken in, on an average, seems rather satisfactory; but the intake of vitamins is certainly below what is required. We have found it very difficult to calculate more or less exactly what the amount of vitamin intake is, because we know that we cannot base our calculations simply on the content of the raw material in these vitamins but have to take into account the habits of the population and their way of preparing food, which, in many instances is very unsatisfactory. But on an average, we have certain indications which show that vitamin A intake is below 3,000 units, probably below 2,500 units per head, per day, which is certainly very much too low.

We have considered so far the average Belgian diet in terms of calories and of certain essential nutrients. Let us also consider it now in terms of foodstuffs. The following table gives us the answer. There is a consumption of 430 grams per head a day of wheat, that is, cereals in general, but this consumption is of practically no other cereal than wheat. In fact, out of the 434 grams of cereals consumed, 430 is wheat. This shows quite clearly that wheat is practically exclusively the cereal which is consumed in Belgium. A very small amount of rice is consumed, but the consumption of potatoes is very high, an average of 560 grams.

The peasants in our country consume very large amounts of potatoes, about 750 grams per head a day; in towns, of course, the percentage is very much lower, but the average is 560 grams, just over one-half kilogram. These potatoes are an important source of vitamin C although a large proportion of the C is lost on account of existing cooking habits.

Then the amount of meat is about 108 grams; and I might just say that as far as free fats are concerned, the average consumption is about 22 grams of butter, 20 grams of margarine, about 10 grams of animal fat, and 7 grams of vegetable table oil, in all about 58 grams of free fat out of the 80 to 100 total fat consumption per head of population.

Let us turn now to milk consumption. The amount is extremely low, namely, 224 cubic centimeters. That is the average consumption per head of the population. The amount of cheese is not high either, so that we consider in our country that the low calcium intake in comparison to the total calorie intake is due to the fact that our milk-product consumption is so low.

The average daily food intake of the Belgian population in 1938 was as follows:

Food Consumed:	*Grams*
Cereals (of which 430 grams are wheat)	434.2
Rice	9.3
Potatoes	560.0
Dried beans, peas, etc.	8.3
Coconut	3.3
Sugar	77.0
Margarine	20.0
Vegetable oils and fats	8.2
Fresh green leafy vegetables	100.0
Canned vegetables	6.7
Chicory	6.7
Coffee	13.3
Imported fruits	50.0
Home-produced fruits	———
Meat	108.0
Fish (fresh and canned)	24.0
Eggs (0.44 apiece)	22.0
Whole milk	224.0
Skimmed milk	4.1
Cheese	9.3
White cheese	4.0
Butter	21.8
Animal fat	9.9
Foods directly produced by land (largely imported):	
Quantity	1,297.0
In round figures	1,300.0
	Calories
Energy value in net calories	2,121.0
Foods of animal origin indirectly produced by land (foods predominantly home-produced):	
	Grams
Quantity	427.1
	Calories
Energy value in net calories	672.0

In all: 1,724 grams of food per head and per day yielding 2,793 net calories.

In general, in our country, we feel that the problem is to increase the consumption of dairy products, but not so much the consumption of meat, which already is satisfactory. The most important thing that we have to consider is to increase the consumption of dairy products and green leafy vegetables in order to be able to shift to a higher level the intake of some of the important protective nutrients.

Now, how is it that we consume so little of these important foodstuffs? The characteristic feature of the conditions of malnutrition which prevailed in Belgium before the war was that almost enough calories were consumed but our population's diet was not an adequately balanced one. Indeed, our problem was not an easy one to solve. All of the milk which we consumed was home-produced; it would have been difficult for us to increase its production very considerably. I have already said how very densely populated our country is, not only as far as human beings are concerned, but also livestock; that the yield of milk per head of cow was on the high side. It did not correspond to the highest figure that exists, it was not as high as in Holland or Denmark, but it was high. It corresponded to an average figure of about 675 gallons a year, or nearly 2 gallons a day on an average for the whole year. It was because of the very large consumption of feedstuffs, in concentrates, that we reached this high level of milk production. Of course, the adequate feeding of the animals and also the adequate selection of milk cows were the two major factors involved.

Where we had to improve a good deal was in the quality of milk. It certainly was very far from being satisfactory. I am speaking not only from the point of view of the bacteriological cleanliness of the milk, but also of its nutritive value. It is very striking indeed that in those parts of the country where our producers of the small farmer types were engaged in production on a cooperative basis, the quality of the milk produced was better from the bacteriological point of view, and from the nutritive point of view, as well. In other parts of the country where the small producers were working on their own, isolatedly, and were not selecting the proper types of animals for milk production or feeding their animals properly, production was low. Where production was inadequate, the average amount of fat in milk was below 3 percent, whereas it averaged above 3.4 percent in those areas where dairy producers worked cooperatively.

This most paradoxical situation existed, that whenever the milk produced was of a higher fat content than 2.8 percent, and such a result was obtained at great pains, skimming was taking place in the distribution process. This skimming was difficult to detect as long as the fat content was not brought below 2.8 percent, a figure often found in nonskimmed milk produced by a poor milk cow. So what had been gained, and with great effort on one side, was lost on the other side on account of this abnormal situation which existed in our country of farmers producing milk greatly varying in quality. The situation was a serious one, for it was impossible for us to think of trying to increase the consumption of milk as long as we had not, first of all, made a greater effort to increase the quality of the milk. Problems of that kind come up in addition to those concerning increased production and are intimately related to it.

Let us now turn to another aspect of our studies in nutrition. We have had many surveys made regarding family budgets of the low-income groups of our population. In many cases such economic studies were made at the same time as surveys regarding food consumption, and these studies showed that in comparable groups of the population where the standard of living and the purchasing conditions are the same, there are very large variations in the balance of the diets. Some families are consuming better balanced diets than others. When one figures out the calorie supply in comparison with the cost of the diet, one sees that the supply of calories can range all the way between 370 and 670 calories per Belgian franc. Thus, for food purchases, the per unit expenditure for the same number of calories may vary from 1 to 2.

We first thought that this was due to differences in housewives' efficiency in dealing adequately with their household problems. That proved, however, not to be the case. The examination of our survey results indicated that those diets with a low calorie yield for a given expenditure—1 franc—were those diets which were better balanced than those yielding more calories for the same expenditure. In the latter case the people were getting their calories cheaply by consuming large amounts of bread and potatoes, foods which were high in starch content and were poor in protective nutrients.

When calculating what the cost of the diet would have been if it had been adequately balanced, or at least partially so, we came to the conclusion that 350 calories per franc of expenditure was closer to what the situation should have been. In other words, if a 3,000-calorie diet, normally balanced, was costing about 8½ Belgian francs per day, the people were endeavoring to get the same amount of energy, namely 3,000 calories, at a very much lower cost, for between 4 and 8 francs instead of 8½ francs. But in order to get these calories very cheaply, they had to do it by sacrificing the adequate intake of protective foodstuffs. When more of the latter were consumed and less of the other ones, the cost of the diet was raised very substantially, notwithstanding a constant calorie intake. The problem in our country, therefore, is really to obtain an increase in consumption of dairy products and green leafy vegetables and fruits among large sections of our population.

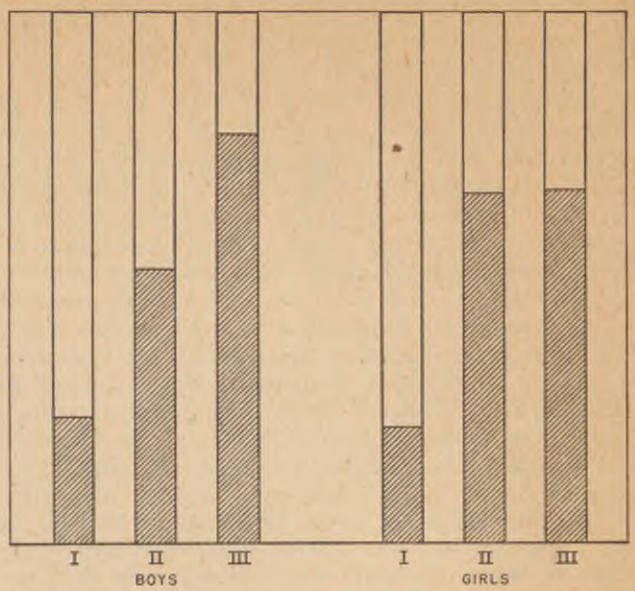
The consequence of this situation has also been studied in our country. We have had several investigations made on the state of nutrition of our population. We have used the dark adaptation test for studying the situation with regard to vitamin A; whatever may be said with regard to the real practical significance of this test, which has been improved technically very much since we used it in

Belgium (we used the Zeiss Birch Hirschfeld adaptometer), we came to the conclusion that among the school children of various income groups, in practically all groups in towns, one could improve the dark adaptation in some 40 percent of the children in large towns, such as, for instance, Brussels.

