Hints on what to eat during the war. Circular 100 February, 1918

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Hints on What to Eat During the War

Save wheat—use more corn

Save meat—use beans and fish

Save fats—use just enough

Save sugar—use syrups

And serve the cause of freedom

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Foods That Help During the War

E. V. McCollum

The highest executive officers of the nation are today doing all in their power to impress upon the people the seriousness of the food shortage and the necessity of making every effort of which we are capable to increase food production. It is pointed out to us that food is going to play as important a part, if not a more important part, in the war than guns and ammunition, and that the greatest moral obligation rests upon every man and woman of the nation to use other foods of equal value in place of part of our normal use of the four foods—wheat, meat, fat, sugar.

"What shall I eat?"

That's what many patriotic citizens of Wisconsin and other states are asking in reply to the appeals of the highest executives of the nation.

They realize the seriousness of the food shortage and, in addition, high prices make it imperative that they save; on the other hand, they appreciate the necessity for keeping themselves fit for the added duties which war times ask them to assume.

"Where can we find out what we must eat to live and work?" they ask. "One day we are advised to do one thing, the next day brings still other and even contrary suggestions."

This bulletin will help you. It tells what food the human machine must have if it is to be kept going at capacity. The fundamental results incorporated in this bulletin were worked out in the laboratories and herd barns of the Agricultural Chemistry and Animal Husbandry departments. They introduce into discussions on foods new factors which are of profound significance.

For example, there are unknown substances in foods which are just as necessary as protein, starch, sugar, fat and mineral matter. We must have them in our food—but some foods do not contain them.

When we enter upon a campaign for the conservation of the four foods we must remember that, with the need for economy in reducing the cost of living—a need that faces 85 per cent of American families whose food and rent must be paid for out of earnings of an unskilled laborer or even an artisan,—we are in grave danger that health may not be maintained. Food prices have already reached a level where the monthly earnings no longer permit the majority of men employed in the industries to maintain the usual standards in providing for the family table. The natural tendency under these circumstances is to restrict the food purchases to fewer articles and to depend upon a diet restricted to a short list of foods which appear to be cheapest. Such a course is fraught with danger and will lead to faulty nutrition unless wise selection of foods is made. Fortunately, it is now possible to give fairly definite advice as to just what combinations of natural food-stuffs will induce physiological well-being. So far as such assurance can be given it is our purpose to describe the general principles which should help guide the public in selecting food while the war lasts. Experimental data of the kind necessary to enable us to interpret the value of a ration has been accumulating only during the last five years and is by no means complete. However, sufficient knowledge has been acquired to enable us to avoid the most probable errors into which the public is likely to fall, namely, use of foods poor in lime and phosphorus, poor in fats, and poor in perfect muscle-building elements.

The text-books on nutrition until very recently enumerated as the essential constituents of an adequate diet, proteins, carbohydrates and fats, inorganic or mineral elements, and water. A few words of explanation of these terms will indicate their special functions as foods:

Proteins are nitrogen-containing compounds and represent the materials of which muscle tissue is formed. Typical proteins are the white of egg, the curd of milk, meat, gluten of wheat. There are many proteins of animal and plant origin, all differing from each other in some degree. All proteins possess the common property that they can be taken apart into fragments by the digestive ferments. A good illustration of what takes place in protein nutrition is seen in words set up from printer's type. The words represent the

proteins and the type (the letters) the digestion products or "fragments."

Different sets of words make up the stanzas; to which we may liken the muscle tissues of the different species of animals. When we have a certain amount of the one set we can transform it into another, but we must inevitably end with an excess of certain ones before the stanza is completed. With this comparison we can easily understand how the words of a single stanza might transform very efficiently into another composition. The letters in the rhyme about Jack Sprat would not go very far in an attempt to make the jingle of Peter Piper and the peck of pickled peppers. The analogy is a good one and shows clearly how we may have excellent, good and poor proteins, and also how two proteins of the poor class may make good each other's deficiencies by each supplying the letters missing in the other. The higher animals can take the words (proteins) and separate them into letters (digestion products) and can again reset the matter into new words (muscle proteins), but they cannot create the letters from the matter of which they are formed. This can be accomplished by the plant only.

