

Excerpts from
NUTRITION
IN
EVERYDAY PRACTICE

Published by
THE CANADIAN MEDICAL ASSOCIATION
in the interest of better health.



Reprint No. 115

LEE FOUNDATION FOR NUTRITIONAL RESEARCH
2023 W. Wisconsin Avenue
Milwaukee 1, Wisconsin

FOREWORD

THE PHYSICIAN'S RESPONSIBILITY FOR NORMAL NUTRITION

NO science has made greater advances during the past twenty-five years than that of human nutrition. Before 1912 the physician's main concern was to see that his patient received a proper supply of fats, carbohydrates and proteins; very little was known of the importance of the minerals, and the word "vitamin" was then unknown. Now we know that of the twenty-two amino acids commonly present in protein ten are essential, and life could not exist without thirteen minerals and at least seven vitamins.

In the past the goal of the physician and public health worker has been to see that the population enjoyed average health and did not suffer from under-nutrition or marked malnutrition. Recent observations on animals show that, starting with a diet already considered adequate, the feeding of additional amounts of certain food elements increases the rate of growth of the animals, maintains their youthful appearance longer, and lengthens their span of life. Carefully conducted studies in Canada have indicated that our present dietary customs may result in many persons not receiving amounts of some of the food elements commensurate with the highest attainable level of health. Unfortunately, the practical application of facts concerning nutrition has not kept pace with our increasing knowledge. The practising physician is so absorbed with the problem of diagnosis and treatment of disease that frequently the question of diet is more or less pushed into the background. The physicians of Canada must increase their interest in this problem of normal nutrition, otherwise the public will seek information on this subject elsewhere.

The Canadian Medical Association has long been interested in this subject, and this interest has crystallized in the formation of a Committee on Nutrition. With the view of presenting very

v

briefly and in a practical manner proved facts concerning what the normal person should eat, and the reasons why, the Committee obtained for the *Canadian Medical Association Journal* a series of short, practical, authoritative articles on normal nutrition, which appeared regularly for eighteen months. This was done in the belief that the physician could apply these facts with benefit to every patient who consults him for any cause.

It is hoped that the efforts of the Committee will result in a more general application of our present knowledge of normal nutrition by the physician in his everyday practice. This, combined with an increased interest of the lay public in the subject of nutrition and a desire on their part to obtain authoritative information free from fads and fallacies, will result in a higher level of health for the Canadian people.



NUTRITION AND RESISTANCE TO DISEASE*

BY ELIZABETH CHANT ROBERTSON
AND FREDERICK F. TISDALL

Toronto, Ont.

XIII.

Nearly a hundred years ago Graves wrote, "Want of a sufficiency or food of an unwholesome or an improper character predisposes the human frame to disease by its debilitating effect on the system". It is interesting to note that some physicians in the past recognized and emphasized the rôle of nutrition in the maintenance of health and resistance against infection. No one now questions the rôle of proper nutrition in resistance against disease. From a clinical standpoint, possibly most of us think of it in terms of under-nutrition rather than of malnutrition. The difficulty of obtaining clinical evidence of the effect of minor nutritional deficiencies is obvious. The story is entirely different however in regard to animal laboratory experiments where all conditions can be adequately controlled.

There is evidence that a lack of almost any one of the 32 food elements essential for animal nutrition will result in a lowered resistance to infection. A number of experiments giving evidence of this nature have been reported by one of us (E.C.R.). The procedure developed was to feed animals with a measured amount of a disease-producing organism and note the number of animals that survived. This sounds like a very simple procedure, but actually it constitutes a most difficult and time-consuming experiment. A suitable disease-producing organism had to be first obtained. After a number of trials, an organism called *Salmonella murioitidis* (rat typhoid) was found to be suitable for this type of study. It was comparatively harmless for the human being, but in suitable doses was found to be pathogenic for the rat and yet not so severe in its effect that it invariably killed all animals. When death occurred it was preceded by marked diarrhoea, cyanosis, and a bloody discharge from the nostrils. Blood cultures were taken aseptically from the hearts of all the dead animals and the organism was regularly recovered, usually in pure culture, indicating that the rats had a murioitidis septicæmia when they died.