All of these investigations have unfortunately been made in Brussels only. Since it has been the experience in most of the countries that the practical significance of these physiological tests is so often difficult to interpret, we have found it advisable also to conduct certain food experiments in schools and to test their influence on the state of nutrition of the children getting the benefit of extra protective food intake at school without cost. Just before the war, we made a fairly important experiment of this kind on some 600 children in schools in Brussels. There we compared the results that we obtained by having milk consumed at school on the one hand, and the Oslo-breakfast type of meal that you all know of, on the other.

I am very sorry, indeed, that I cannot show you a few charts with regard to our results. We were not dealing with the children of the poorest classes, but with families of low- or average-income groups of the population in Belgium. We knew the experience that England had with respect to the distribution of milk in schools, and, on the other hand, of the Oslo-breakfast type of scheme. We tried both, and we printed a fairly extensive publication on its experimental bearing on the general physical condition of the children, on their height and weight, thus their growth; also on the influence on their mental fitness as judged from their behavior at school. This publication is a book of some 350 pages, which just came out of press 2 days before the Germans came into Belgium, "Une experience alimentaire en Belgique," by E. J. Bigwood, G. Jaeguemyns, and Paul M. G. Levy—Imprimere Vronans, Brussels, 1940. I took two copies of it with me out of occupied Belgium. I left one of them in London, and I was hoping to find the other one in this country. I had given it to a friend of mine who brought it to America, but I had unfortunately not succeeded in getting it for this occasion; otherwise, I might have shown you what the exact results were. I shall, therefore, quote them from memory.

We found them important because of their extremely beneficial results, showing how very much there was to be done in order to improve our country's food position. We found that the Oslo-breakfast scheme gave us very much better results than the milk scheme, but this difference was chiefly observed among the boys. The milk scheme and the Oslo-breakfast scheme gave us, on the average, the same results in girls, but in boys the advantage of the latter was tremendous. We had the children divided into three groups: One test group for comparison, receiving no extra food at school, a second group was put on the milk scheme, and the third one on the Oslo-breakfast scheme. If we represent the situation schematically, the results were as follows as far as the general physical condition was concerned.



Comparison of relative growth of children fed on various diets: *I*, Test groups; *II*, milk-fed groups; *III*, Oslo-breakfast groups.

The physical condition of the children was assessed at the beginning and the end of the experiment, which lasted about 8 months. It had improved in the test group (I) in a proportion of cases given approximately by the dark section of the column I. The frequency of improvement in the milk group is given in column II and in the Oslo-breakfast group in Column III. We obtained consistently the same sort of results regarding growth curves as well as the improvement in mental fitness and behavior at school. The outstanding beneficial results obtained with the Oslo breakfast were practically all found in boys, whereas, with girls, the milk scheme gave the same beneficial results as those obtained with the Oslo breakfast. We were of the opinion, however, that further investigations were needed to confirm those findings. The schoolmasters, who were very skeptical at the beginning of the experiment, were fully convinced of the absolute necessity of improving the health condition of our urban school-aged children by methods which would adequately influence food habits.

I have given you a general idea of what the situation was in normal times, and what sort of investigations were made in our country to ascertain it. May I just say one or two words before finishing, with regard to what has happened since the occupation of Belgium? The Nazi policy in the occupied countries has been more or less the same everywhere; their tendency has been to try to induce the people in the occupied countries to become more self-sustaining with regard to their calorie requirements. As far as Belgium is concerend, there are publications in Germany—of which I have the reference—which show what was to be done to reach that result.

As a matter of fact we knew before the war that if we plowed up some 25 percent of the pastures and

increased by 33 percent the potato crops, increased by 100 percent the sugar consumption, if there was no change or not very much change in the cereal production, and if the whole of the rye produced in Belgium, which was used as feeding stuffs in normal times, was used for human consumption as well as wheat, we would reach a situation which would meet by home production alone the requirements as far as calories are concerned. This would reduce by one-fourth the amount of meat consumed, the amount of milk products, that is to say, the consumption of those foods which were either just normally or insufficiently consumed in normal times. On the other hand, we would have to increase the consumption of those other foodstuffs which are stable, but which yield larger proportions of calories, namely, those foodstuffs of high starch or sugar content, which supply chiefly calories but none or very little protective nutrients. It would have brought us back as far as diet balance was concerned to the situation that existed some 150 years ago, namely, one that lay in the opposite direction.

In the beginning of the occupation, it was the intention of the Germans to try to engage our country in such an agricultural scheme, and they made great efforts to succeed in that direction but they met decided opposition on the part of our farmers, who have endeavored to preserve the surface area used as pastures. Crop land has been increased in surface area but chiefly at the expense of land other than that used for pastures. The Nazi's policy has been one which would have led us to become in the future much more dependent on imports for the most perishable type of our foodstuffs, those of the protective group of which we were already short; whereas we would have become more independent for those other foodstuffs yielding chiefly calories, which are much more stable and easier to transport throughout the world and to stock anywhere for a certain time. Indeed, it was a paradoxical situation in which the Nazis tried to engage the allied countries they dominate. It was the case in Holland and in Denmark, as well as in Belgium. In general, it was the case in most of the occupied countries or parts of countries where there was a large production of food of animal origin. Fortunately our farmers did not give in. They opposed such a policy as strongly as they could.

But, we cannot expect that no harm at all has been achieved by the Germans during the last 3 years of Nazi domination. Our livestock has been reduced very considerably. Cattle have undergone a 30-percent reduction, and have now necessarily to feed on a proportionately larger surface of pasture, because the importation of feeding stuffs has stopped. We have practically no pigs any more and hardly any poultry. (There is a reduction of about 80 percent in this livestock.) The production of milk has dropped by about 50 to 60 percent and the meat production has also gone down to the same extent. If we remember that the rationed diet in Belgium for the vast majority of the people living in towns and industrial areas, has fallen from a level corresponding to 2,850 calories, half of which was home-produced, down to one varying between 900 and 1,300 calories a day, and that this situation has been going on since the end of 1940, one can realize the gravity of the situation.

During the 4 years of German occupation during the last war, the diet never dropped below 2,000 calories per head a day. Only a very few wealthy people, can afford during the present war to spend large enough sums of money on the black market to obtain the food they need. The black market is developing very widely because what can be obtained by the Belgium population on the black market is that much that the Germans don't get, so that there is a good deal of black marketing going on, but extremely expensive it is. Those of you who have some idea of the purchasing power of the Belgian franc in pre-war times might be interested to know that a family of 4 people will expend at the present time something like 100,000 to 120,000 francs a year, on food alone. This sum is very far above the budgets of the vast majority of the people.

Very few people in occupied Belgium, therefore, can now afford to live in conditions similar to those of the last war. That is the situation, ladies and gentlemen. Protein in the diet has fallen below 30 grams a day for something like two-thirds of the population. We have, of course, a certain number, some 300,000 or 400,000, of workmen who are being sent to Germany; but, on the other hand, we have something like 600,000 or 800,000 German soldiers to feed, and they get three times the 1,250-calorie theoretical ration of the civilians. The fat content of the diet—the free-fat intake— has fallen to a level corresponding to 10 grams a day, whereas in pre-war time it was of the order of 55 to 60 grams.

These various figures will justify the very pessimistic outlook we have regarding the public health conditions we are going to face when we come back to our country. The only hope we have is that it won't be altogether too late when we do. It is indeed with anguish that we think of the future. One of our most urgent agricultural problems will be to rebuild as quickly as possible our livestock, which will take several years, and we shall, therefore, during that time, have to live on a very much more ill-balanced diet than the one we used to consume, discarding altogether the question of the quantity of calories. This kind of situation is going to be met within most of the allied countries which are completely occupied by the enemy. That represents something like 140 million people for the 8 allied countries on the European continent, exclusive of Russia, which is only partly occupied. I am speaking exclusively of those countries now entirely occupied by Germany.

Such is the situation as I see it. It is going to raise quite different problems from those that we would have had to deal with had there been no war at all. I think that is all, ladies and gentlemen, that I have to tell you.