PROTEINS FROM GRAIN AND SEEDS

The proteins derived from plant products are in general deficient in some way and are of poor quality and need to be combined with other proteins which make good their deficiencies in nutrition. The proteins of the wheat, oat and corn kernels can be converted into muscle proteins by the growing pig only to the extent of 20 to 25 per cent, but certain combinations of other plant proteins are of twice this value, while the proteins of milk are of exceptional value in that they are utilized for growth to the extent of 63 per cent. Meat and egg proteins are likewise of excellent quality, ranking with milk proteins.

The carbohydrates (the starches and sugars) and the fats are the sources of energy for work and for maintaining the body temperature above that of the atmosphere in which we live. Animals can within fairly wide limits employ fats and carbohydrates interchangeably, but experimental trials have shown that, without proteins, no amount of the remaining groups of food-stuffs can suffice to keep an animal alive, and no one has

been able to long maintain an animal on foods entirely free from the fats.

The various mineral salts which are left when the tissues of an animal are burned are just as essential to the maintenance of life and health as are the other food substances.

We have for many years been instructed as to our requirements of energy and of protein (tissue builders), and when a question arises as to the minimum allowance of food which will preserve body weight and health, these matters are of the greatest importance. The warring nations have used the results of the studies of Voit, Atwater, Benedict, Rübner, Chittenden, Lusk and their associates in determining the amount of food required by an individual of a given body weight in the various occupations, and these efforts at making the limited supplies go as far as possible have been of great service. There is, however, no doubt in the mind of anyone who is acquainted with the progress of experimental dietary studies of the past four years that there are still other factors which must be taken into account in deciding when a food supply will suffice to maintain health.

NUTRITION EXPERIMENTS DESCRIBED

We can best explain what constitutes an adequate diet by describing briefly the type of feeding experiments by which we arrived at an understanding of this complex subject. We employed in most instances domestic rats as experimental animals, but the results have also been verified in many cases with pigs.

When we attempted to feed young animals on diets which conformed in every respect to the requirements set forth in the authoritative writings on nutrition, but which consisted of carefully purified proteins from various sources, with starch, sugars, fats, and inorganic salt mixtures, steady loss of weight and early death followed. The salt mixtures were so made up as to closely imitate the mineral content of certain rations of natural foodstuffs with which we had been highly successful in nourishing young animals during growth. You may have all you can eat, but still lack certain foods necessary for growth and maintenance. The rations of purified food-stuffs all supplied an abundance of energy, protein and inorganic elements, and

they were easily digestible, yet nutrition was a complete failure. After many systematic trials the explanation was found for these results.

If to such a diet of purified food substances there be added a small amount (3 to 5 per cent) of pure butterfat, and a small amount of a natural food or a water or alcohol extract of some natural food, such as a seed, leaf, tuber, fruit, or milk, the resulting mixture will promote growth in a perfectly normal way. If the same mixture is made up with lard or with any plant oil in place of butterfat, no growth takes place. Egg-yolk fats and the fats from such organs as the liver and kidney, extracted by means of fat solvents, may take the place of butterfat, but the body fats of animals, such as lard and suet, in the amounts in which they are generally included in a human diet, cannot. These exepriments show that the fats from certain sources contain an unknown something which is itself not a fat, but which is indispensable for the maintenance of life in an animal. It is for this reason that especial care is necessary today in choosing the daily food.

If now we feed the same mixture with the butterfat in it but with the natural food or the extract of the natural food omitted, the animals are no better off than when fed purified proteins, carbohydrates, fats, and salts only. There is, therefore, a second substance which is indispensable to the life of an animal. This is soluble in water, and is fortunately never associated with fats, a matter of great importance in simplifying the experimental proof of its existence. Like the fat-soluble substance, the chemical nature of the water-soluble one is unknown. We know where and how to obtain each of these two substances, but nothing more. Almost infinite small amounts of each is required, but without both of them nutrition promptly fails. Since we know only of the solubilities of these two dietary constituents and cannot further characterize them we have provisionally named them fat-soluble A and water-soluble B.

WHERE TO FIND THE NEW UNKNOWNS

Fortunately, the growth stimulant, fat-soluble A, is not limited to certain fats of animal origin, but is found in fairly liberal amounts in the leaves of plants, as well as a few seeds. The most important seeds used as human foods, wheat, oats,

corn, beans, peas, contain much too small an amount of it to support growth or prolonged well-being. Of all the seeds we have examined, only flaxseed and millet seed compare favorably, in the fat-soluble growth stimulant, with alfalfa leaves. Our experience with leaves has been limited to alfalfa, cabbage and clover, all of which are distinctly richer in the fat-soluble A than are the seeds of grains.

