

T H E S I S
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CEREAL BREAKFAST FOODS
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CEREAL BREAKFAST FOODS.

Introduction.

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CEREAL BREAKFAST FOODS.

There is nothing grown more universally used than cereal Breakfast foods. They are extensively cultivated in all regions except in the Arctic. The oats and rye in the north and rice in the tropical regions.

We do not realize the great importance of these common every day cereals until we investigate the dietary side of the question. It has been found that in many of our American families that vegetable foods, including flour, bread, and other cereal products, furnish 55 percent of their food. 39 percent of the protein, 8 percent of the fat, and 95 percent of the carbohydrates. Cereal foods alone supply 22 percent of the total food, 31 percent of the protein, 7 percent of the fat, 55 percent of the total carbohydrates, or about three-quarters of the vegetable protein, one-half of the carbohydrates, and seven-eighths of the vegetable fats. Together oats, rice, and wheat breakfast foods furnish about two percent of the total food and protein, one percent of the total fat, and four percent of the carbohydrates of the ordinary mixed diet.

Cereals are used because they are easily grown, they contain about the right proportion of food ingredients necessary for the human body, and because they

are inexpensive and readily prepared. They are very dry and can therefore be kept without deterioration.

All the grains we use are surrounded by a hull or husk which must be removed before using because it is so indigestible. The grains also have an outer skin or bran layer which is sometimes removed in milling. The grains that are hulled or husked and slightly crushed are called groats or grits; more finely ground are called meal, and when very carefully ground and sifted they are known as flour.

Like all other foods they are faultily advertized for a brain food, nerve tonic, and for weak digestion. And again like all others some of the claims are obviously preposterous, while others are true.

The grains used for cereal breakfast foods are corn, oats, rice, wheat, barley, millet, rye, buckwheat, kafir corn, and in some sections wild rice. Those made from corn, rice, wheat, and oats are the ones used most extensively in United States and are the ones I will consider in my thesis.

Like every thing else each cereal has its own region for growth. Corn, or maize, is a native of America. Its growth requires a warm even temperature. Corn is used as a food through-out Southern Europe and other Orients as well as in the United States. When corn was first used it was either cooked whole or crushed and cooked for a long time. But latter it was

found better to grind it thus having it finer and easier cooked. The germ of the corn is relatively large and rich in fat, which tends to become rancid in keeping and is therefore sometimes removed in preparing the more popular meals.

Oats are distinctively a cereal of northern regions, and wherever grown are an important porridge staple. Breakfast foods made from oats keep better than similar ones made from wheat and corn.

Rice is a staple food in all tropical and subtropical regions, and is much eaten elsewhere. The rice grain is covered by a husk and dark inner skin which requires special machinery to remove them. It is not desirable to eat until at least three months after harvesting, and is considered better by most people when three years old.

Wheat is next to the most important of all breakfast cereals in America, it is also the most important of all bread stuff. The grain is treated in several different ways thus giving us a variety.

Wild rice is also used as a cereal breakfast food, it is sometimes called Indian and Canada rice and water oats. It is a native of North America, Texas, and Canada, being especially common in the north central United States and south central Canada. It was given the name Indian because the Indians have long used its

seed for food, gathering in the crop and parching it to improve the flavor and keeping quality. This was taken up when their white neighbors, and sportsmen, and has steadily increased until at the present time it is used quite extensively as a breakfast food. The grain resembles the real rice slightly, the seeds being longer, thinner, and darker in color, and has a more pronounced flavor than the latter. It also requires much longer cooking.

The first record we have of the use of cereals, the grains were merely husked and slightly crushed. When so treated required long slow cooking before they could be eaten, thus making it very inconvenient for those who could not keep a fire all day. As time speed on and life became more busy, and men began to desire new machinery they found new ways of preparing the grain for use. Making some for long cooking and others for less cooking, While others are brought on the market ready -to-eat.

They are prepared in the four following ways:

1-Those prepared by simply grinding the grain, as Scotch oat meal, cracked wheat, or wheat grits.

2- Steamed or otherwise cooked, then ground or rolled as rolled oats, flaked rice.

3-Flaked or otherwise mechanically treated and parched so that they are ready to eat.

4-Flaked similarly treated and also acted upon by malt to some extent induces chemical changes in starch. The chief effect being to change the flavor of the cereal.

The grains are collected from all parts of the country and of course are mixed with other seed, insects and dust. During the first years of the use of cereals the grain were used in this dirty condition. But during the last few years ingenious devices have been invented for the purpose of removing all these foreign particles. The husk or glumes of such grains as oats, barley, and rice are very thoroughly removed, so that the amount left in is much smaller than formerly.

After the crushing comes the rolling process. In doing this the grain is cooked for sometime after the husks have been removed and when still moist is run between heavy rollers and pressed into fine flakes. The flakes are then thoroughly dried, and ready for market. The cooking the grain receives before rolling is not sufficient, and must be recooked before serving.