Question: I would like to ask a question, Dr. Bigwood. I noticed you did not mention any of the de-

ficiency diseases. Could you tell us anything about the prevalence of deficiency disease in Belgium before the war?

Dr. Bigwood: As far as clear-cut deficiency diseases are concerned, Belgium's situation was rather satisfactory in normal times. We had rickets, which developed very extensively during the last war, but we improved the situation considerably since that time although there was a low calcium intake, which I mentioned. It corresponded to an intake without any safety margin at all, but we did favor very considerably the intake of cod-liver oil and, in fact, the proportion of rickets was going down very considerably. As far as the other deficiency diseases clinically evident are concerned, we had very little. We believe, though, that predeficiencies were widespread in our country. During the present war, as far as we know, the two major and very serious consequences of food deficiency have been nutritional edema, which is very widespread and which did not occur at all during the last war in Belgium; and, secondly, an alarming extension of tuberculosis, often developing acutely.

Question: I would like to ask a question in connection with the Oslo breakfasts. I think you said you compared the school milk breakfasts with the Oslo breakfasts, and I am not sure we all know just what the Oslo breakfast is.

Dr. Bigwood: The Oslo-breakfast type of school meal is one which is formed practically exclusively of protective foodstuffs. That is to say, it is composed of whole-meal bread with butter and cheese, half an orange, and a pint of milk. But in our experiment, we reduced the amount of milk in the Oslo breakfast, simply because we were comparing this type of meal with the scheme providing milk alone so that if we had given relatively the same amount of milk in both groups, we would not have had anything that might have been compared satisfactorily. We, therefore, reduced somewhat the amount of milk in our Oslo-breakfast type of meal, whereas in the other group the milk ration was high and sugar was added to it in order to increase the calorie intake in this second group. In principle the Oslo-breakfast type of meal intends to supply at school as much as possible of the protective foodstuffs so that it doesn't matter so much if the other meals of the day are deficient in these types of food.

Question: May I ask, did you form any opinion of why the boys improved more on the Oslo breakfast than the girls?

Dr. Bigwood: We had the impression, but this was only an impression, that most boys probably are a more vulnerable group than girls. For a given inadequacy of the diet, boys are liable to feel it more than girls. We were of the opinion, however, that no explanation could really be given and our intention was to repeat the experiment, had not the war broke out. This intention was mentioned in our published conclusion.

Question: I suppose the home food habits of these children were the same:

Dr. Bigwood: Oh, yes, exactly, the same.

Question: Dr. Bigwood, can you give us the comparison of the calories in this center?

Dr. Bigwood: The calories were inevitably higher in the Oslo breakfast group; we could not adjust our two experiments in order to have the same calorie intake; that was not only impossible but also not desirable because the children on the milk scheme had breakfast at home before coming to school, whereas those on the Oslo-breakfast scheme did not.

Question: How much milk did you give in the Oslo breakfast?

Dr. Bigwood: In the Oslo breakfast, we only gave, I quote from memory, about a quarter of liter, that is 250 cubic centimeters. Whereas, we gave 500 to 750 cubic centimeters of milk in the other group.

DIETARY HABITS OF THE CHINESE

By Dr. J. Heng Liu

Liu, J. Heng, physician; b. China; B. S., M. D., Harvard University. Director of Peiping Union Medical College, Peiping; Minister of Health, Nanking; Surgeon-General of Chinese Army Medical Service; President, Chinese Medical Association; organized and is member of Chinese National Health Administration. Now head of the Division of Medical Supplies, China Defense Supplies, Inc., and attached to Chinese Embassy, Washington, D. C.

I suppose everybody here knows something about Chinese food. It is really quite astonishing to us Chinese that Chinese food should be so popular in the United States.

When I passed through India last October on my way here, I stopped at a place called Karachi and there we went to a Chinese dinner in a Chinese restaurant. The restaurant was new, it had just been opened. The proprietor was telling us that in that month, October, 10 new Chinese restaurants were opened in that city—not for the Hindus, who don't care anything about Chinese food, not for the Englishmen there, not for the Chinese of whom there were very few in Karachi, but for the benefit of the American Army in Karachi.

I suppose the American boys get tired of the food served in the camps. Although all of your Army camps serve excellent food, the soldiers must get tired of it, and want something different, and immediately they think of chop suey.

Talking about chop suey, it really is not a Chinese dish. I mean, those of you who might walk into a Chinese restaurant in China and order chop suey would not get it, and the people would not know what you were talking about.

A few years ago an American in Shanghai opened a restaurant, and outside the door he put up a great big neon sign "American chop suey." This, as I remember, was the first chop suey.

Anyway, Chinese food is popular; I don't know why, but I suppose because it is different and it is tasty.

But as I say, all Chinese food is not alike. The food you get here in the Chinese restaurants is Cantonese food. I mean that other than chop suey there are a good many dishes which are Chinese, but they are Cantonese in style, in the way of their preparation, and in the materials which are used.

China is such a big country that there are great differences between the food used by the northerners and by the southerners and by the people in the east and those in the west.

The main difference is in the staple foods which the people use. In the north—I come from North China—the food we eat consists mainly of wheat flour, that is, we eat much more bread than rice.

Rice is the staple diet of all the provinces south of the Yangtze River. That is a very rough lay of the distribution of the food habits of the northerners and the southerners, and it may be the main reason why the northern Chinese is a larger person than the southerner.

Compared to the average, I am a short fellow. In North China the people are tall and heavy and it isn't at all unusual to see groups of people who average 5 feet 10 inches or over, and who weigh 150 pounds and more. In the south, however, the people are much smaller, their average height being probably 5 feet 3 or 4, and the average weight, 120 pounds. And as you go into the interior—go in west from the coast—the people are very much smaller. In the Province Szechuan, in which Chungking is located, the average is even smaller, probably 5 feet 1, the average weight less than 110 pounds.

We do not know whether the diet has very much to do with the size of the people or whether it is heredity. But anyway, wherever wheat and cereals other than rice are the staple diet, the people are larger in stature. They are taller, and they are heavier.

You must have heard of Chinese feasts where sharks, bird's-nest, and such unusual food materials are used. We do have these delicacies, but they do not amount to very much as general items of food, probably not more than one in a million or half a million people ever eat sharks' fins.

The ordinary food that we eat, as you know, is quite different from your diet. We never eat large pieces of meat like your roasts, steaks, or chops. You know that in chop suey or chow mein, the meat is chopped up, and that is the way we eat meat. It is almost always chopped into small pieces before it is cooked, and most of the time it is mixed with a lot of vegetables.

As you have seen, we depend largely on rice or on other cereals. By "other cereals" I mean wheat flour —in the form of bread—or millet, corn, sorghum, barley, and oats, eaten sometimes in the form of gruels and sometimes in the form of bread.

In addition to consuming these cereal elements—wheat flour and other cereals in the north, and rice in the south, which supply the energy intake, or the

calories—the general average population, and particularly the poorer people, have to depend on vegetables.

All kinds of the common vegetables are grown in China; and in addition, we have different kinds of beans, of which the soybean is very generally used. Then we make different food materials from soybeans—bean-curd, bean milk, bean sprouts, and so forth—so that the soybean becomes a very important food element in China.

In the preparation of Chinese foods, the vegetables are not cooked the way you cook them. We do not prefer the way that Americans or the Englishmen cook their vegetables, for your vegetables are boiled in water, and you eat them after adding a little butter or milk. We chop up the vegetables and usually fry them in a little oil. Very often a little meat is added to the vegetable, not much, just enough to give a better flavor, and then some salt is added and often a little soy sauce, made from soybeans, which is commonly seen in all the Chinese restaurants in this country. Now that gives us a much more tasty vegetable dish than what you have; but then, of course, your vegetable dishes are what you call side dishes, whereas with most of our people, this vegetable dish is the main dish of the meal.

Depending on the number of persons to a meal, you can have several kinds of vegetables prepared in different ways: Some with meat, some without meat, some with pepper, some with sweet sauce, and so on. But with the very poor families, you get only one dish, only one kind of vegetable, and very often this is cooked with a few drops of oil and some salt and no meat at all.

The consumption of meat in China is very small. As I said, we never eat a very large piece of meat the way you eat a roast or a steak. Too, the ordinary person cannot afford to eat such an expensive item as meat. But before the war, meat was very cheap according to American standards of living. And eggs, for instance, I still remember the time 10 or 12 years ago when you could get 100 or 150 eggs for one Chinese dollar. One Chinese dollar would be worth about 50 cents in American money, so that you could get eggs, three or four, for one of your pennies. But even at that price many people could not afford them.