One of the most remarkable observations concerning this substance is that it appears to be in chemical union in the plant in a form in which it has not been removed except when the union is broken in the course of digestion or elsewhere in the body. This growth stimulant is, in the body, very soluble in fats, and thereafter accompanies some of the fats in the animal body. Animals which eat the green foods rich in leaves and grass, contain in their fats this dietary essential, fat-soluble A. It is found concentrated in the milk. Being very soluble in fats, the larger part of it is in the milk fat.

The unidentified fat-soluble A is not present in the common seeds in amount equivalent to the needs of growing young. If in certain species of animals, and especially man, the diet should consist largely of seeds or their by-products, the food would in all probability be too low in this dietary essential. Fortunately, our diet generally contains some of the foods which contain this fat-soluble growth stimulant in abundance. These are milk, eggs, certain animal organs and the leaves of plants. Meats, in general, are not very rich in this substance.

DISEASES OFTEN DUE TO LACK OF CERTAIN FOODS

The second unidentified dietary essential, water-soluble B, is present in great abundance in practically all naturally occurring foods. Exceptions are polished rice, and the refined starches, sugars and fats. In parts of India, China, the Philippines and other places in the Far East where the poorer natives eat polished rice as the principal article of diet, the disease beri-beri is prevalent. The most characteristic manifestation of this disease is paralysis, especially of the legs. Numerous carefully conducted experiments have indicated that this disease is the result of specific starvation for the water-soluble unidentified dietary essential for growth. Fortunately we are

in no danger of obtaining too little of this substance, as all native foods contain it.

The nature of the dietary errors which are likely to prove serious both in animal production and even more so in human nutrition can best be illustrated by the following table which shows the character of the growth of animals fed one of the with the addition of specific purifed food supplements.

BEHAVIOR OF AN ANIMAL FED EITHER WHEAT, OATS, OR CORN, OR ALL THREE TOGETHER, WITH SPECIFIC FOOD ADDITIONS

1. Seed alone	No growth, short life
2. Seed with pure protein addition	" " " "
3. Seed with butter fat	" " " "
4. Seed with salt mixture added	Little growth. longer life
5. Seed with salt mixture and butter fat	Slow growth, life ⅓ usual span
6. Seed with protein and butter fat	No growth, life ⅓ usual span
7. Seed with salt mixture and protein	Good growth for a few weeks, then failure
8. Seed with salt mixture and protein	Normal growth and normal span of life
9. The three seeds in equal proportions	No growth, short life

In the above table it is shown that the three most important seeds employed as human foods are singly or collectively incomplete foods and the manner in which they are deficient in quality is clear.

1. Their proteins are of poor muscle-building quality and the values of their proteins are not much improved by feeding them in mixtures of two or three. A diet principally derived from these seeds needs the right kind of protein supplement from other sources. Milk, eggs, the leaves of plants, and meats serve this purpose.

2. They all fail to supply enough of the unidentified fat-soluble A found in butterfat. This growth and repair deficiency can be made good either by taking with the grains, milk, eggs or *the leaves of plants.* Many experiments have proven that the leaf of the plant is, in general, much richer than the seed in this unknown dietary factor.

3. The mineral salts of the seeds generally are present in too small amounts, especially with respect to the salts of lime and common table salt, to make it possible for a young animal to

grow without further additions of these inorganic elements. In some places the drinking water will supply the lacking salts, but in many other localities it will not.

When but one of these classes of deficiency is made good the diet is not greatly improved. When two of these factors are improved the well-being of the animals is greatly benefited, provided one line of improvement includes adding the necessary salt mixtures, but not otherwise. Proper amounts and proper proportions of the mineral salts in the food mixture constitute one of the most fundamental dietary requirements.

When all three of the dietary factors in which these seeds are deficient, protein, fat-soluble A and inorganic salts, are properly supplemented, each of the seeds—wheat, oat, or corn, or mixtures of these—become highly efficient for the promotion of health.