The ready-to-eat brands are prepared in a great variety of ways. Some simply cooked in water and then dried and crushed, some are made of a mixture of different grains; some have common salt, malt, and apparently sugar, molasses, or other carbohydrates materials added to them; some probably caramel or other similar coloring matter. Those with a flake like appearance are made

like rolled grains, except the cooking must be longer. Those which look like bread dried crushed and browned, are probably made into a dough, baked, crushed and browned.

Then comes the shredded wheat. Special machinery is required for the preparation of the shredded cereals. The grain after it has been cooked for several days is put into the machinery which tears the grain into shreds and deposits the long threads in a long layer, this layer is then cut by a sharp knife into the required length. They are then placed in a hot oven and heated until a delicate brown. Thus giving them a darker color, making them crisp, and giving them a flavor which is relished by many people.

In some factories the wheat is handled with so much care that the grain is not allowed to be touched by hands after it has been steamed. When ready for market they are packed in cardboard boxes. This prevents it from being handled, and also keeps the dust and insects out.

In the so called "malted" or "predigested" preparations, malt or some similar substance is added during the process of manufacturing. This malt is made from grain which has been allowed to germinate until a ferment called diastase is developed, and then kiln-dried. Under certain conditions this ferment has the power of changing starch, which is insoluble in

water, into various soluble forms, as dextrin, asomaltose, and maltose. These forms are much easier acted upon by the digestive juices than the original starch.

Cereal breakfast foods are put put under much cleaner surroundings at the present time than they were in former years. The card board boxes are considered by all a great improvement in handling. Some are sealed in tin cans. The cans are filled under pressure and consequently the cereal occupies a small amount of space per pound.

Cereal breakfast foods contain all five of the food principles necessary for the human body namely, the protein, carbohydrates, fats, mineral matter and water.

The average cereal contains two-thirds carbohydrates, one-tenth protein, one-tenth water, a little fat and mineral matter. They are chiefly valuable for fuel foods and also as tissue builders. The protein being the tissue builder. Foods rich in protein are usually expensive, thus making the cereals more important ^{because} of their cheapness. They can be substituted to a certain extent for the more expensive protein food, such as eggs and meat.

Oats rank first in protein, wheat second, corn third, and rice last. Those richest in protein lack in starch, this making rice first, corn second, wheat third, and oats third.

In comparing breakfast cereals and protein food it is necessary to compare them with the water added necessary for cooking them. The following table will give a comparison of one pound of representative cooked cereal foods and certain other foods.

Kind of food 1 lb.	water lb.	protein lb.	fat lb.	crbdts. lb.	ash lb.	energy cal.	cost per lb.
Cooked oat meal	0.845	0.028	0.005	0.115	0.007	285	0.6¢
Cooked hominy	.793	.022	.002	.178	.005	380	.8¢
Cooked rice	.720	.020	.001	.244	.003	525	1.6¢
Beefsteak	.660	.203	.136	- -	.011	950	20.0¢
Eggs, edible portion	.730	.134	.105	- -	.010	720	- -
Milk	.870	.033	.040	.050	.007	325	3.5 ¢

This shows that the breakfast cereals do not compare very closely with beef in composition, but that those which absorb the least water give the most nourishment as they are served on the table. The dry ready-to-eat cereals would give more nutriment ounce for ounce than the home-cooked, moist ones, but not necessarily cup full for cup full, for the former are very light and bulky.

The protein is the foundation of all the tissues of the body and is an indispensable food ingredient. It is also the most costly of food nutrients. The carbohy-

drates include the various kinds of sugars and starches, commonly grouped together under the name nitrogen-free extract. Cellulose, the crude fiber, or the woody framework of plants, also belongs to the carbohydrate group. The cellulose has no food value, but merely gives bulk. The mineral matter or ash includes phosphates, chlorides, and other salts of calcium, magnesium, sodium, potassium, iron, etc.

Digestion and digestible are terms commonly used in reference to the ease or quickness of digestion or to the agreement of a given food with an individual. Digestibility in physiological discussion refers more to the thoroughness with which a food is absorbed, that is, the amount or percentage of nutrients retained by the body when food passes through the digestive tract. The following table will show the total and digestible nutrients and fuel value of cereal breakfast foods.

Proportion of total water and nutrients in food.

Proportion of digestible nutrients in food.

