

CEREALS and THEIR ECONOMIC VALUE.

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Cereals and their Economic Value.

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CEREALS and THEIR ECONOMIC VALUE.

Of all the plants now so universally diffused over the surface of the globe the grasses are of the first importance to man. From them he derives all the essentials of life. The cereals embracing a portion only of the family of grasses are to man in his civilized condition more important than the other classes of grasses. They contain the elements to form bone, muscle and fat.

Wheat is probably one of the oldest grains cultivated and used for food. Its history goes back through all the ancient writings, where frequent or occasional mention enables us to trace its lineage. But beyond even that we have been enabled to trace it by means of specimens found in connection with prehistoric material of the stone age, this showing that wheat was cultivated by early nations and by them used as food. It has formed the chief article of food for all civilized nations. There are many circumstances, both in history and the sciences, more especially in botany, which indicate that we are indebted to Persia for the wheat plant. Some writers claim we are indebted to India and not to Persia for it. The Goddess of Agriculture, more especially of grain, who by the Greeks was called Demeter, and by the Romans Ceres, was said to have her native place at Enna, which was situated in a fertile region of Sicily.

The native country of the cultivated oat is unknown, although most probably it is Central Asia. There is no reference, however, to the oat in the Old Testament: and although it was known to the Greeks, who called it Bramas, and to the Romans, it is probable that they derived their knowledge of it from the Celts, Germans

and other northern nations. It can be successfully cultivated even to the Arctic Zone. The grain is used either in the form of groats or made into meal. Oatmeal, prepared by various processes of making, composes at this day a large proportion of the food of the inhabitants of Scotland, and particularly of the better fed portion of the laboring classes. It being a favorite dish with the Scotch and Irish its adoption has naturally followed the immigration of these races.

Indian Corn, our most valuable cereal, is a Native American plant of the New World to the list of cereals. All the other cereals have come with the white race from the Old World. Before the discovery of this country by Columbus this cereal was unknown in Europe, Asia or Africa, and to this day it is cultivated only sparingly in Europe. It is there often planted upon lawns as an ornamental plant.

Maize was undoubtedly grown by the inhabitants of North America, Central and Southern American in prehistoric times. Mounds that were erected prior to the time of the American Indian, that have been explored in recent years, have contained corncobs and charred kernels. There are many reasons for thinking that the original home of our great cereal was the country called New Grenada, in Central America. From this point it became dispersed all over North and South America, before the advent of the European - a wide spread dispersion that indicates antiquity.

Rice is a native of the East Indies, but is now cultivated in all quarters of the globe. The introduction of rice into the United States took place only about the middle or close of the 17th Century, 1694 being the earliest year in which it is known to have been grown. Rice forms the food of one-half the population of the

earth; it is used considerably in this country and is cultivated to some extent but not enough to meet the demand.

Rye is supposed to be a native of Crete, of Canada and many other eastern portions of the globe. It is extensively cultivated in Europe, where it forms the food of one-third the population; it is not much cultivated in England, and its cultivation is decreasing in the United States.

Two centuries ago rye flour, either alone or mixed with wheaten flour, formed the common bread of the country, now this mixture is only partially used. Rye when parched and ground has been recently used as a substitute for coffee. Bread made of rye is not much used in the North of Europe, it is the familiar black-bread of Germany and the main sustenance of the Russian peasant.

Barley was cultivated before other cereals in Scandinavia and that generic term "corn" was applied among Northmen to this grain, only from the oldest times. Barley is not used very extensively in this country, its principal use being in soups and broths. It is employed in the manufacture of malt. When barley is deprived of its outer husky covering, it is then used as an article of food, called pot-barley, or when well rounded and polished in the mill, pearl-barley, this is sometimes ground into a fine quality of barley meal.

Barley meal is used in Wales and Scotland in winter when the wheaten flour is dear, and to some extent in Ireland; at the time of Charles I (1626) according to McCulloch it was the usual food of people in the northern part of England. As late as the middle of the last century hardly any wheat was used in that part of England.

Buckwheat is a native of the basin of the Volga, the shores of the Caspian sea and many parts of Central Asia. A recent German

authority affirms that there is no authentic mention of it until 1436 at Mecklenburg, whence it spread over Europe in the following century. It is also said to have been introduced by the Moors in Spain, and thence to have extended over Europe, and again to have been brought to Europe by the Crusaders. The seed is most frequently used in the form of groats, or made into pottage. In the United States thin cakes made of the flour are a standard food. It is freely consumed as a human food in Brittany and Holland but rarely in the United States.