A striking generalization can now be made which was forced upon us only after many experimental trials. *Provided salt-free or nearly salt-free water such as rain water, distilled water and some of the purer natural waters are used for drinking, it is not possible to make up a diet, derived solely from the seeds of plants, which will support normal growth and health.*

LEAVES SUPPLEMENT SEEDS

In marked contrast to our experience with seeds stand the results of feeding combinations of the seed with an abundance of the leaf of the plant. We have as yet extensive experience only with the alfalfa leaf, but enough study has been made of cabbage and clover leaves to make it apparent, when our knowledge of the chemical composition of other leaves is considered:

1. That the leaves of plants are essentially similar in their organic content,
2. That all are high in just those mineral elements in which the seeds are deficient; viz., salts of lime and common salt.

We know from common experience that those animals which thrive upon a strictly vegetarian diet eat the entire plant. Pigs have in farm practice frequently been stunted and reproduction has been interfered with as the result of being fed too

largely on seeds and by-products of seeds when confined in pens nearly free from vegetation. Under these conditions they get an inorganic supply which is not of suitable character, and run short of the unidentified growth stimulant factor, fat-soluble A. In many cases they also receive proteins of relatively poor quality. These dietary faults are sufficient to undermine the health of the animal.

When, however, the *leaf* is fed with seed, highly successful nutrition has been secured. Simple mixtures such as 60 per cent of rolled oats with 40 per cent of alfalfa flour, prepared by grinding and sifting the dried leaves, were capable of promoting normal growth and well-being when fed throughout life. The reason for this is clear. The leaf portion supplies the fat-soluble essential in which the seed is deficient, and also makes good the particular mineral elements contained in insufficient amounts in the seed. Similar mixtures of wheat or corn with alfalfa-leaf flour, promote the well-being of animals in a manner which we have never been able to successfully imitate with mixtures of seeds.

PART II

PRACTICAL APPLICATIONS

The evidence presented shows clearly that the dietary deficiencies of the seeds of the most important cereals—wheat, oats and corn—are three-fold, and that before growth and prolonged well-being are possible the protein mixture which builds tissue must be supplemented so as to enhance its food value; the fat-soluble unknown must be increased in amount; and certain salt mixtures must be added. Adequate diets cannot be made up entirely of seeds even though several kinds be taken together, but combinations of leaf with seed prove much more satisfactory.

Two facts should be emphasized here: First, the fallacy of the doctrine which has been many times preached that in eating whole wheat or other whole grain we could feel certain that all the elements necessary to the preservation of health are combined in just the right proportions by Nature to form

an ideal food for man. Such statements have been frequent in the utterances of "authorities" who condemned the milled products as prejudicial to health, and extolled the dietary value of Nature's unbroken package, the entire seed. Numerous carefully controlled experiments with seeds fed singly and in combination have clearly demonstrated that Nature's unbroken packages are for man as deceptive as some other unbroken packages which have come into our hands. They are not what they are purported to be. Seeds are perfectly good foods for the plant, but for animals they are good only when combined with such other foods as make good the deficiencies.

The leaf possesses peculiar properties which meet these requirements. We may now consider in detail the dietary relationships between seeds and some of our other more important foodstuffs. Of first importance as a supplement to grains is milk. Cow's milk is not, as is so frequently asserted, an ideal food for the human animal. It is the nearest approach to an ideal food which we know. Milk alone is not so satisfactory as a single diet after the first year. The combinations of grains with milk and fruit in which about 75 per cent of the energy (calories) is furnished by the grains and 25 per cent by the milk are highly satisfactory as human foods. Milk supplements well the mineral deficiencies of the grains and furnishes a liberal supply of the fat-soluble unknown. Fruits furnish some energy, but are important because they furnish mineral salts and roughage.

During the war, when prices of food are high, it should be especially urged that the purchase of milk be continued, even though the price may be as high as 15 cents a quart. The greatest factor in safeguarding the health and nutrition of the most progressive nations of the world may fairly be said to be the prevalence of the consumption of dairy products. It is unfortunate that the name of the first man or woman to practice keeping dairy animals is not known in order that we might do him or her honor.

Adequate nutrition on a strictly vegetarian diet involves combining seed, *leaf*, tuber and fruit. Care is especially necessary during the winter season, when but a limited number of the best keeping green-leaved foods are available. Therefore, every effort possible should be put forth to save green leaved

foods for winter use and a word may be said as to the possibility of making use of many leaves for vegetables. It will be remembered that the leaves are very rich in the dietary essential, fat-soluble A, the growth promoting substance in butter fat. Leaves are usually found on the table in the form of greens or salads. Those which are most commonly used for greens are spinach, cabbage, beet and turnip tops, dandelion, Swiss chard, and in many localities water cress and lettuce. Those which form the basis for many kinds of salads are lettuce, water cress, endive, and cabbage. Any of these may be preserved by canning or drying, as heat does not seem to destroy the value of the growth stimulants.