I was looking up certain figures, and I found that before the war, in 1935–36, Chinese exports of eggs and egg products amounted to 40 million dollars, and most of those eggs and egg products came to this country. From a nutritional point of view, China really could not afford to export all these eggs; I mean they were not a surplus stock of eggs. The people were so poor that they could not afford to eat them so the eggs were exported so as to get money in order to buy rice and other cereals. At the Food Conference at Hot Springs, it was shown that the main causes of malnutrition are poverty and ignorance. When a person cannot afford to buy the food materials—well—he has to go hungry; but when he can afford to buy food, but still is malnourished, then, of course, the cause is ignorance.

In China, 85 percent of our people are farmers, and living is very difficult for them. The income of these farmers per year per person before the war was so little that they had a difficult time just getting enough to eat.

At the Food Conference, when delegates from several countries spoke of food, they immediately talked about milk, cheese, butter, and dairy products in general. Now China has been getting along without dairy products of any kind. When you go into a Chinese restaurant, you will see that the menus do not contain butter; there is no milk served, no cream, and no cheese. We do not use these foods except among the Mongols and Tibetans, who do take milk and butter, and even cheese, but they are a very small percentage of the population of China. In general, we do not get fresh milk except in a few of the larger cities where there are modern dairies. In those cities you can get fresh milk, and, of course, you can buy evaporated milk and condensed milk, but certainly more than 99 percent of the Chinese people do not use milk at all from the time they leave the mother's breast.

This may be a good thing for China, because milk products are expensive in the first place, and also, milk requires very expensive equipment to keep it in drinkable condition. We know that many diseases can be conveyed by means of milk, and China has enough cases of gastro-intestinal diseases without those carried by milk. We have typhoid, we have cholera, we have the dysenteries, but these diseases could be very much worse if China used more milk. But there is another factor which has kept down the incidence of gastro-intestinal diseases, and that is the habit of drinking tea instead of cold water. No Chinese would think of drinking cold water. He always drinks tea, and tea, of course, is always hot, and that helps to keep down the gastro-intestinal diseases.

So I say, those two factors are really very important, and I would hesitate very much to introduce milk and other dairy products into China, to the Chinese. It isn't that I think milk is not an important food in countries like yours; it is a very important one, and I have no doubt that it would be a very good thing if the Chinese people as a whole could get the benefits of utilizing milk products, but according to the present economic standards, and keeping in mind the dangers which may come from the use of milk improperly cared for, I think it will be many years before we should try to encourage milk drinking in China.

In order to supply the food elements which are necessary, we can use in place of cow's milk a beverage prepared from the soybean. It tastes very much like cow's milk and has chemical properties and nutritional values very similar to those of cow's milk. A good deal of that is used, and it is always used hot. Also, we utilize a good deal of soybean curd. It is used as a fresh curd or as a compressed or dried curd and can take the place of your cheese.

Now a few words on diseases caused by deficiencies in diets. The northerner, being a wheat eater or

mixed-cereal eater, very seldom gets beriberi, so that in North China we almost never see a case of beriberi. But as soon as we cross the Yangtze River, there is a good deal of beriberi, also pellagra. The rice that is used is always polished rice. That, we know, is very bad, because it lacks vitamin B.

Now in the last couple of years, the Government has promulgated regulations against the polishing of rice. Just this year I heard that the Chinese armies are supplied with unpolished rice only. It used to be that the armies were full of cases of beriberi. I still remember some years ago during one of the civil wars, I was visiting one of the interior Provinces. The sight was a terrific one. I could see so much beriberi among the soldiers, and particularly, a condition which you cannot imagine—a combination of beriberi and dysentery. These men, of course, would become very anemic, very thin; they also had nutritional edema so that they had edema of the abdomen, of the legs, and of the face. In certain camps I saw hundreds and hundreds of these cases. Of course, the disease is fatal in most of the cases.

Scurvy is not very common in China, and neither is rickets. In certain regions, there is a disease called osteomalacia, particularly in women. In North China, we have a very good climate. In winter there is plenty of sunshine almost all the time. The reason that the women get osteomalacia, which is, as you know, due to lack of calcium and vitamin D, is because of their habits of staying indoors. The women, particularly before the habit of foot-binding was abolished, just sat in their rooms where there was a fire, the outside being very cold, and they developed osteomalacia. It is a disease in which the person afflicted has soft bones which later become deformed, and the deformity is very often in the pelvis so that these women have terrible difficulties at childbirth. In many cases they have to have Caesarean sections or their lives would be endangered—their own lives as well as those of their babies. In one or two Provinces in North China, osteomalacia has been very common indeed.

Goiter from lack of iodine is quite common in certain mountainous regions. In the Province of Yunnan, where Kunming is located, there is a great deal of it. In many villages almost every woman has a great cystic goiter in the neck. The Government is trying to remedy this by iodizing the salt and issuing tablets of the iodides. Then, in certain places, there are many bladder stones; particularly in Kwangtung Province, it is very common to have people in the hospital to be operated on for bladder stones.

I just want to say one word about the preparation of the North China diet. I have told you that flour is eaten either as bread or as cereal or gruel. You know the story, I suppose, that the Italian spaghetti was brought to Italy from China by Marco Polo, so that China is really the home of spaghetti and macaroni.

I want to say a word also about the Chinese bread. We do not bake bread in large loaves, as you do. We have both raised and unraised breads, made in the home. Our wheat-flour bread, the raised bread, is always steamed.

For yeast, we don't go out to buy a yeast cake because there are none for sale in China. We mix a little flour with a little water and just put it aside somewhere. A mold from the air soon grows in the mixture and this ferments the flour. But this isn't a very good yeast, because the dough becomes very sour, and if you make a bread out of it you would not be able to eat the bread. This sourness, the acidity in the dough, has to be neutralized with soda.

For this purpose the Chinese housewife uses, not sodium bicarbonate, not baking soda, but cleaning soda, sodium carbonate; and she knows exactly how much to put in. She makes a very concentrated solution of soda and puts it in drop by drop—at the same time, kneading the dough—and then she smells it ever so often until the neutral point is reached. The expert housewife knows exactly when to stop adding the soda solution. If she puts in too much soda, the bread becomes yellow and the taste is very bad; and if not enough soda is added, she still gets a sour bread. But anyway, the average Chinese housewife knows how to make a very good steamed bread which consists of nothing but water and flour and yeast. We never use sugar, milk, or anything else in these breads.

The unleavened bread is usually made in the form of a pancake. We mix flour with water, knead it, and then take a piece of the dough, and roll it out into a pancake. Very often some vegetable oil or lard is mixed in and between layers of this pancake and the whole is cooked, not in an oven, but in a flat frying pan. Now that is a very good bread that is very tasty, although it is a little hard. The corn-meal bread also is sometimes raised and sometimes not. Sorghum, or kaoliang, which you call broomcorn, also makes a very good flour and gruel and is used quite extensively in North China. Millet, too, is used as a gruel or as a flour. Millet flour, by the way, is very much more tasty than corn flour for making bread.

As I said, the farmer, the average Chinese, gets very little to eat. There are many farmers, particularly in the poorer sections of the country, who do not see meat more often than a few times a year. That is only at the time of New Year, two or three festivals, the birthday of the head of the family and that sort of occasion, so that as far as the whole country is concerned, there is a good deal of malnutrition, and deficiency diseases are prevalent. But there is less malnutrition as a whole in North China than in South China. The food habits of the northerners and southerners are quite different.

The people in the north, for instance, eat more vegetables and fruits. It is because they are cheaper, I suppose. I remember traveling one time from the north to the south, and on the train I remarked to my friends, "Now, see the difference in the diets as soon as we cross the Yangtze River; there is a very marked difference." It was in the summer time and the northerners were eating a lot of onions and fruits, particularly melons and cucumbers, in very large

quantities, and they were very cheap; for one copper, you get several melons, or several cucumbers. The largest watermelons in North China cost only a few cents but as soon as you cross the Yangtze River, you will see small watermelons of this size (indicating) selling for a dollar apiece. Of course, one reason is that transportation is bad and foods which are produced plentifully in one part of the country do not get to the other part of the country. That explains a good deal of it, but anyway the northerners get more fresh vegetables and fruits to eat. They have the habit of eating more of these foods, mainly because they happen to be very cheap.

