

CEREAL BREAKFAST FOODS.

by

Margaret Haggart.



### CEREAL BREAKFAST FOODS.

Within a few years various cereal products, which are called Breakfast Foods have been placed on the market. These are manufactured from wheat, corn, oats and rice and in the making are said to undergo various secret processes.

The first breakfast food was "porridge" which was made by boiling coarsely ground wheat or oats. This was used chiefly by the people of the British Isles. These people subjected this oat or wheat meal to prolonged cooking, it being a historical fact that the porridge pot was always on the stove.

It constituted their main article of food and with milk it formed a balanced dietary.

When some of these people immigrated to this country, they introduced their food here. Finding little wheat or oats and learning to use corn, they substituted coarsely ground corn for the basis of their porridge. They knew by experience that these coarsely ground cereals were more palatable after prolonged cooking and thus unintentionally increased their digestibility.

### Manufacture.

With improved methods along all lines, the attention of the manufacturers has been called to the possibilities of cereal preparations.

With the desire for shorter methods and quicker results, which everywhere permeates American life, the production of prepared



breakfast foods has met a demand.

The result is that today there is found on the market these breakfast foods in clean, attractive and air-tight packages. In spite of the great variety appears for sale, the cereals from which they are made are few, and while some differ in mode of manufacture, many differ only in name.

This variety arises from the cereals used, the difference in mode of manufacture, and the final treatment, that is whether they are cooked only or cooked and predigested.

The composition of the cereals differ somewhat. They all contain a high percentage of carbohydrates, varying from 60% to 80%. Wheat contains a high per cent of protein being excelled only by hulled oats.

Corn though much richer in fat has a lower protein content than either of these. Rice is nearly pure starch.

Breakfast foods are usually divided into three classes, the unprepared or those requiring cooking, the prepared or cooked and the predigested. Among the unprepared are the rolled oats and wheat also the cracked grains.

In the preparation of these, the manufacturers claim a secret process, which in some way adds to the nutritive value. This however finds little credence with thinking people.

The grain from which it is prepared gives it its food value, though there are processes by which the nutriment of the grains is made more easily assimilated than others i.e. the removal of the tough outer covering and the crushing of the cell walls by great pressure.



The first process in the manufacture of any breakfast food is the thorough cleansing of the grain. This includes winnowing, washing, removal of dirt and foreign matter as seeds, impurities etc. by many ingenious devices.

In many old fashioned breakfast foods, the outer coat or covering was removed and the grain crushed or cracked. Some are yet prepared this way and necessarily demand a great deal of cooking to render them digestible as the digestive juices cannot easily permeate the starch granules held in by the cell walls. Prolonged cooking breaks down the cell walls.

In the manufacture of rolled oats and wheat, after being cleaned and the outer coat removed, the grain is softened by steaming, then crushed between rollers and dried.

The resulting article keeps well and being partially cooked and the cell walls being ruptured by crushing, it is more easily prepared for the table. The cooking of the grain may be carried still further and then rolled thinner the so-called flaked preparations are the result.

The raw grains are sometimes roasted or parched and then ground. This product resembles dried bread crumbs. In the shredded goods the grains are softened, then worked by machinery into shreds which are deposited in layers.

These layers are more closely packed together then roasted or parched. These which have been either parched or toasted may be eaten without further cooking as the starch and cellulose of the grain have been changed into dextrin by the high temperature of the process.



On many of the packages of breakfast foods we find the claim that they are predigested or that the starch has been changed to sugar through the action of the diastatic enzymes.

As is well known starch is insoluble in water but is acted upon by the digestive juices which contain these ferments.

Whatever of starch is not converted into sugar in the process of digestion is lost as food.

While raw starch is not easily digested by man, cooked starch is quite easily disposed of by people with normal digestions. Some people with weak digestive powers have difficulty in digesting starch even when properly cooked.

Seeking to aid the latter, the manufacturers have put upon market the so-called predigested food. In these foods it is claimed that the starch is all changed to sugar by a process called malting. This malt is a product of sprouting barley. The malting is done while the grain is warm and wet, but it ceases as soon as the product is heated as the enzyme is then killed.

This is done before all the starch is acted upon in order to prevent any disagreeable taste which may arise.

#### Chemical Analysis.

Any food is valuable for nutriment to the extent it yields energy or builds tissue. Protein, carbohydrates, fats and mineral salts are the ingredients of food used in body.

Some of the nutriments are found in every food and in some foods all are found, but in every different proportions. All of the



cereals contain all of the food elements.