Millet is a native of East India, but is extensively cultivated in the warmer parts of Europe and other quarters of the world. The grain is used in the form of groats, or in flour mixed with wheat flour, which makes a good bread; but bread made of millet alone is brittle and full of cracks. Millet of various species is the staple food of India as a whole, and not rice, as is often thought.

Millet is consumed in Africa being the staple article of diet of the Negroes of the Upper Nile, and in some southern European countries, while in China it is used to make bread. It is not used as a human food in this country.

The cereals most commonly used for food are wheat, oats, corn (maize), rice, rye, barley and buckwheat, the first three being by far the most important in this country. The predominating ingredient of all cereals is carbohydrates in the form of starch which makes up from 60 to 70 per cent of the entire grain. The proteids vary considerably in kind in the different cereals, but their nutritive value is probably about the same. In addition to the proteids, small quantities of other nitrogenous substances are present, the amount of which varies in different cereals. Small quantities of sugar are also met with, but cellulose is not abundant except in the

outer protective covering. The proportion of fat varies very notably in different members of the group. The mineral matter amounts to about 2 per cent of the grain, lime and phosphoric acid being most abundantly represented, while organic salts are almost absent. In this respect the cereals resemble the animal rather than the vegetable foods.

The following represents the composition of cereals in a crude form:

Cereal.	:Water :	Proteid :	Fat :	Carbo- :hydrates :	Cellu- :lose :	Mineral :matter.
General Composition	: 10-12 :	10-12 :	65-75 :	1/2-8 :	:	2
Wheat	: 12.0 :	11.0 :	1.7 :	71.2 :	2.2 :	1.9
Oats	: 10.0 :	10.9 :	4.5 :	59.1 :	12.0 :	3.5
Oats (hulled)	: 6.9 :	13.0 :	8.1 :	68.6 :	1.3 :	2.1
Barley	: 12.3 :	10.1 :	1.9 :	69.5 :	3.8 :	2.4
Rye	: 11.0 :	10.2 :	2.3 :	72.3 :	2.1 :	2.1
Maize	: 12.5 :	9.7 :	5.4 :	68.9 :	2.0 :	1.5
Rice (poddy)	: 10.5 :	6.8 :	1.6 :	68.1 :	9.0 :	4.0
Rice (polished)	: 12.4 :	6.9 :	0.4 :	79.4 :	0.4 :	0.5
Millet	: 12.3 :	10.4 :	3.9 :	68.3 :	2.9 :	2.2
Buckwheat	: 13.0 :	10.2 :	2.2 :	61.3 :	11.1 :	2.2

When people first began to grind their grain they did so simply by crushing it between two stones which happened to be convenient, a little later they kept two flat stones especially for the purpose, one of which was kept stationary while the other was turned on it. At first each woman ground the meal for her own family on her own stone; but after treadmills, windmills, and later water-wheels, came into use all the grinding was done by the professional miller in the village.

In feudal days the lord forced his tenants to have their grain ground in his mill, even to bake their bread in his oven and charged for the use of each. Various devices for grinding and sifting the grain have gradually been invented until today we have mills covering acres of ground, and do apparently impossible things with grain. In high roller milling the grain is washed and skinned, as in milling entire wheat, and then run through more pairs of rollers, each successive pair being closer together. After each grinding or "break", the meal is sifted and the leavings of each sifting is called "tailings", are themselves ground and sifted many times. In a mill where the grain goes through a series of six straight breaks there are as many as eighty direct milling products, varying in quality from the finest white flour to bran. In the production of standard patent flour all the bran is left out, and in addition the germ is removed, for the reason that it contains much of the oil of the wheat, which is likely to become rancid and spoil the flour; and which acts upon the other constituents of the flour so that in baking the bread is darkened in color.

Rolling has recently been begun to be employed as a method of preparing oats, instead of grinding. The great pressure to which the grains are subjected between the rollers rupture the cell walls, breaks down the cellulose and flattens the grain out, so that they are more easily softened by cooking. By the application of heat during the rolling process, the grains are at the same time partially cooked, this not only renders the preparation for the table less laborous, but also alters the fat which is so abundant in oats, in such a way that it is less liable to become rancid, so preserving the natural flavor of the grain.

The rice as it comes from the thresher is known as "paddy" or "rough rice". The object of milling is to produce cleaned rice by removing the husk and cuticle and polishing the surface of the grain. The improved processes of milling rice are quite complicated, the paddy is first screened to remove trash and foreign particles, the hulls or chaff are removed by rapidly revolving "milling stones" set about two-thirds of a rice grain apart. The product goes over horizontal screens and blowers, which separates the light chaff and broken and whole kernels. The grain is now of a mixed yellow and white color. To remove the outer skin the grain is put in huge mortars and pounded with heavy pestles. The rice next goes to the cooling bins. The grain is now ready for the polishing. From the polishers the rice goes to the separating machines, where it is divided into grades. It is then barreled and ready for market.