Where skim milk can be obtained it will afford one of the foods that is most important in the family diet. The creamed gravies such as creamed codfish, dried beef, creamed chicken, are valuable because of their high protein value. There is the least possible waste in dishes prepared in this way. They are meat extenders. Cream sauce using different proportions of thickening agents can also be used for creamed toast, scalloped dishes, cheese sauces, pudding sauces, salad dressings, croquettes and souffles. Cottage cheese should be used in as many ways as possible in the diet, as in salad and sandwiches.

Every housewife knows of the very palatable dishes which can be made by using the white sauce as a basis. Skim milk can be used to good advantage in making this sauce. Creamed soups with thin white sauce as a basis can be made from left-over peas, corn, potatoes, celery, asparagus, and tomatoes. These vegetables give flavor to the soup and add greatly to its palatability. The creamed vegetables such as carrots, cabbage, turnips, radishes, celery, asparagus, beans, peas, cauliflower, onions and chard form a valuable source of mineral matter and also of the fat-soluble A.

EAT LESS MEAT

Are you a meat eater? Use less meat. Eat more vegetables and dairy products and you will feel better in health and pocketbook. The surest of all places to attack the high cost of living is the meat bill. The consumption of meat is grossly overdone in this country and was in many parts of Europe before the war. That meat is an excellent source of protein (tissue

builders) cannot be denied, but it is so easily possible to obtain a protein mixture of high quality by the proper combination of vegetable foods, together with a small amount of milk and eggs, that extensive expenditure of money for meat is unwarranted.

Meats have a value in another way, however, as contributors to the palatability of the diet. As far as possible, meat should be employed in giving flavor to gravies, and for cooking with vegetables in such combinations as chowders and stews. The purchase of meats by anyone who needs to practice economy is indefensible except within the limits prescribed above. The factor of palatability of foods is so important that a small additional expenditure is advisable in order to attain it. No fact in physiology is better established than that of the importance of pleasurable anticipations, agreable flavors, attractive appearance and proper texture of foods on the efficiency of digestion. Make food attractive if you would stimulate digestion and make the greatest use of the food you eat. Food which is unattractive for any reason will not cause proper response of the digestive glands with secretion. Digestion when delayed or enfeebled for want of proper stimulus, leaves the foods exposed to the developmnt of bacteria and through their agency to the formation of gases and unwholesome products which cause the sensations of ill-being attending indigestion. Good digestion waits on appetite, but on appetite for good things, things which, when hungry, we like to contemplate and which, when eaten, contain all the necessary things for the nutrition of our bodies. Health waits on both, but neither good digestion nor health wait on merely a craving for food.

Eggs are not quite in the same class with meats, but their purchase should also be restricted. Their use when prices are high should be limited to food for children and to improving the quality of certain other dishes such as those made with mixed flours.

SUBSTITUTE WHOLE WHEAT FOR WHITE FLOUR

The first place for the housewife in the average American home to practice economy is in cutting boldly on the meat bill. The second point at which to economize is on wheat flour. There is nothing relating to nutrition which rests upon a more firm experimental basis than the inferiority of white flour

as a food. One might well ask why the dealer persists in handling white flour instead of entire wheat flour, if it is not best for the public to eat. There are several reasons for this. First, entire wheat flour containing the germ will always become infested with maggots when warm weather comes, while white flour, which contains neither germ, bran, nor aluerone layer of the wheat kernel keeps well. This is really the reason why white rice (germ free) is marketed instead of brown rice. The removal of the outer coat and consequent whitening was only incidental in the beginning of the rice polishing industry. The object was to get rid of the germ and make it possible to keep the product without spoilage through the ravages of insects. Incidentally, however, the public has become educated to the use of a white flour and a white rice. The proteins of white flour are distinctly poorer in quality than those of the whole wheat, imperfect as these are, and the mineral salts are largely removed with the portion sold for stock food.