It is necessary to determine by chemical analysis the exact composition before its food value can be known.

Analyses of different breakfast foods have been made by Experiment Stations. These analyses agree in the main. The station furnishing analyses are Iowa, Michigan, Maine and Connecticut. The analysis is usually made of only one sample. It is not quite just to draw final conclusions concerning a brand by one analysis.

For example the Connecticut Station reports five analyses of Granose Flakes (a wheat preparation made by the Battle Creek Sanitarium Co. of Battle Creek, Mich.) in which the protein content ranged from 11.5% to 15.6 % and that of carbohydrates from 69.7 to 76.8 per cent.

This is due largely to the grain used as wheat varies from 7 to 19 per cent in its protein content. Uniformity in composition cannot be assured even if the same variety of grain is used as climate and soil alter the chemical composition very much.

The chemical composition of any breakfast food is dependent largely upon the process of manufacture egs. whether the whole grain is used or the grain after the outer coverings are removed.

In each case the sample analyzed by chemist was purchased direct from a dealer in the vicinity and was guaranteed as fresh.

In making the analysis the protein was determined first as nitrogen and then multiplied by 6.25 to find percent of protein.

The oat preparations outrank all others in protein content, containing about one third more than wheat and twice as much as corn or rice.



The carbohydrates were present chiefly as starch though some sugars were found. In some of the predigested foods maltose was found to be present in small quantities. Maltose in that case was the product of malting. Some manufacturers make the claim that by the action of malt starch is changed to dextrose. This is not true.

If glucose or dextrose was present in any of the foods analyzed, the chemist thought that it must have been added.

The highest per cent of fat was found in oats. Corn ranked next but the absence or small percentage of fat in corn preparations is noticeable. This was due to the removal of the germ, which is the chief source of fat in corn. The presence of the whole amount of fat in corn would cause it to spoil more easily.

The mineral salts present in these cereal foods was chiefly the sodium, calcium and potassium phosphates and some salts of vegetable acids.

The amount of crude fibre these foods contained was higher than that of whole wheat flour.

The average composition has been tabulated by some stations. One table from the Connecticut Experiment Station follows here.



Average	No. anal.	Water	Prot.	Fat	Crude Fiber	Carbo.	Ash	Energy per gram.
Wheat - uncooked and partially cooked.	58	9.8	12.3	1.8	(1.8)	74.8	1.5	4.022
Wheat cooked	20	8.1	11.7	1.9	(1.6)	76.7	1.6	4.077
Oats uncooked	12	7.8	16.1	7.3	(1.1)	66.9	1.9	4.423
Corn " and Part.	15	10.8	8.6	.6	(.5)	79.5	.5	3.894
Corn cooked	3	7.3	10.1	1.8	(1.2)	78.4	2.4	4.046
Rice uncooked	24	11.4	7.7	.8	---	79.3	.6	3.526
Malted wheat	16	8.8	12.5	1.4	(1.4)	75.0	2.3	4.005
" Oats	2	7.9	16.2	5.2	(1.6)	68.3	2.4	4.292

It will be noted that the preparation causes a loss in water to some extent and a corresponding apparent gain in protein and other constituents.



### Cooking.

It has been suggested before that the rendering of the starch soluble by cooking is an important step for upon this the digestibility rests largely.

If all the household cooking were as neglected or as poorly done as the cooking of breakfast, the prevalence of invalids, suffering from some form of indigestion would be very marked.

Almost all people follow the recipe given on the package of cereal which they are using. An examination was made of a large number of the unprepared cereals and almost without exception the recipe read as follows:

"Into two cups of boiling water, sift slowly a cup of -----.  
Add salt to taste. Cook in a double boiler fifteen minutes or longer."

In order to determine the state of starch grains under such cooking, the following experiments were made.

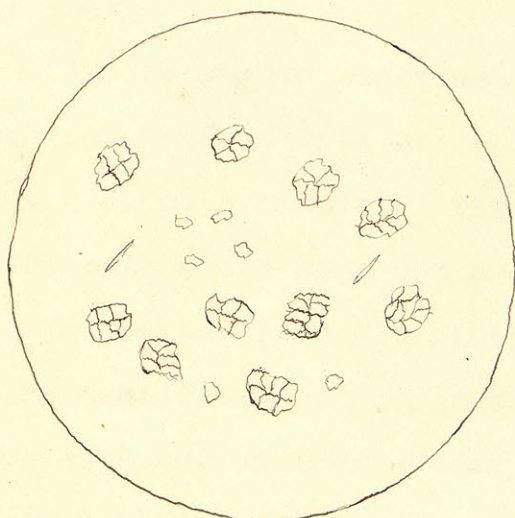
In the first series of experiments the cereal used was Scotch Oats manufactured by the American Cereal Company of Chicago.