That is why the northern Chinese is a very much healthier and larger person than the southerner. On the other hand, the Cantonese are very proud, saying they eat the best food there is in the world. There is a proverb in China that if you want to eat properly, go to Canton. That is only a part of the whole proverb. There is another place, Hangchow, where silk is produced. You go there to be dressed properly. Then there is a place in Kwangsi where the best wood for coffins is produced, so another part of the proverb says you have to go there to die properly, or to be buried properly.

But the Cantonese are great eaters. I mean you go into the richer people's homes, they spend more per unit of income for food than other Chinese. We give a reason for that. In Canton, the climate is terribly hot for 6 months of the year. It can be much worse than it was in Washington last Thursday and Friday, [laughter] with a temperature of 96° to 105° F., and 100 percent humidity. The people perspire all the time so it is no use for them to spend any money to buy decent clothes. For them any kind of garment will do and so they spend all their money on food. But farther north, of course, the climate isn't so bad. People think more of their appearance and spend more of their income on clothing.

That is a very general picture of the food problem in China. Now, as I have told Dr. Sebrell, I do not pretend to be a nutrition expert at all. I never call myself that. In fact, my interests have always been in general problems in public health, and it is only in that connection that I have any interest in nutrition whatsoever. However, I am very glad to have this opportunity today of meeting so many of you and giving you a little idea about China. Thank you.

Chairman: Would anyone like to ask Dr. Liu a question? He has kindly consented to spend a few minutes in discussion.

Question: I would like to ask whether the land south of the Yangtze River is poorer, and if that is the reason that they do not have——

Dr. Liu: I don't believe that is true at all. The land, if anything, is more fertile. Most of the rice is grown south of the Yangtze, and they have two crops a year, so there is no doubt about the fertility or difference of fertility in the soil.

Question: Is the wheat flour used in the north of China white, fine, or whole?

Dr. Liu: It used to be crude flour until we started to import what we call foreign flour. Now, the people, particularly the people in the larger cities, are spoiled. I mean when they saw this nice (white) flour, how much nicer it is than the native flour, everybody wanted it, so for some years we were importing flours from America and from Australia, and then we started mills of our own in the larger cities in Tientsin and in Shanghai, and everybody was eating white flour, very refined flour. For the health of the people as a whole, the native coarse flour is, of course, much better.

Dr. Sebrell: Someone in the audience wanted me to ask you about how much malignancy and how much infantile paralysis there are in China. I don't know what the connection is with nutrition, but if you have any estimates on those two diseases in your mind——

Dr. Liu: I don't think that these two diseases are as a whole as common in China as in this country. Infantile paralysis we do have, but I am sure the extent is nothing compared with what you have here. I don't know why, but it is a fact that we do not see many cases of infantile paralysis.

As far as cancer is concerned, our expectation of life is not as long as yours. I mean our average length of life is probably within 30 years, while yours is about 60, isn't it? Over 50, anyway, and of course, there is a difference of 20-odd years in which you would have more chances of having cancer.

I have operated on a good many women with cancers of the breast, and cancer of the uterus is a common disease. There is also cancer of the stomach, probably more common in the north than in the south, but as a whole I don't think it is as common as here. It may be because we do not have as many ulcers of the stomach as you have. There is more cancer of the skin.

Question: To what extent has the processing of fruits and vegetables taken place in China, if any?

Dr. Liu: Would you include canning?

Questioner: Yes, sir.

Dr. Liu: In the larger cities, we have started a good many canning factories. But talking about dehydrated foods, I was saying the other day that China has had dehydrated foods for many many years, probably thousands of years. We have dried meats, dried vegetables, dried fruits of all kinds, dried shrimps, dried fish, all of which is really dehydrated foods. But it is dried in the sun without machinery. But we do use a good many dehydrated foods. One reason for that, of course, is the large size of the country; there is very poor communication between points, so that the people in the interior mountainous regions where there are no fish can be able to buy the dried fish and fish products. It is only in the last 30 or 40 years that people started to use processed foods, I mean canned foods and that sort of thing, and I think that will develop in China very rapidly after the war is over. With reference to milk, of course we must try to provide infants and growing children with milk products or evapo-

rated milk. We don't think soybean milk would entirely replace cow's milk for that group of persons.

Dr. Sebrell: Any further questions?

Question: I would like to ask to what extent the Chinese people adapt themselves to the different diet in one part of the country from that in another.

Dr. Liu: Well, I am a northerner, and I have lived a good many years in South China, and the southern Chinese would eat two meals of rice. Personally I refuse to eat two meals of rice, so for one of my meals I would have rice and for the other, I would have bread or noodles. Even the southerner going to North China, after a short while, gets to like one meal of rice and one meal of wheat flour. I don't think it is too much of an effort for people from one part of the country to get used to the food practices in another part of the country.

Dr. Sebrell: Any further questions? I noted at the Food Conference, Dr. Liu, that there was a little discussion of the various methods of farming concerning the very small patches of land that were used by the Chinese farmer. A word or two about those farming practices might be of interest to this audience.

Dr. Liu: I cannot give you any figures on the size of the farms, but anyway the average size of a farm is very much smaller in China than what you have here. The Chinese farmer is a very poor man and often he doesn't own his farm; he is a tenant. The average size of the Chinese farm is one-half acre, and he does everything on it himself, and raises a family on the income from this small piece of land on which he has to pay rent and taxes. That is, of course, one reason for the poverty of the Chinese farmer. In recent years, the Government has started cooperatives and has been adopting methods whereby these poor farmers can be helped so that their income would be increased and their standard of living raised.

PUBLIC HEALTH AND NUTRITION IN INDIA

By Dr. W. R. AYKROYD

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I am going to talk to you on public health and nutrition in India. The Principal Public Health Commissioner with the Government of India said in a report which was written in 1935:

> No preventive campaign against malaria, against tuberculosis or against leprosy, no maternity relief or child welfare activities are likely to achive any great success unless those responsible recognize the vital importance of this factor of defective nutrition and from the very start give it their most serious attention. Abundant supplies of quinine and the multiplication of tuberculosis hospitals, sanatoria, leprosy colonies, and maternity and child welfare centers are no doubt desirable, if not essential, but none of these go to the root of the matter. The first essentials for the prevention of disease are a higher standard of health, a better physique, and a greater power of resistance to infection. These can only be attained if the food of the people is such as will give all the physiological and nutritional requirements of the human frame.

How far that is true is the subject which I shall discuss. India is a very unhealthy country. In 1931 the expectation of life at birth was reckoned as between 26 and 27 years, which is a very low figure compared with the figures current in a number of other countries. For example, the figure for New Zealand some 10 years ago was 68, and that for Sweden almost equally high; and, since then, the expectation of life has increased considerably in such countries.

The nutrition worker in India often asks himself: What proportion of disease in India has its roots in malnutrition? Medical officers in hospitals, in reply to such a question, will often say that half of the patients would not be there if they had had enough of the right sort of food to eat, but such estimates scarcely constitute scientific evidence. Actually it is quite impossible to make any satisfactory quantitative assessment of faulty and insufficient diet as a disease-producing factor in India. But some light can be thrown on the question by the study of available morbidity and mortality statistics, by the study of the trends of diseases in times of food scarcity and famine, and by study of the incidence of deficiency diseases which are known to be directly due to a dietary factor.

First, consider infant and childhood mortality. The recorded infantile mortality rate for births in India in 1939 was 155 per 1,000 live births. This means that a little less than a million and a half infants died before reaching the age of 1 year. Deaths among infants amounted to 23.6 percent of total mortality. Of the total infant deaths, 47.3 percent took place during the first month of life, and of these neonatal deaths 61.3 percent occurred during the first week after birth. The percentage of stillbirths to live births is known to be abnormally high, though the recorded figures are very inaccurate. Respiratory diseases account for a large number of deaths in the later stages of infancy.

At present we have very little accurate information about the causes of infant mortality in India, and investigations of this problem are very badly needed. In one part of the country, the Northern Circars, where adult beriberi is prevalent, we have observed a very high mortality in breast-fed infants at about the third and fourth months of life, which is unquestionably due to infantile beriberi. This is an example of how a deficient maternal diet may profoundly influence infantile mortality. And I think there is no shadow of a doubt that in India generally the faulty feeding of mother and child is a factor of major importance in producing the high infantile mortality rate. General experience is strongly in support of that. We know that in any ill-fed population group, whether human or animal, it is the newly born and the very young that suffer most severely from the ill effects of malnutrition.