In the process of polishing rice some of the most nutritious portions of the rice grains are lost, according to food value, the fats being nearly all removed. Rice polish (or flour) is 1-3/4 times as valuable for food as polished rice. In the South, the farmers remove the hulls and bran, and use the grains without polishing.

There are many different methods of preparing maize, the simplest and most prevalent until within a few years, consisted in grinding the kernel between stones and using the whole meal coarsely sifted, thus produced. A finer grade of Indian Corn flour is produced by grinding and bolting to remove a large portion of the bran. The fat, which is largely confined to the germ, is a source of weakness, since it readily becomes rancid and the meal musty. Hominy and samp, from which the germ has been removed, are free from this objection. An improved method of milling corn is now coming into use by which the

kernel is degerminated before being ground, the result being a product of much better keeping qualities. Artificial heat is also used in the manufacturing of corn-meal, which insures better results.

Many attempts have been made to remove the outer covering of the rye by means of chemicals, especially sulphuric acid and soda lye, but in practice these processes have had no success. The removal of the outer coating of the rye by mechanical methods before the regular grinding takes place has, however, to a certain extent been successfully accomplished by rubbing the grains in a bowl-shaped vessel with pestles of steel covered with sharp quartz sand. By this process the envelopes of the grain are partly or completely removed. It is then subjected to the ordinary milling and sifting operations.

The main secret in the successful preparation of cereals is thorough cooking, and this necessitates cooking them slowly in the proper quantity of boiling liquid, for a considerable length of time. If liquid has to be added or has to be drained off after the grain is cooked, some of the flavor is lost, and the result is generally an insipid mess, instead of a savory and appetizing dish. It is therefore very important that the same cup used for measuring the grain should be used for measuring the liquid in which the grain is to be cooked so that the quantity of liquid be just sufficient to make the mush or porridge the proper consistency and to perfectly develop the flavor of the cereal.

A great deal has been written about preparing mushes for the table in from two to twenty minutes, and many cooks serve them prepared in this length of time; but all cereals are more digestible and much finer flavored when thoroughly cooked. The amount of liquid necessary, and the length of time required for cooking cereals properly,

depends greatly on the nature of the cereal and the method in which it has been ground or milled. Water alone can be used for cooking any of the cereals, but most of them are richer and finer flavored when the liquid used is milk and water, mixed in about equal proportions. Especially is this the case with barley, rice, hominy and farina. The quantity of salt that should be used is largely a matter of individual taste. A safe rule to follow is to add a teaspoonful of salt to each pint of liquid used.

All cereals can be cooked in an ordinary agate ware or porcelain-lined stewpan, if carefully watched and stirred; but, as much stirring renders cereals starchy and robs them of some of their finest flavor, a double boiler, is much the best and most convenient utensil for cooking mushes and grains of every kind.

To cook cereals in a double boiler: Fill the outside boiler two-thirds full of boiling water, put the necessary quantity of boiling liquid in the inside kettle, add the salt, sprinkle in the grain or meal, stirring slowly until it swells or thickens enough to keep it from settling to the bottom of the kettle. Cook five minutes then place in outside boiler over boiling water and let it cook slowly until thoroughly cooked.

All mushes thicken in cooling, and in preparing cereals to be eaten cold the proportions of liquid should be increased at least two-thirds.

The cereal foods furnish a large proportion of the nutrients in the diet of the American people. In the studies of dietaries, we find that cereal products of all kinds comprise almost 22 per cent of the total foods, and supply 30 per cent of the total protein, 7 per cent of the total fat and nearly 55 per cent of the total carbohydrates. These are on a whole the cheapest and most economical materials

consumed, although there are some individual exceptions.

In general we may say that the nutritive value of the breakfast foods is much the same as that of the grain from which it is made, varying with the kind or quality of the grain used and the amount of the outer portion or seed coat that is removed in the process of manufacture. The cereal breakfast food in the uncooked state has more actual nutriment than any other food material with the exception of flours and meals, sugars, starch, butter, lard and some of the fatter meats.

Little is known as to just what kind of nutrients or compounds best nourish the brain and nerves, and the claim that any material is a particular brain and nerve food lacks foundation upon scientific basis. As a rule, toasted, germ, and gluten wheat preparations contain rather more gluten than do the others.

Cereals are not fitted for the best nutrition when eaten alone, but should be combined with some material furnishing protein and fat.

Wheat is the only cereal, the proteids of which form a true gluten, the peculiar tenacity of which makes a leavened or "raised" bread possible. This property in itself must forever distinguish wheat as the bread making cereal. Aside from this, the nutritive value of wheat places it in the front rank of vegetable foods. In protein content it is excelled only by hulled oats.