*From the Department of Pædiatrics, University of Toronto.

The animals were observed for 28 days after the infecting dose, when the experiments were terminated, and those that lived for this length of time constituted the survivors. When death occurred it usually was within the first ten days. The degree of resistance was estimated by the percentage of survivors in each experiment. In every case the experimental animals were fed a diet adequate in all respects with the exception of the factor or factors being studied. Control litter mates were fed the same diet with the addition of the substance under study.

In Table I is shown the effect of lack of vitamin A on resistance

TABLE I.
THE EFFECT OF A LACK OF VITAMIN A (CAROTENE) ON
RESISTANCE TO INFECTION

Vitamin A deficient diet	
No. of animals.....	10
No. of survivors.....	4
Survivors.....	40 per cent
Vitamin A deficient diet, plus 0.5 per cent. carotene solution	
No. of animals.....	14
No. of survivors.....	11
Survivors.....	79 per cent

to infection. It is to be noted that when the diet was deficient in this vitamin only 40 per cent of the animals survived as compared to a survival rate of 79 per cent in the litter mates who were fed the same diet with added vitamin A, in the form of its precursor, carotene.

In Table II it is seen that when the diet was lacking in the

TABLE II.
THE EFFECT OF A LACK OF THE VITAMIN B COMPLEX
ON RESISTANCE TO INFECTION

Vitamin B deficient diet	
No. of animals.....	79
No. of survivors.....	16
Survivors.....	20 per cent
Vitamin B deficient diet plus 6 per cent yeast	
No. of animals.....	72
No. of survivors.....	52
Survivors.....	72 per cent

vitamin B complex 20 per cent of the animals survived, as compared with a survival rate of 72 per cent when the diet was perfect in all respects.

Similar results were obtained, as shown in Tables III, IV and V, when the diets were lacking respectively in vitamin D, minerals, and animal protein. In Table V it should be noted that the first lot of animals received their protein from grain sources, while the

control animals received their protein largely from milk casein. This is evidence in favour of the advisability of including in the diet each day a certain proportion of protein as *animal* protein, namely, meats, fish, poultry, eggs, milk and cheese.

In considering the percentage of survivors in Tables I to V,

TABLE III.
THE EFFECT OF A LACK OF VITAMIN D
ON RESISTANCE TO INFECTION

Rachitogenic diet	
No. of animals.....	375
No. of survivors.....	106
Survivors.....	28 per cent
Rachitogenic diet plus Vitamin D	
No. of animals.....	364
No. of survivors.....	201
Survivors.....	55 per cent

TABLE IV.
THE EFFECT OF A LACK OF MINERALS
ON RESISTANCE TO INFECTION

Diet very low in minerals	
No. of animals.....	63
No. of survivors.....	34
Survivors.....	54 per cent
Diet adequate in minerals	
No. of animals.....	61
No. of survivors.....	53
Survivors.....	87 per cent

TABLE V.
THE EFFECT OF A LACK OF ANIMAL PROTEIN
ON RESISTANCE TO INFECTION

Normal diet with 17 per cent wheat gluten	
No. of animals.....	40
No. of survivors.....	23
Survivors.....	57 per cent
Normal diet with 17 per cent casein	
No. of animals.....	41
No. of survivors.....	37
Survivors.....	90 per cent

no comparison should be made between the number of survivors in one table with the number of survivors in another table, because with each set of experiments it was necessary to regulate the dosage of the *Salmonella murioitidis*. This was necessary because there was a variation as the experiments proceeded in the degree of virulence of the organism. However, in every individual

experiment the conditions of the control animals and of the experimental animals were identical, with the exception that the diet in the experimental group was lacking in the factor or factors being studied.