In Coonoor, my predecessor, Robert McCarrison, was very fond of pointing out how he had eliminated from our colony of rats the infantile mortality of suckling rats by providing an excellent diet. Our rats have an admirable diet, which we have adopted from McCarrison and have not changed since, based on whole wheat, milk, and vegetables; and the mother rats invariably rear successfully their litters of 6 to 12 young. And quite recently, we have been carrying out a series of experiments in which we have given part of our rat colony instead of this admirable McCarrison diet, as we often call it, the diet of certain peoples in certain parts of India—we give them what we call the poor rice diet, which corresponds to the type of diet consumed by the rice eaters in India generally, and we immediately find that our infant mortality on suckling rats rises enormously. The vital statistics of the ill-fed colony assume a very different nature. They move, in fact, more closely towards the vital statistics of the mortality among human infants in India.

Mortality in India remains high throughout early childhood. I quote now from the Public Health Commissioner's Report for 1936:

> About 49 percent of the total mortality in any given year is among those below 10 years of age, while the corresponding figure for England is only 12 percent. During the first year of life India's proportionate mortality is about three-and-a-

half times that of England, at the next period (1 to 5) it is about five times greater, and between 5 and 10 years it is more than three times as high.

In 1939, total deaths of those under 10 years amounted to 2.9 millions, or 47 percent of all deaths. It will be recalled that in most western countries early childhood, after infancy, is one of the healthiest periods of life. It is far from being so in India.

Here, again, I must admit that the causes of this extraordinarily high childhood mortality have not been adequately studied. They have scarcely been seriously studied anywhere else in the Tropics or the East, but one series of observations which have been made by a pediatrician in Java is extremely significant. The pediatrician's name was De Haas, and he was physician to the Children's Hospital in Batavia for a period of 12 years or more. He found that, in Batavia, about 22 percent of total mortality occurs in what he called the preschool group of children, aged 1 to 4; whereas, in Holland, the percentage in 1939 was 3.1. The actual death rate within this age group in Batavia was 76 per thousand. And De Haas strongly emphasizes the importance of malnutrition as a factor in producing this very high mortality. I quote from De Haas:

> Tropical nutrition in general and the food of preschool children in particular show deficiencies for the poorer classes among which shortages of calories, animal protein, and vitamin A are the most important. [I, personally, as far as India is concerned, would place more emphasis on deficiency of vitamins of the B_2 group.] Dairy produce practically does not appear in the native diet of Batavia. . . . After breast feeding has ceased, the children, then about 1 year old, are still too small to select food for themselves. It is the children of preschool age, therefore, who suffer most from the insufficient tropical nutrition. Their menu consists mostly of rice and a few vegetables, and so it is not surprising that such serious deficiency diseases as xerophthalmia and nutritional oedema are found most among children of preschool age and that dystrophic development is most conspicuous among those from a half to three years old.

De Haas goes on to say that among children of preschool age, pneumonia and bacillary dysentery take the first place as causes of death. He remarks that "it appears likely that the frequency and fatality rate of broncho-pneumonia and the general state of nutrition of the children are in closer interrelation than is the case in the majority of other infectious diseases." His general experience in the Children's Department of the Medical College in Batavia leads him to believe that malnutrition is a major factor in causing disease and death in young children. "Since the state of nutrition is nearly always defective, too much significance cannot be given to the causes of death in children of preschool age."

We have in India exactly the same situation. We have the same amount of malnutrition among the preschool children. One of the major problems of nutrition is how to improve the diet of the child after it has been taken off the breast. That problem exists throughout the Tropics and the East. There is no reason whatever to suppose that the state of nutrition of the preschool child is very different in most parts of India than that which is observed in Batavia. A visit to a children's ward in an Indian hospital will provide confirmatory evidence, for such wards are always thronged with cases of nutritional disease and of disease indirectly due to malnutrition, so that one has little doubt that what De Haas says is correct, as far as India is concerned; and that a very high percentage of mortality in the preschool child is due to malnutrition. And when we consider, as aforesaid, that some 50 percent of the total mortality in the country in any given year occurs in that group, it obviously emphasizes the importance of the nutritional factor in public health.

Maternal Mortality

The female death rate during the reproductive period of 15 to 45 years is higher than that of the male, and the excess is largely due to mortality from childbearing. Estimates of maternal mortality in various parts of India vary from 16 to 24 per thousand live births, a very high rate. As far as I remember, the maternity mortality rate in England is somewhere in the neighborhood of 2 or 3 per thousand live births. I can't remember the figure for the United States.

Some inquiries in India have been carried out into the causes of this high maternity mortality. In Calcutta it was found that some 23 percent of maternity deaths were due to anemia. Coexistent anemia probably plays a part in the high death rate from puerperal sepsis, the principal recorded cause of maternal mortality. It is extremely difficult to make a quantitative assessment of the part played by malnutrition in this very high maternity mortality, but it is very reasonable to suppose that diet deficiency is responsible for much of the illness among pregnant and nursing women in India. The relation between diet and the anemias of pregnancy requires further elucidation, but it can be assumed that faulty diet is one of the causes, and probably the major factor.

It is a striking experience to visit maternity hospitals, in many parts of India, and to see rows of women suffering most severely from pregnancy and anemia. A few years ago the mortality rate among such women was extremely high. Some of the figures which I have quoted were not very recent ones. The introduction of the treatment of anemias of pregnancy by liver extracts has unquestionably done something to reduce maternal mortality. We know, of course, as a general principle, that the pregnant organism is highly sensitive to the ill effects of diet deficiency, and we recognize that fact in drawing up our dietary standards by setting the requirements of pregnant and lactating women for vitamins, mineral salts, and so on, at a higher figure than those of normal nonpregnant women. We certainly have other evidence on the positive side from other countries that maternal mortality rates can be influenced by improving the diet.

It would be impossible for me, within the limits of a short talk, to discuss fully the relation between nutrition and a number of various common diseases of India.

I think we can dismiss at once the possibility of any close association between malnutrition and

cholera, smallpox, and plague, diseases which occupy the major part of the attention of public health departments. It is to be observed that they are today, numerically speaking, not important causes of death. The ordinary public health measures against such diseases can be applied with a very reasonable degree of success. It has often been suggested that deficient diet is a predisposing cause of leprosy, but actually there is very little evidence of a scientific nature in support of this hypothesis. Further investigation of this problem is required.

In India the incidence of leprosy is unquestionably a peculiar one. It is much higher in the rice-eating parts of India than it is in those parts of the country where whole wheat is the staple cereal. That is a fact which certainly does suggest some relation between leprosy and malnutrition because people in wheat-eating areas are generally better fed, having, for example, a higher intake of milk. But so far in our investigations of various cases, we have not found much further evidence in support of a close relationship between leprosy and malnutrition; we have not been able to hasten the cure of leprosy in any striking way by improving the diet, and this remains a problem which requires much further investigation in many parts of the world.

The greatest single cause of deaths in the mortality returns is "fevers," the generic name which is used in the Public Health Commissioner's report for a heterogeneous group of diseases in which malaria stands preeminent. It has been estimated that about a hundred million persons suffer annually from malaria in India and that the annual number of deaths exceeds 1.5 millions. Many malariologists have drawn attention to an association between malaria and economic stress, and the invariable accompaniment of the latter, malnutrition. This question has recently been discussed by Passmore and Sommerville (1940), who found that the course of primary attacks of experimental malaria in monkeys was unaffected by differences in state of nutrition. There does not appear to be any conclusive evidence that nutrition influences the epidemiology of malaria or the susceptibility to, or severity of, the disease in individual cases. There is, however, a close relation of the opposite kind between malaria and malnutrition. Malaria is a direct cause of malnutrition because its languid victims cannot cultivate their land properly and thus improve their lot. Vigorous antimalarial measures will improve the food supply and the national diet.

There are available in India voluminous official reports of famine commissions, published during the second half of the last century. They often repay detailed study; they are full of quite remarkable and interesting material. They describe the effect of famine on the incidence of various diseases, the effect of famine on the birth rate, the death rate, and the influence of food scarcity and famine on the incidence of various diseases, which even today would repay further study.