Kind of food	Proportion of total water and nutrients in food.					Proportion of digestible nutrients in food.					Ash Fuel value per lb.
	Water %	Protein %	Fat %	carbohy- drates. Nitrogen-free extract %	Fiber %	Ash %	Protein %	Fat %	Carbohydrates %		
Oat preparations:											
Whole grain	11.0	11.8	5.0	59.7	9.5	3.0	-	-	-	-	-
Oatmeal raw	7.3	16.1	7.2	66.6	.9	1.9	12.5	6.5	65.5	1.4	17
Rolled and cooked	8.2	16.1	7.4	65.2	1.3	1.8	12.5	6.7	64.5	1.4	17
Wheat:											
Whole grain	10.5	11.9	2.1	71.9	1.8	1.8	-	-	-	-	-
Rolled and steamed	10.6	10.2	1.8	74.1	1.8	1.5	8.5	1.6	70.7	1.1	15
Flaked, crisp and malted, ready-to-eat	9.0	12.1	1.4	73.0	1.8	2.7	9.1	1.3	68.4	2.0	15
Shredded	8.1	10.6	1.4	76.0	2.1	1.8	7.7	1.3	71.1	1.4	15
Corn:											
Whole grain	10.9	10.5	5.4	69.6	2.1	1.5	-	-	-	-	-
Meal, bolted	12.5	9.2	1.9	74.4	1.0	1.0	6.8	1.7	74.6	.8	16
Hominy	10.9	8.6	.6	79.2	.4	.3	6.4	.5	78.7	.2	16
Flaked, parched	7.3	10.1	1.8	77.2	1.2	2.4	7.5	1.6	77.5	1.8	17
Rice:											
Whole grain	12.3	6.9	.3	80.0	-	.5	5.8	.3	78.4	.4	15

Different specimens of the same grain may show a great variation in composition, depending upon the variety, the soil, the climate, and the season in which they are grown. Cereal breakfast foods and other materials prepared from the grain shows a corresponding difference in composition to the grain from which they are made. Also the way in which they are prepared has to do with their composition.

At the Connecticut, Maine, and Minnesota Agricultural experiment stations a large number of experiments with healthy men have been carried out, to learn how thoroughly breakfast cereals/ foods are digested. In which the majority were eaten with sugar and cream, and the digestibility of the cereal breakfast food alone was computed by the usual methods from the values obtained from the ration as a whole. In other tests made the cereals formed a good proportion of a simple mixed diet, that is, the way they are usually served. The ready-to-eat goods were served without further cooking. The other were thoroughly cooked.

At the Experiment Station at Maine the results from the experiments showed about 90 percent or over of the organic matter was assimilated when eaten in a mixed diet containing bread and meat, and in a simple diet of cereal, cream, and sugar, and also when the results were computed for the cereal breakfast food alone. IN the mixed diet the highest coefficient of digestibility of protein, 93.2 was noticed with

rolled wheat, and the lowest 88.9 percent, with hominy.

In the simple diet, the digestibility of protein was from 82.3 percent, with granulated corn meal, to 91.6 percent with rolled wheat. The lowest value computed for cereal breakfast foods alone was 57.7 percent digestibility of protein, with a specially prepared whole-wheat products, and the highest value, 85 percent, with rolled oats.

The availability of energy was high in each case. About 90 or 93 percent with the mixed diet. The range was somewhat greater with the simple diet, it being 91.1 percent and with a specially malted cereal to 96.4 percent. With cereals alone the lowest value was 84.1 percent available energy with a specially prepared whole-wheat cereal, and the highest value, 94.4 percent, with hominy.

The conclusion drawn from these experiments were, if the cereal breakfast foods, especially those made from oats, corn and wheat, are rated in proportion to the digestibility of their protein when used with a mixed diet, rolled wheat must be placed first and the corn product last. But when the digestibility of the cereals alone was calculated, rolled wheat should be placed first, not only in digestibility of the total organic matter but also with respect to the protein.

The value of predigested food is usually greatly

over estimated. Physicians often use predigested foods of different kinds for their patients since the diastase of malt imitates the work of the diastase of the saliva and pancrease to a certain extent, It is the common means of predigesting carbohydrates, carbohydrates. But the predigested food should be used for the invalid, only as the doctor orders.

The diastase of the malt is suppose to change the insoluble starch inthese cereal foods into more soluble forms.

At the Iowa Experiment Station a number of malted cereals were analyzed, and the largest amount of soluble carbohydrates found was 13.23 percent of the total carbohydrates, the next largest 10.91 percent, and the lowest was 0.35 percent, while the average was in the neighborhood of 5 percent.

In most malted cereals very little of the starch is changed into soluble forms except dextrin, it is beleived that certain forms of soluble carbohydrates, like glucose, have been added during the process of making. The malt has a characteristic taste which many people relish. Their greatest use is to give a variety to the diet. The cereals cooked at home have a much higher range of soluble carbohydrates than do the predigested, or malted cereal. If it is the labor of cooking that causes the use of these ready-to-eat cereals it might be well to substitute crackers and milk in their place, as the composition of crackers are similar to the cereals,

at an average price furnishes more nourishment for the same amount of money.