In the first experiment the recipe given on the package was followed. Of this samples for inspection were taken at the end of fifteen minutes and half an hour.

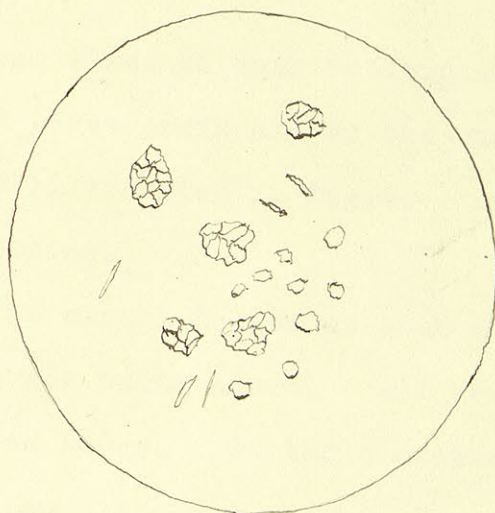
From these samples microscopic slides were made. In Fig. I of Plate I is shown the characteristic marking of oat starch cells.

In Fig. 2 is shown a few starch grains after being cooked fifteen minutes. In this only a few of the cell walls are broken down. The long pieces are part of the outer covering.

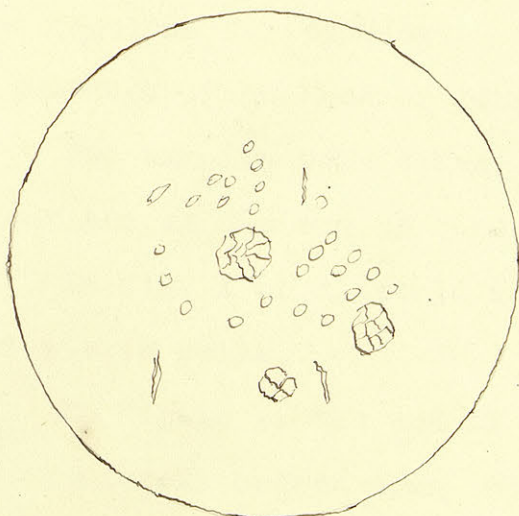




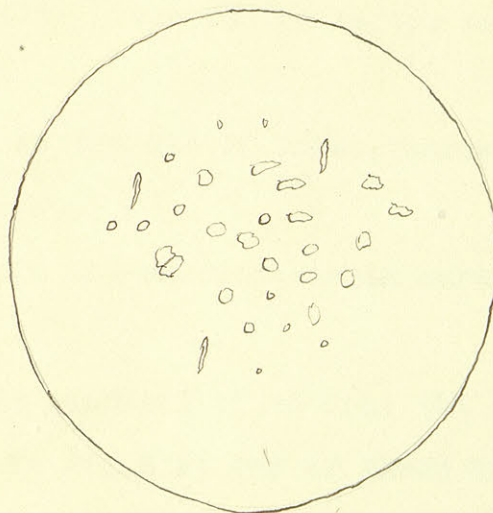
1.



2.



3.



4.



In Fig. 3 almost the same condition is observed after cooking one-half hour.

In the second experiment four times as much boiling water as cereal was used. This was cooked three hours and at the end of that time a slide was made. This is illustrated in Fig.4. In this even a few cell walls were not broken down.

A number of people tasted the cereal cooked in each experiment, the conditions of preparations not being known. All were unanimous in favor of that cooked three hours. It had a much sweeter taste. The others had the taste of raw starch.

In these rolled preparations the manufacturers claim that the cell walls are ruptured by the great pressure to which they are subjected. This may account for the broken cell walls in Fig. 2. Another series of experiments were made with Cream of Wheat, manufactured by the Cream of Wheat Company of Minneapolis, Minn.

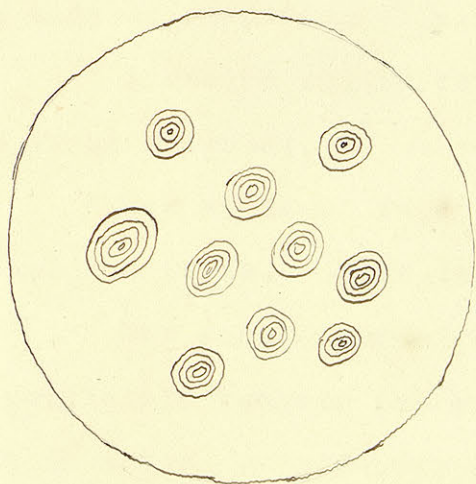
The recipe on the package was followed. This recipe is an exception to the general rule and is very satisfactory in everything but time required for cooking. The time given in the recipe is "three quarters of an hour or longer."