In more recent times some interesting analyses of mortality and morbidity rates in famine areas have been made. Quite recently, Lieutenant Colonel Nicol (1941), Director of Public Health in the Punjab district, has published an interesting analysis of mortality and morbidity in the Hissar famine of 1939–40. It was fortunate that at that time there was a Director of Public Health in the Punjab who took a close interest in problems of nutrition and had a short time before appointed as Nutrition Officer to the Public Health Department a worker who had been trained in the famine-code idolatries. Thus a possibility arose of making more detailed studies of the effect of food scarcity on the incidence of disease. I say "food scarcity," because the famine code of India was in full operation at the time.

For people who are interested in practical nutrition work the famine code of India is well worth a little study because it represents a very early attempt at what one might call practical nutrition work. It was evolved during the second half of the last century, mainly by administrative officers, but the methods which they adopted certainly proved effective in preventing the worst effects of famine.

When the famine code is in operation, the population which is being carried through the famine is by no means at the starvation level; they are receiving nearly enough food to meet their requirements.

In Hissar the famine code was put into operation at quite an early date, and the population was by no means underfed; they probably had nearly enough calories, but their diet was very restricted from the standpoint of quality. In a famine area in which there has been drought for 3 years, there are not only no vegetables, but also not a single plant of grass for hundreds of miles. The cattle go dry and die, so that there is no milk. The population is largely reduced to a diet composed of a single grain, of which they may get, at any rate, nearly enough.

In the Hissar famine, the total number of deaths in the worst famine year, which was 1939, was 37,767, as compared with 20,910 in 1937. The rise in the death rate was greatest in the age groups under 10 years and 60 years and upwards, that is, among the very young and the very old. Of the 37,767 deaths in 1939, 21,160 were of children under 10. There was no rise in the incidence of malaria, and smallpox and cholera were kept under control. But there was a striking increase in the number of cases of almost all other diseases during the period when food supply was deficient in quantity and also in quality.

I would now like to give you some figures, showing the number of cases of various conditions treated in hospitals and dispensaries in Hissar in 1937 and 1939, respectively, taken from the Health Director's report:

Respiratory diseases, excluding pneumonia and pulmonary tuberculosis, 1937, 25,178 cases; 1939, 44,117 cases.

Pneumonia, 1937, 1,409 cases; 1939, 1,942 cases.

Tuberculosis of the lungs, 1937, 696 cases; 1939, 973 cases.

Dysentery and diarrhea, 1937, 10,268 cases; 1939, 19,907 cases.

Enteric feyer, 1937, 282 cases; 1939, 539 cases.

Trachoma, 1937, 21,031 cases; 1939, 26,550 cases.

Pyrexia of uncertain origin, and other diseases due to infection, 1937, 2,925 cases; 1939, 5,216 cases.

Some of the increase can no doubt be attributed to the disorganization of living conditions inevitable in famine times; also, allowances must be made for the inaccuracy of hospital and out-patient-department statistics. The figures are nevertheless striking, and illustrate how the resistance of a population to disease in general is conditioned by the dietary factor.

We have seen and are seeing, of course, precisely the same thing happening at the moment in the countries of Europe which have been overrun by the Nazis and are suffering from food shortage. The incidence of all kinds of disease is rising rapidly.

As far as India is concerned, a large percentage of the population always lives on a diet which is defective in quality and often in quantity. And I think it is not unreasonable to suppose that the incidence of diseases which become more prevalent in times of food scarcity is influenced by diet in normal times.

Much has been written about the association between malnutrition and tuberculosis, a disease of growing public health importance in India, and, for that matter, throughout the East and the Tropics generally. It appears to be generally accepted that a poor diet lowers the resistance of the body to the tubercle bacillus. There is a growing problem of tuberculosis in many parts of the world which becomes more acute as industrialization proceeds among populations which have hitherto enjoyed a very rural existence.

I want to mention in passing one group of diseases—those falling into the category of dysentery and diarrhea in the health returns. It is interesting in studying the old famine reports to which I referred a few moments ago to note how, invariably, in times of food scarcity the death rate from dysentery and diarrhea doubled or more than doubled the deaths during the Hissar famine. Colonel McCarrison, in 1921, as a result of some experimentation he carried out in Coonoor, reached the conclusion that the health of the gastro-intestinal tract is dependent on an adequate provision of accessory food factors and observed that experiments with animals have led us to expect that acute intestinal disorders will be among the commonest of the consequences of deficient and ill-balanced food.

More recently, Rao has produced in monkeys a chronic diarrhea accompanied by atrophic changes in the small intestine by feeding with ill-balanced rice diets. It is perhaps significant that the death rate from dysentery and diarrhea in the Punjab (probably the best-fed province in India), where the staple foods are wheat and milk, is usually from one-fourth to one-sixth that of Orissa, the Central Provinces, and Madras. The Punjab is a Province of wheat-eating population with a relatively high consumption of milk, while in the latter Provinces rice is the principal or an important staple and the consumption of milk is low. This is certainly a question which requires much further investigation.

Now let me briefly refer to food-deficiency diseases, that is to say, diseases which are directly due to the insufficiency of some necessary constituent in the diet and which are capable of being prevented or cured by supplying that constituent. They are in themselves a problem of public health importance in India. In the Northern Circars beriberi in adults is a common disease, leading to much suffering and disability but not often to death. We have one area in which beriberi is prevalent both in infants and adults. Beriberi in infants, as has already been pointed out, is probably the cause of many infant deaths in this area.

There is not time enough to discuss the rice problem in India, the curiously limited geographical incidence of beriberi of the Indian territory, or the difference in the vitamin content of parboiled milled rice and raw milled rice. As many of you know a great proportion of the rice eaters in India consume home-pounded rice which, whether parboiled or raw, retains a good proportion of its outer layers and, therefore of its vitamins.

Another very considerable group consumes parboiled milled rice, and parboiled rice retains its vitamin content if it has been machine-milled; but we have the raw-rice area, which is quite extensive, with a population of about 20 million people, and there is plenty of beriberi in that area.

Quite recently we have been obtaining remarkable results by injecting infants who have beriberi with two milligrams of vitamin B_1, and the effects are most striking. The recovery can be almost as rapid as that which one can observe in a patient suffering from acute diabetes upon injection of insulin.

Keratomalacia is probably the commonest cause of permanent blindness in south India; it is also prevalent in other parts of the country. In fact, I think it is certainly the commonest cause of permanent blindness in South India. The treatment of keratomalacia has become very much more effective within the last few years because it has been discovered that very rapid and immediate effects can be produced by injecting large doses of vitamin A, 100,000 units, and more, perhaps; and with such treatment, you can save eyes which previously would have been lost, because the old, almost traditional, method of injection with cod-liver oil did not supply enough vitamin A quickly enough.

Osteomalacia and rickets present a formidable public health problem in certain parts of northern India. We have very full knowledge of the ideology behind this, and of how the diseases could be prevented, but it is a tremendous social problem which will be adequately tackled only when the education of women has been developed. Osteomalacia is very largely, except in certain areas, a disease of women who remain in seclusion and who receive no direct sunlight, since even when they go out of doors they are covered from head to foot. With these groups, the incidence of osteomalacia is extremely high.

One of the commonest deficiency states is a syndrome including stomatitis, dermatitis in the genital regions, and sometimes superficial keratitis, which is associated with lack of the B_2 group of vitamins, and in particular with riboflavin deficiency. Goiter

is another nutritional disease highly prevalent in certain Himalayan and sub-Himalayan areas.

I think there is more deficiency of riboflavin in India than of any other vitamin, and it is one of the most difficult vitamins to supply cheaply. That, of course, is associated with the very low per capita consumption of milk.

Goiter is an enormous problem, of which we scarcely have as yet full information.

Severe scurvy is uncommon, except in famine times. During the Hissar famine we had a very acute outbreak of scurvy, which was the only time I have had the opportunity of seeing really acute cases of scurvy. The disease was brought under control by the issue on a very large scale of sprouted legumes which, although the amount of ascorbic acid supplied appeared to be very small on a per capita basis, nevertheless apparently was able to bring the outbreak of scurvy very rapidly under control.

Further clinical research will probably reveal other deficiency diseases, at present unrecognized. Diabetes—the scourge of the middle classes in India—can scarcely be included under this head, though its cause is presumably some long-continued error in diet. It has so far received little attention from nutrition research workers in India.

Quite apart from such diseases, we have a whole row of relatively obscure conditions, which, in all probability, are closely associated with the dietary factor. I could mention a number of those: We have a condition of sclerosis of the liver, occurring in middle-aged people of the poorer classes which, in some ways, unquestionably, is related to malnutrition. We have a condition of chronic duodenal ulcer, which again is certainly of dietary origin. We have obscure nervous diseases related to lathyrism which again may require further detailed investigation.