It has been estimated that a man at moderate work requires about a fifth of a pound of protein and about 3,000 calories of energy per day. The proteins are usually supplied by meat, fish, milk, and other animal foods, these also supply the fats. The vegetable foods supply the carbohydrates, and a small amount of fat and protein. These are usually supplied at the dinner meal, but does not seem to appeal to consumers for breakfast, so the different cereals prepared in the many different ways may be used.

Cereal breakfast foods are of great value in the diet of young children and invalids. They are usually eaten with milk or cream and sugar, this adding to the food value. They have been considered by some to be very hard to digest. But by experiments have been made showing that when properly cooked and eaten with proper amount of sugar they are very easy to digest, and are very nourishing.

Many of our cereals as hominy and rolled oats, require long slow cooking in order to convert its nutrients into more digestible forms, and to soften the cellulose which surround the nutrients. Unless these cell walls are broken down the digestive juices cannot come in contact with the nutrients without expending material and energy in trying to get at them. This

goes to show the reason so many cereals, cooked by some people are injurious to the health. Oatmeal is often cooked for fifteen minutes, and when served looks like a hard mass. When in this condition is practically indigestible.

But these are two other important reasons for cooking, namely, to sterilize the material, and to improve the flavor and appearance. A good flavor and served in an attractive way tempts the appetite and causes a good flow of the digestive juices. The digestive system grows tired of the same things as well as the eye. So we find it necessary to change the style of cooking and serving of certain things.

We have a great variety of uncooked cereal breakfast food, and many different ways of serving them. But the first thing to be considered is the proper cooking. In my experimental work I find the following table very satisfactory in cooking rice, hominy, oatmeal, cream of wheat, corn meal, and germ meal.

Cereal Used	Amt.	Water	Salt	Time of cooking.	
	cups			cups	Tsp.
Corn meal	1/2	2	1/2	1	30
Rolled Oats	1/2	2	1/2	15	
Hominy soak 12 hrs.	1/4	2 1/2	1	12	10
Rice boiled	1/4	3	1		45
Rice steamed	1/4	3/4	1	1	25
Cream of Wheat	3/4	1 1/2	1/2		45
Germ Meal	3/4	2	1		45/

When they are thoroughly cooked, they may be served in many different ways. A great variety may be had by the use of fruits. I find that cream of wheat cooked in strawberry juice in the following way makes a very good dish:

- 3/4 cup cream of wheat.
- 1 1/2 " of water.
- 1/2 " strawberry juice.
- 1 T sugar.

Cook wheat in boiling water one-half hour, then add strawberry juice. Let stand in buttered molds in a warm place for a few minutes. Serve in dishes with some of the juice and berries that have been cooked with sugar until syrupy. Sugar and cream may be used. Other fruits may be used beside strawberries. Chopped raisins and currants may be added during the process of cooking.

Oatmeal, rice and germ meal may either be boiled and steamed, and served with sugar and cream, or with fruit as with cream of wheat, as shown by the table. The oats require much longer cooking. They may also be served with oranges and bananas. Rice may be cooked in the oven in milk, a little sugar sprinkled on the top. When this caramelizes stir it through the rice. This gives it a delicate brown color. Raisins added improve it. Served with cream and sugar.

The ready-to-eat cereals may be served in several

different ways. Shredded wheat should be put in the oven and toasted or dried out a few minutes before eating. Moistened with hot milk or water, may be served with butter or cream (whipped or unwhipped), also with a few slices of oranges or bannas, or fresh fruit as peaches, and strawberries placed around the biscuit. The biscuit may be split and the fruit placed between the halves. Poached or coddled eggs may be used instead of fruit. In the winter when fresh fruits cannot be had, canned fruit may be used very well. Some of the juices of the fruit may be heated to moisten the cereal and eaten with the fruit. Jams and jellies are very nice served with the shredded wheat.

Grapenut moistened with hot water, milk or fruit juice, cherry or peach, makes a very dainty dish served with sugar and cream. Fresh fruits, as for shredded wheat, may be used.

There are many different kinds of the ready-to-eat cereals and by serving them in the different ways a very good variety may be had.

It should be remembered that breakfast cereals of all kinds are as a rule free from harmful, adulterants and that, especially in the case of package goods, the consumer gets it in a fresh condition. Any uniform relation between price and nutritive value has not yet been made. The usual price of cereal breakfast foods

run all the way from 3 cents a pound for some of the plain meals sold in bulk to 15 cents or more for some of the ready-to-eat. The ready-to-eat brands usually higher in price but have practically the same nutritive value pound for pound as other classes of cereal breakfast foods.

After writing this thesis I have drawn for my conclusion that cereal breakfast foods as a class are nutritious, convenient, and reasonably economical foods and should have a very important place in the diet.

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