Oats contain one-third more protein than wheat and nearly four times as much fat. On the other hand they contain less starch than wheat: but since starch possesses a much lower nutritive value than protein and fat, the oats must be the more nutritious.

Oats are sold principally as oat meal or rolled oats, either in bulk or put up in packages. The cost per pound in the latter form

is nearly twice that of the former. Like quantities of nutrients and energy can be obtained for a small sum in oat meal or rolled oats in bulk.

Maize is used largely as corn-meal and as breakfast food in the form of hominy, cerealine and samp. Of all cereal foods, corn-meal furnishes the largest amount of energy for a given expenditure. It contains considerable protein and at ordinary prices is an economical material. It has a high nutritive value and is used for bread making in this country. With a diet of Indian corn bread and pork, the workmen of this country are capable of enduring fatigue and performing the greatest amount of physical labor. Its high nutritive value was illustrated in the military service during the civil war. Both experience and chemical analysis show there is little if any difference between the nutritive properties of bread made from wheat and the whole Indian corn deprived only of the coarsest part of the bran.

There is in some localities an erroneous impression that white corn meal is not as nutritious as the yellow meal. But the color of the meal is due simply to the color of the corn from which it is ground. When grown under similar conditions, the yellow and the white are almost identical in composition and equal in food value.

Rice is the poorest of all cereals in proteid and fat. On the other hand it has fully 76 per cent of starch, which is present in small and easily digested grains. When boiled, rice swells up and absorbs nearly five times its weight of water, while some of the mineral constituents are lost by solution. It is preferable therefore to cook it by steaming. Rice is absorbed with great completeness in the intestines, its solid constituents enter the blood almost as completely as those of meat, practically none of the starch is lost but

the waste of proteids amounts to about 19 per cent.

Rice being one of the foods which leaves the smallest residue in the intestines, is of considerable value in some cases of disease.

The nutritive value of rice is much impaired by its poverty in proteid and fat. Hence it is not adapted as an exclusive diet, but should be eaten alone with substances rich in these, such as eggs and milk.

Next to wheat, rye is the great bread-making grain of the world. It contains less gluten, and the kind of gluten seems to be chemically different, the result of this is that the bread is apt to be rather moist and dense. It is more laxative than that made of wheat flour, and perhaps less nutritious.

Barley is chiefly characterized by its richness in mineral matter. It contains more fat than wheat but is comparatively poor in proteid. Barley contains but little gluten, in consequence of which its dough is too "heavy" to make good bread. When mixed with half its weight of wheat flour, however, barley meal can be converted into good loaves. As an article of diet in the sick room barley finds its chief use as the main ingredient in barley water, a preparation that contains but little nutriment.

Millet and buckwheat are not used as human food in this country, although they are by no means of low nutritive value, but stand midway in that respect between wheat on the one hand and rice on the other. Buckwheat is about equal in nutritive value to millet, but contains much more cellulose. Buckwheat flour and rye flour are somewhat similar to corn-meal as sources of protein and energy, but are more expensive.

The trade names of the preparations from the different cer-

eals vary greatly, but the products from the same cereal are found to be similar, and may be divided into a few groups on the basis of the mechanical process employed in preparing them. In general personal tastes and preferences should be followed in selecting a brand of oats or wheat preparation rather than the claims made upon the package. So far as the pecuniary economy of the different brands of breakfast foods is concerned there is considerable difference. It has been found that the price is little or no measure of the nutritive value, but depends more upon the method of preparation, physical condition and flavor. The majority of the cereal foods now on the market are made from wheat and oats, although some are prepared from corn, rice and barley. Many of these are similar in appearance, being used in the form of meal or flour. They have lately come into very popular favor and the number is rapidly increasing. They are attractive and palatable, affording a pleasing variety, and because of special treatment in manufacture, often including partial cooking, their preparation for the table is very materially simplified, and so are economical in so far as they save time and labor.

The kinds and qualities of nutrients in the different varieties depend upon the composition of the cereal from which they are made. The difference in nutritive value of similar brands from the same cereal are insignificant. They are all wholesome and valuable, and when reasonable in price are, most of them, economical sources of nutrients and energy as compared with meats and vegetables.

In opinion of hygienists and dietary specialists they are particularly desirable food for children. The attempts made with some of them to increase the ease with which they may be digested have been to some degree successful, and to some extent to which this is

true has their value been enhanced for people with weak digestion. But for consumers in general the cost of such treatment is simply wasted.

Cereal foods are therefore valuable as they furnish a great deal of energy and form an economical and healthful source of nourishment.

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