Two samples were taken, one at the end of three quarters of an hour and at the end of three hours.

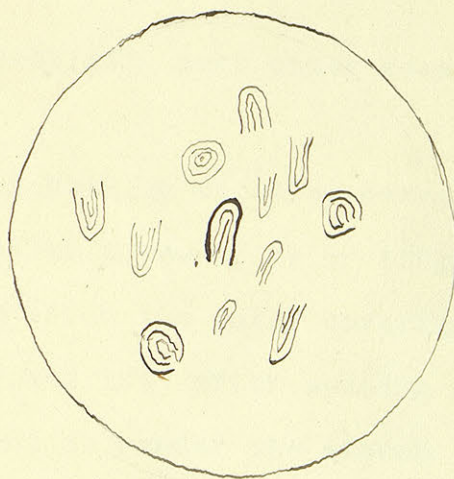
In Fig. 1 of Plate II is shown the characteristic marking of wheat starch cells.

In Fig.2, at the end of three quarters of an hour the cells are not completely broken down, while in Fig.3 at end of three hours we find a homogenous mass of soluble starch. The small round dots in each are parts of cellular coverings.

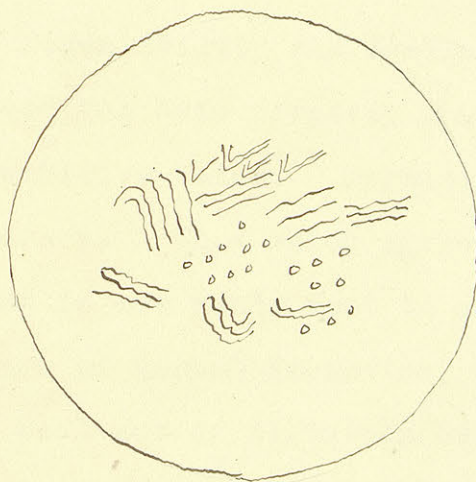




1.



2



3



The cereal cooked three hours had the best flavor.

From these experiments it follows, that the prolonged cooking breaks down the cell walls, makes the starch soluble and gives the cereal a sweeter and more palatable flavor. The amount of water used aids in rendering it palatable.

A recipe suited for cereals containing part outer seed coat is as follows:

Use at least four times as much boiling water as cereal. Add salt to taste. Cook in a double boiler three hours or longer.

For such a cereal as rice from which the outer coverings are completely removed the experiment showed that after soaking all night in water, a half-hour was sufficient to render the starch soluble.

#### Digestibility and Availability.

After a food has been properly prepared, the digestion of it determines its nutritive value. Digestion though is a matter of personal idiosyncrasy. That which agrees with one may not agree with another. "What is one man's meat is another man's poison." But considering a case of normal digestion, and the food properly prepared, the first real act of digestion begins in the mouth. The saliva contains the ferment ptyalin which begins converting starch into sugar as soon as mastication begins. The process goes on after the food reaches the stomach for about half an hour or until the acidity of the gastric juice stops it.

In the small intestine the remaining starch is converted into dextrose and as such absorbed. If the cereal foods are not



well cooked, the digestive juices are unable to penetrate the cellular walls and fermentation may set in. The Iowa Station points out the fact that the so-called predigested foods are not thoroughly cooked in many cases and on this account constitute a constant source of danger. The normal digestion not being able to rightly digest raw starch is disturbed and indigestion with its attendant evils may result. The large percentage of crude fiber which the cereal preparations contain makes a greater drain on the digestion than such foods as white flour, for example, for in this case the hulls and bran have been removed.

The presence of crude fiber gives bouyancy and bulk to the meal and aids the digestive organs in their peristaltic movements. There have been no experiments reported to determine the digestibility and availability of uncooked breakfast food preparations, after careful cooking.

Last year the Connecticut Station carried on a series of experiments with the cooked preparations. The work was made up of nine experiments with three different brands of breakfast food: three with "Grape Nuts", four with "Malta Vita" and two with "Force."

Each of these materials was eaten, in separate experiments consisting only of milk cream and sugar in addition to the cereal. The experiments were carried on with five young men of good physical condition and normal digestion and nutrition. The experiments did not cover more than three or four days each, yet in that time the diet grew very unpalatable and in one or two cases set up digestive disorders.