I would like, before stopping, to refer very briefly to what has been done in the public health nutrition line in India. I have attempted to outline the situation with regard to the importance of nutrition in public health.

Public health nutrition work in any country is extremely difficult, but it is peculiarly difficult in a very poor country because at the outset the public health worker comes up against the basic difficulty that the primary cause of malnutrition in India and elsewhere is the economic factor over which he has little control. But this point I would emphasize: That even in the existing economic circumstances, progress can be made in raising dietary standards if the best use is made of available resources. The first essential is the education of those who in turn can educate the people. This means that greater emphasis must be laid on nutrition in the training of doctors and public health workers of all grades. It means the education of the professional and administrative classes generally, including workers in agricultural, animal husbandry, and development departments.

We have attempted in Coonoor to do something in the educational field by the issue of bulletins, which have received a pretty wide circulation throughout the country. Various other pamphlets have been produced, and other educational methods have been followed. For the last 6 years we have given annually in Coonoor a training course in nutrition lasting from 2 to 3 months, mainly for public health workers, but also for any other type of worker, including agricultural workers who would be likely to be benefited by the course. In India, we have full-time nutrition officers, trained in Coonoor, employed in public health departments in Bengal, the Punjab, Bihar, the Central Provinces, Baroda, and Hyderabad. We have also a nutrition officer in Burma. Some of these nutrition officers have been able to do extremely useful work both in the investigation of malnutrition and also in public health. But although a beginning has been made, we perhaps haven't gotten very far.

The feeding of school children, about which we had a great deal of talk at the Food Conference, has not been developed very far in India. In certain cities, there are quite extensive schemes for feeding poor children, for example, the province of Madras supplies a daily meal to school children, consisting of rice pulp and vegetables which I think has brought quite good results. The provision of milk to school children is usually impossible because of the difficulty of getting a reasonably good supply of milk in sufficient quantities. In a few places, there has been an issue of milk to a certain number of school children, but it is usually almost impossible on account of expense and one has to be satisfied with a meal consisting, say, of rice and of some vegetables as is done in the Madras.

We had, here and there, before the war, encouraged the use of imported dried separated milk, which is relatively cheap, for distribution to children in institutions, and also to day-school children. The dietary side of maternity and child welfare work, infant welfare work generally, has shown some development, but there again a great deal more work needs to be done.

There is one genuinely successful piece of work which has been achieved in nutrition in India, and that is the improvement of diet in institutions. That is the easiest thing of the lot to do. There is no particular reason why a government or a charitable institution should not at least, although it may be very poor, do the best it can with its available funds. And there has been a visible and striking improvement in the diet and health of children's institutions in south India during the period that I have been in the country. Visibly, its effects are clear to see. The problem is often a very acute one.

We received a request in Coonoor for an adequate diet coupled with the information that the total amount of money which is available to spend on the food is under 3 rupees[1] or, shall we say, under 5 shillings per child per month, and it is by no means an easy task to devise a suitable diet within those limits.

I should say, in conclusion, that it would seem, when you look at the public health picture in general

[1] About a dollar in United States currency.

in India (and the same applies to countries in the East, in the Tropics generally), that the public health has not disposed its forces so that the most dangerous section of the front is most strongly defended. The most dangerous section of the front is the child from under the age of 10 and perhaps we can also include the expectant and nursing mothers.

So far, I think it is generally true to say that the public health mission in such a country as India has not adjusted itself so that in that particular direction I feel that as time goes on it will be necessary to consider a reorganization of the usual public health scheme. It is, of course, extremely difficult to devise public health measures which will be effective against malnutrition in a poor country. We have methods of dealing with infectious diseases, as far as cholera, smallpox, and so on, are concerned, that have been laid down and worked out over a period of years. The public health people understand them, they know what to do when an epidemic of cholera occurs. But it is very difficult for them to act when it is a case of chronic malnutrition, although the malnutrition may, in fact, be a far more potent factor in producing ill health, disease, and death than some of these great killing diseases.

With certain qualifications, the statement from the Public Health Commissioner's Report with which my talk began may be endorsed. I feel that in general the standpoint which he adopted can be taken as justified, with certain qualifications, of course. I feel that the vital statistics of India, inaccurate though they may be, provide clear indications for the future orientation of public health work, and of the importance of nutrition in public health in India. One could conclude from that, I think, that if we are to maintain the goal of a healthy nation in India, or, for that matter, of most other countries of the world, the improvement of diet is a factor of essential importance.

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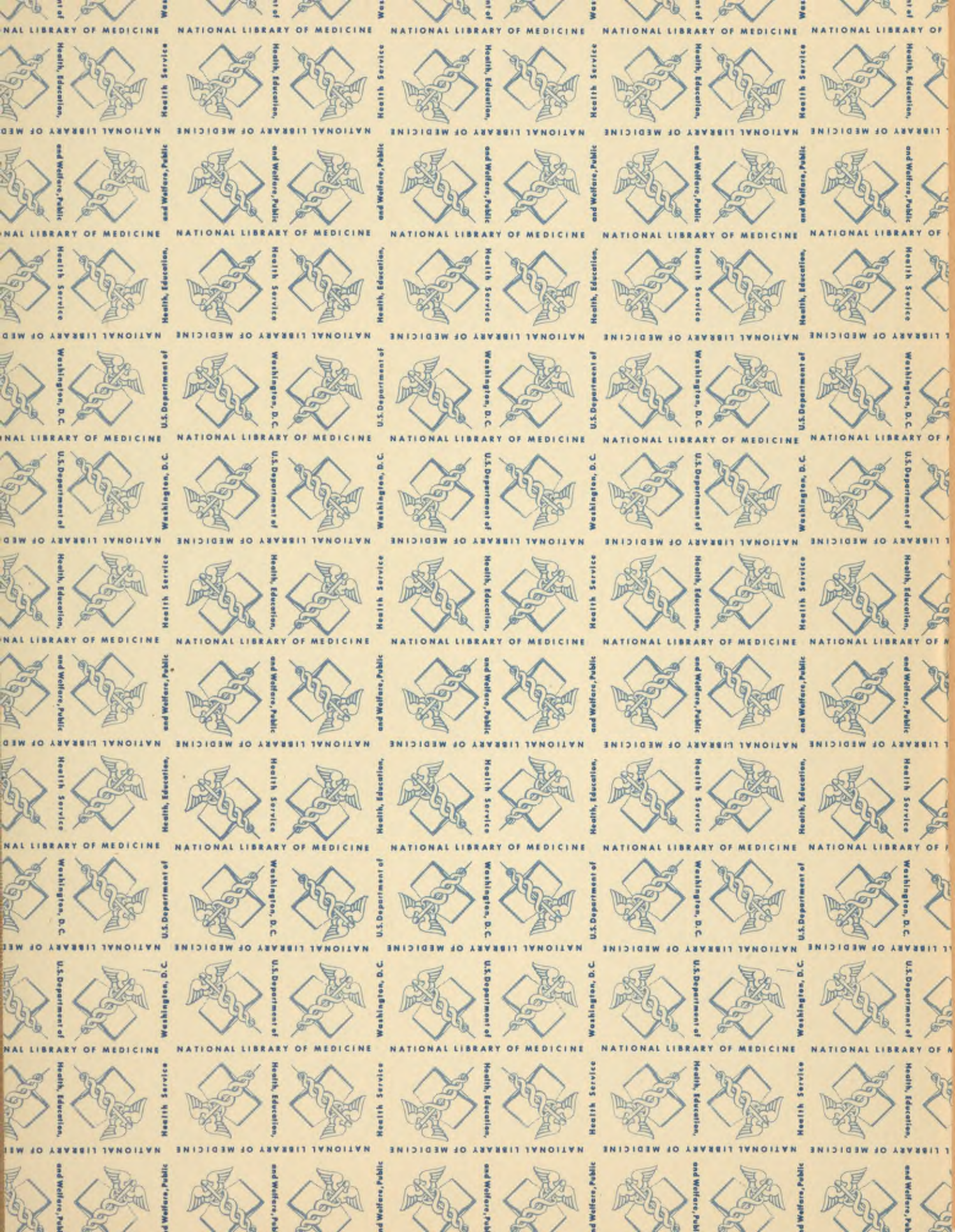
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