In the experiments the conditions were naturally quite severe, in that the deficiencies produced were very marked. One might say that deficiencies of this degree would rarely if ever be encountered under Canadian dietary conditions. Further studies were then made in which the degree of the deficiency in the diet was comparatively slight. The results obtained in one set of experiments are given in Table VI. It is seen that with this lesser degree of deficiency there is still a marked difference in the re-

TABLE VI.
THE EFFECT OF A PARTIAL LACK OF THE VITAMIN B
COMPLEX ON RESISTANCE TO INFECTION

Partial vitamin B deficient diet	
No. of animals.....	30
No. of survivors.....	6
Survivors.....	20 per cent
Same diet plus vitamin B	
No. of animals.....	38
No. of survivors.....	33
Survivors.....	87 per cent

sistance of the two groups of animals against disease. These studies with animals furnish clear-cut evidence that improper nutrition lowers the resistance of the animal to infection and also that the nutritional deficiency does not have to be so severe as to produce outstanding evidence of disease.

With this laboratory evidence in mind, that a nutritional deficiency will result in a lowered resistance to infection, how are we going to feed our sick patients? If the illness is an acute one of short duration, simply a matter of 3 or 4 days, this question is not urgent. However, it is obvious that if the patient is suffering from any disease that lasts more than a week or so, special attention must be given to his nutrition as a whole. Strange as it may seem, this is frequently neglected. Recent work has indicated that the presence of any infection increases the need of the body for many of the food elements. To give only three examples; it has been shown that the amount of vitamin A and vitamin C in the blood is markedly lowered by infection, and there is evidence of an increased need for vitamin B₁.

The physician's duty to his patients, however, should not stop with just the treatment of the acute or chronic illness. When the patient presents himself with even some minor infection, our interest should be aroused as to why the infection developed. Was it the result simply of a focus which could have been removed or treated, or have the patient's habits been such that he is not

enjoying the highest level of resistance? Probably the most important of these habits are his habits of nutrition. The remarkable adaptability of the body is such that a person may have a nutritional deficiency for many years before it clearly evidences itself. In the interval, however, the patient will not be enjoying the highest possible level of health and resistance against infection.

One should not expect that infections can be completely prevented by dietary means. This, of course, is impossible, and with many diseases there is no evidence that nutrition has any effect on the susceptibility of the patient to the disease. However, from clinical observations, there is no question that with proper nutrition the patient's resistance to disease is maintained at a high level and that he will "throw off" or recover from his infection more often and more quickly than the one who is malnourished.

One cannot lay down any rules as to the nutritional treatment of a patient during illness. However, when the patient has recovered, and there is no specific contraindication, his food should include each day a pint to a pint and a half of milk for children, one-half pint for the adult, some meat, one egg daily, two liberal helpings of vegetables besides potatoes, some raw fruit or vegetables, and, during the winter months, some source of vitamin D. If this is done, you will be assisting your patients to reach that goal which we all desire, namely, optimum resistance against infection and optimum health.



Excerpt from

Dr. E. V. McCollum's chapter on

BETTER NUTRITION AS A HEALTH MEASURE

Turning to the vitamins, we find eminent medical opinion supporting the view that many people do not get enough of several of them because their diets are not well chosen. I can mention only the most important practical applications.

Vitamin A is closely associated with the health of the mucous membranes lining the respiratory, gastrointestinal, and urinary tracts. Healthy mucous membranes are an effective barrier against the entrance of bacteria, and as a general health measure it pays to take a diet abundant in this vitamin. It is provided by all green and yellow vegetables, by milk, butter, liver, kidney, fish, etc., but not by white vegetables such as potatoes, white turnips and white cereal products. It is very abundant in fish liver oils.

A striking relation exists between deficiency of vitamin A and the functioning of the eye. There is a pigment called visual purple in the retina of the eye, which is, in part, made of vitamin A. When we become depleted of this substance vision is impaired. This condition is widely prevalent among people who subsist upon poor diets.

Many people, especially children and pregnant and lactating women, are not getting enough of vitamin B₁, which is necessary for the health of the nervous system. The prevalence of neuritis, poor appetite, and of the smooth, bald tongue, point to deficiency of this vitamin.

Vitamin C is found in fresh, uncooked fruits and vegetables, and in other raw and commercially canned foods. Deficiency causes scurvy, which is still fairly common in infants. The health of the blood vessels is dependent upon an adequate supply of this substance. When the body becomes depleted in vitamin C it is much more susceptible to injury by bacterial poisons which arise through infections than is the case when the body reserves are high. Arterial damage resembling that seen in arteriosclerosis seems to result from bacterial poisons in persons who run short of this vitamin.