There is not the slightest reason why one should not eat white rice in liberal quantities provided these are combined with such things as make good their deficiencies. But in a time like the present, when we must save wheat and when the desire for the most and best food for the smallest expenditure of money leads us to simplify our diets by omitting the purchase of a larger variety and often of the more expensive articles, there is an increased risk that the deficiencies of white flour and white rice, which are among the cheapest sources of heat or energy, will not be made good by the remaining articles of the diet. In localities where wheat is grown the thoughtful housewife is to stop buying white flour and use instead oatmeal, barley and rye, which improve the quality of the diet. She may purchase from the feed-store man a supply of wheat of good quality. This, coarsely cracked in a coffee mill, may be used as a breakfast food. Grind it in the same mill for any other purpose for which flour is used. It will cost less than half as much as white flour and much more nearly approximates a complete food.

Brown rice is sold now only in packages and is more expensive than white rice, so the latter should be continued in use, but with a full appreciation of the fact that it is a starchy food

and contains but little protein or mineral salts. Both the fat-soluble A and water-soluble B are absent because they were removed with the germ. Rice may be looked upon as an economical source of energy. But do not forget that energy and protein are not the only things of importance in nutrition. Without a suitable inorganic supply, an adequate amount of the unknown A and B, and abundant calories of energy and protein in the food, health will fail within a short time.

We have sometimes been asked whether there is not an unnecessary note of alarm in such a discussion as is here given regarding the necessity of giving thought to *what* to eat, rather than how much food we need when food is scarce. Are we not over-anxious about such matters because we have been accustomed to observe experimental animals, the deficiencies of whose diets were intensified in greater degree than would ever be likely to arise in the experience of a human being even in war time? In reply to this we would call attention to the experiences of the pioneers in certain sections of the United States. Living on the edge of the wilderness, struggling with poverty, they often sold everything which was salable in order to buy needed live stock, farming implements, and other necessaries. Their food was much more simple even in summer than that of the farmer of today and in winter they regularly limited themselves to a very simple diet, the staple ingredients of which were cornmeal and meat. This led in the spring to the routine practice of using tonics and blood purifiers to relieve that tired feeling. A little observation will show that with improved living conditions, the need of spring medicines has disappeared. We no longer feel worse in spring than at other seasons. The explanation is simple and evident. An inadequate restricted diet, even though two or more articles fresh from the hand of Nature were regular constituents, did not suffice to prevent failure of health when persisted in for three or four months.

Goldberger of the Public Health Service in Washington has emphasized his belief that pellagra, a disease which is at present incapacitating thousands in the South, is the result of inadequacy of the diet of the people during the winter months. The great majority of all cases of the disease develop in the spring, or rather at the end of a winter during which the diets

of many are practically limited to corn bread, molasses and salt pork. Extensive and heroic efforts of Dr. Goldberger and his associates to infect themselves with the disease have proven futile, and in orphanages and asylums where pellagra was formerly a scourge, it has all but disappeared with an improvement in the diets of the inmates. He has furthermore produced the disease experimentally in human beings. A group of convicts from the state penitentiary of Mississippi volunteered, on promise of pardon, to eat the diet which Dr. Goldberger prescribed. This consisted of patent wheat flour, corn meal, corn grits, corn starch, white polished rice, standard granulated sugar, cane syrup, sweet potatoes, pork fat (fried out of salt pork), cabbage, collards, turnip-greens and coffee. On this diet there was loss of weight and strength, and mild nervous symptoms. Gastro-intestinal symptoms were slight. After five months the typical skin manifestations appeared in six of the eleven volunteers. Protein and the fat-soluble A were deficient. Variety, calories of energy and protein are not the only things to be considered in the planning of the diet, and with the advent of war it behooves those upon whom rests the responsibility for planning the dietaries of themselves and others, to take cognizance of what specific knowledge is now available in order to safeguard against the dangers of malnutrition.

The first experimental proof of the existence of the unknown dietary essential fat-soluble A came through studies conducted with butterfat and with egg fats. We were unable to find the peculiar growth-promoting properties in any of the plant oils and observed that the content of the unknown A in the body fats of animals and in the wheat, oat and corn kernels, was very small as compared with the content in butterfat and egg-fats. Butter substitutes require the addition to the diet of milk and eggs—besides the liberal use of fresh vegetables such as cabbage, lettuce, and greens. Whole grain must be used to take the place of the by-products lacking the germ (white flour). The leaves of plants are sufficiently rich in the fat-soluble A to make it possible to arrange dietaries without either butter, eggs or milk, which could induce adequate nutrition. This is not an easy task with foods which are acceptable to the human palate, for we do not eat leaves in the dry state.