The chief purpose of the experiments was to find out what proportions of the different nutrients of the food would be digested



and made available to the body.

In the experiments with Grape Nuts the coefficients of digestion for all three subjects agreed closely, ranging from 93.6 to 94.5 of total organic matter.

In Malta Vita the coefficients of digestibility range from 87.6 to 91.2 per cent of total organic matter.

With Force a great range is shown, being from 87 to 96 per cent of total organic matter.

The Station sought to compare these experiments with those in which a diet of bread and milk or bread and butter were used.

They say "It will be seen from a comparison with the data in the table that the coefficients for protein in the diet containing the breakfast foods are a little smaller than the lowest for diets containing bread.

The differences in respect to the other nutrients and energy are for the most part less noticeable but still on the whole in favor of the breads. The inference is therefore, that the nutrients of the cereal breakfast foods were less available than those of bread.

#### Availability of nutrients and energy of total diet.

Cereal part of diet.	Total organic matter %	Protein %	Fat %	Carbohydrates %	Energy %
Grape Nuts	94.0	87.3	96.2	94.4	90.7
Malta Vita	92.9	86.9	95.6	93.1	89.8
Force	92.2	88.6	90.7	92.3	86.8
Graham Bread	92.2	89.8	94.5	92.3	87.6
Entire wheat bread	94.8	92.0	95.8	95.4	89.8
White bread	97.0	94.2	96.3	97.9	91.6



### Cost.

The amounts paid for these cereals by the chemists have been tabulated along with the chemical analysis. The price of the uncooked breakfast food varies from 6.33 cents to 7.56 cents per pound while the cost of the prepared varies from 10 to 16.48 cents.

The Maine Station reports the average price for corn preparations to be 5.7 cents, for oat preparations 6.0 cents and wheat 10.6 cents. As a rule these prices are not unreasonable when the first cost of material and cost of production are considered.

Chemical analysis furnished no measure of the digestibility.

We find the cereals which have undergone a special process to render them more digestible, selling at a greater price. As these are intended for people with faulty digestions the lower priced ones are suitable for people in normal health.

The real value of a food depends upon the actual amount of available protein and energy it contains.

Comparisons of the food value with the cost have been tabulated by determining the amounts of availability of different foods upon the basis of what 10 cents will buy.

The Connecticut Station report the largest amount in sample and rolled oats in bulk. Next to oats in bulk come the package oatmeal preparations, then hominy, wheat preparations, malted food and finally rice.

Also in considering the cost the expense incident to cooking must be taken into consideration, but in many cases the price of cooked preparations is excessive even when cost of fuel is considered.



If the unprepared ones are to be poorly cooked the prepared ones will have to be preferred.

The selling price would have interfered with the sale of certain breakfast foods if it were not for the skillfull advertising and untrue statements concerning its nutriment. For example - the package of Grape Nuts has on it that four heaping teaspoonsful are enough for an average meal.

A man at moderate work requires about .28 pounds of protein and sufficient fat and carbohydrate to supply about three thousand calories per day. Comparing the two, the man would need about .075 pounds protein for one meal (one third of a day) and four heaping teaspoonsful of Grape Nuts (one ounce) would furnish .007 pounds protein.

Then according to the best authorities it would require about .77 pounds of Grape Nuts for one meal in order to furnish enough protein.

It has been shown that only 85% of protein in breakfast foods is available.

From these as well as many other incidents which could be cited, the cost of breakfast foods is not in proportion to their nutritive value.

#### Summary.

1. Breakfast foods put up under methods of modern manufacture are attractive, wholesome and palatable.
2. Each one is made from one or more cereals. Wheat, corn,



oats and rice are most used.

3. The mode of manufacture is very similar although there is such a diversity of names.

4. The food value of the preparations depends altogether on the cereal it contains.

5. The methods of manufacture determine in some not only the digestibility but also its chemical constituents.

6. Few recipes given are suitable. The chief care in cooking should be the prolonged boiling, three to four hours being necessary.

7. Predigestion is carried on to a limited degree only.

8. The digestibility of these foods compared with highly milled products is in favor of the latter though the large amount of crude fiber they contain aids in peristaltic action of the digestive system.

9. The oat preparations are not only the cheapest but also have the highest food value.

10. The uncooked cereals are the cheapest and the price asked for cooked ones is out of proportion to the cost of production.

11. The claims of manufacturers about the food value of their products is not always true.