Vitamin D is of outstanding interest in relation to health. Only twenty years ago rickets, a disease of the bones, was common. The discovery of vitamin D and its power of promoting normal bone growth represents one of the major contributions of nutritional science to public health. Now rickets in infants and

children is much less common than formerly, and when the disease exists it is much milder. Now almost all mothers in Europe and America know that the baby must be given cod liver oil or one of the other sources of vitamin D. The benefits to infants and children resulting from the application of this knowledge have already been incalculable, and the boon of this knowledge is a permanent possession for the future.

There are three ways in which tooth structure may be influenced by diet. The organ which forms the enamel is very dependent for its health and function on vitamin A. If a deficiency of this vitamin occurs in the infant or child whose teeth are still forming the enamel will contain pits and fissures, which are potential food traps, in which particles of carbohydrate food lodge and ferment, with the formation of acids which dissolve away the enamel. If the diet contains an abundance of vitamin A but not enough vitamin D the content of phosphate in the blood will fall, as it does in rickets, to so low a level that calcium phosphate, the substance of enamel, cannot be laid down, and poor enamel will result from this deficiency. The dentin-forming organ is especially dependent upon an abundance of vitamin C. If an infant or child whose teeth are forming does not get enough of this factor the dentin of the teeth will be badly formed and the future health of the tooth will be impaired.

Teeth of perfect structure, free from imperfections such as pits and fissures, and with smooth, polished enamel surfaces, are far less likely to decay than are teeth exhibiting these imperfections. Hence the fundamental importance to the individual of having optimum nutrition during the period when the teeth are developing. Decay of the teeth is not only a source of discomfort, as from toothache, but also an inconvenience because of the early loss of the teeth. Tooth decay is a menace to health, since the dead tooth is frequently the source of an abscess from which bacteria or their poisons find their way into the blood stream. Secondary infections in the joints, kidneys, gall bladder, and other places, have not infrequently been traced to an infected tooth. Decayed teeth have been and are the cause of much ill health. The prevention of tooth decay would constitute one of the greatest possible achievements in improving the public health. If our present day knowledge of nutrition could be applied to the entire population there is no doubt that tooth decay could be reduced to a small fraction of its present ravages.

Optimum nutrition is so important in the minds of the leaders in the field of public health that in Europe and America a great movement is under way to improve the dietaries of the peoples. Governments are now taking active measures to provide the better-class foods at lower cost. In Canada an abundance of the better class foods are available. The great need is for the dissemination of knowledge about the selection of foods so that the daily diet will be complete.

In summary, let me emphasize that through diet we may accomplish:

1. Improvement of the health of the mucous membranes, making them more effective as barriers against the entrance of infective agents, with consequent reduction in the incidence and severity of respiratory diseases.

2. Improvement in the structure of the teeth, and reduction in their liability to decay and subsequent infection; relief in great measure from secondary infections of the joints, kidneys and heart.

3. Safeguarding the health of the nervous system, especially as respects neuritis and the secondary effects of nerve injury, such as heart and digestive disorders and disease of the digestive tract.

4. Protection of the blood vessels against injury caused by bacterial poisons acting upon them when the body's reserves of vitamin C are low.

We do not claim to have found in adequate nutrition the panacea for all human ills. We do claim that malnutrition is widespread and of a degree of severity which is reflected in many people in ill health in one of the categories mentioned. Attention to the proper selection of foods throughout life will go far toward reducing the incidence and severity of these conditions. When the body is not functioning normally, as in malnutrition, its capacity is lowered to withstand the effects of infections, fatigue, and emotional strain.

■Note: Lee Foundation for Nutritional Research is a non-profit, public-service institution, chartered to investigate and disseminate nutritional information. The attached publication is not literature or labeling for any product, nor shall it be employed as such by anyone. In accordance with the right of freedom of the press, granted to the Foundation by the First Amendment of the U. S. Constitution, the attached publication is issued and distributed for educational purposes.