So long as milk and eggs are used as directed in a former paragraph, and liberal use is made of fresh vegetables such as cabbage, lettuce, cauliflower and various leaves used as greens, and with the substitution in as large a measure as possible of the whole grain of the wheat and corn for the by-products lacking the germ, it is perfectly safe for the adult to replace butter wholly by the less expensive butter substitutes.

The value of beans and peas has been somewhat misunderstood. They are very rich in protein and fats and one hears frequently today the statements that these are the poor man's beef. Goldberger has expressed the belief that the inclusion of the legume seeds in the diet will greatly contribute to the prevention of pellegra.

Dried peas and navy beans are, when properly cooked, perfectly wholesome foods, but only when used in moderation. Taken too liberally, beans, in particular, tend to undergo fermentation to a degree which may produce discomfort. Navy beans cannot replace milk, eggs, or vegetables in the diet. We have studied the navy bean very extensively and have found that it possesses no peculiar dietary properties which make it superior to other seeds, and most beans cannot replace entirely milk, eggs or plant leaves in the diet. Although the proteins of the navy bean when taken as a sole source of protein are of surprisingly poor quality, their deficiencies are made good by the proteins of the cereals and probably most of the other common food-stuffs. Properly combined, therefore, it may be conceded that beans may in a measure replace meat as a source of protein, but they compare very unfavorably with meats as a means of conferring palatability upon other foods. Navy beans do not contain the fat-soluble A in amount greater than do the cereal grains.

On the other hand, the protein of the soybean and of the peanut have proved to be most excellent for growth. The only objection that can be made to their use is that the high percentage of fat, 20 per cent in the soybean and 40 in the peanut, makes their heat value extremely high. They should, therefore, be used in moderation with food rich in starch. They should also be combined with milks and fruits to balance the mineral matter and increase the growth stimulant.

The dietary properties of the tubers resemble the seeds ex-

cept for their exceptionally high content of water. As food, potatoes are not worth $2 a bushel—they contain too much water. Their use in the family diet should be discontinued when the supply becomes so short as to inflate the price. Their protein content is low but of good quality. In most tubers there is much starch. The inorganic content of the tubers is closely similar in all but is by no means so good for supplementing the deficiencies of the grains as are the ash constituents of the leaves of plants.*

A few words should be devoted to the planning of diets at the present time, the primary object being to relieve the wheat shortage. The wheat supply is very inadequate. Yet we must be prepared to sacrifice in order to send wheat to Europe. The English and French do not want corn, they want wheat. They have never learned to grind corn or to prepare it in quick breads, and we have, so we should as a patriotic duty deprive ourselves so far as possible of wheat for the benefit of our armies and our allies. This we can readily do, without detriment, to an extent which will save about 25 to 30 per cent of the wheat which we shall consume in the next twelve months if we go on in an unthinking way.

A spirit of patriotism should impel each and everyone of us to decrease the consumption of wheat bread so far as possible and extend the use of the products of the vegetable garden just as far as possible during the summer and fall. Have a supply of cabbage, cauliflower, rutabagas, turnips, carrots, beets and onions for preservation in the autumn as long as possible.

"Economize on wheat" should be on every lip until this war is over.

When there is a shortage of potatoes do not use them. Make use of the other root crops to an extent never before reached. This will relieve the demand for potatoes to a considerable extent and will discourage speculation and exorbitant prices.

Another most important way in which wheat can be saved is by the use of mixed flours. As much as 25 per cent of cornmeal in form of mush can be incorporated with wheat flour

* The Home Economics Department of the University of Wisconsin has prepared a table in which the common foods are arranged in groups, according to the main characteristic found in the food. By using this table, which may be obtained by application to the department, it will be possible to combine the foods more rationally than has been done in the past.

without its losing much of the physical properties of wheat bread, and the product loses nothing in palatability. Rye or barley can be employed with wheat to even greater extent and the loaf be hardly distinguishable from wheat.

The practices recommended are known to be entirely safe. Let us from the beginning of the struggle which awaits us follow the dictates of scientific investigation. Begin now to help relieve the food situation and avoid the possibility of heroic France and her fighting companions being later reported as forced to suffer for food.

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