

# Breakfast Foods Analysed

*Their Actual Nutritive Qualities, Compared with the Popular Idea of their Value as a Food*

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An American authority has stated that "Vegetable foods, including flour, breakfast foods, and other cereal products, furnish 55 per cent of the total food, 39 per cent of the protein, 8 per cent of the fat, and 95 per cent of the carbohydrates of the diet of the ordinary family." The same authority states that oats, rice, and wheat breakfast foods together furnish about 2 per cent of the total food, and protein, 1 per cent of the total fat, and 4 per cent of the carbohydrates of the ordinary mixed diet. These

digestion may find them helpful, but it is hard to understand how this treatment will increase the value of the food to such an extent as is sometimes claimed in advertising matter. They may be more easily digested, but digestion experiments show that they are no more fully digested and absorbed than are the older forms of breakfast foods when properly cooked.

The composition of a number of breakfast foods then on the market was determined a few years ago. The results are as follows:

Product.	No. of samples analyzed.	Crude Water, Protein.		Crude Fat, P.C.	Nitrogen		Crude Ash, P.C.	Teat of Comb't'n per gm. Calorie.
		P.C.	P.C.		Free Extract, P.C.	Crude Fibre, P.C.		
Granulated Oatmeal . . . . .	5	7.84	12.68	6.49	69.78	1.71	1.50	4,283
Rolled Oatmeal . . . . .	18	8.60	12.41	6.72	69.36	1.26	1.65	4,253
Wheat Farinas . . . . .	7	10.84	9.56	1.01	77.54	.47	.58	3,856
Wheat Germ . . . . .	1	8.39	10.97	2.79	75.61	1.16	1.08	4,073
Rolled Wheat . . . . .	5	10.79	9.25	1.51	74.94	1.80	1.71	3,832
Flaked Barley . . . . .	3	10.91	9.61	1.11	76.47	1.01	.89	3,847
Corn Meal . . . . .	3	9.90	6.56	1.25	81.28	.53	.48	3,857
Orange Meat . . . . .	3	8.77	9.55	1.32	76.49	1.95	1.92	3,903
Canada Flakes . . . . .	3	8.49	10.43	1.34	75.33	2.21	2.20	3,919
Force . . . . .	3	9.07	10.11	1.51	75.05	1.85	2.41	3,890
Norka . . . . .	3	7.38	14.10	5.55	68.02	1.84	2.81	4,230
Malta Vita . . . . .	3	8.24	9.91	1.36	*78.25	...	2.24	3,919
Grape Nuts . . . . .	3	7.08	11.50	.95	*78.76	...	1.71	3,996
Shredded Wheat . . . . .	2	9.41	11.41	.85	*76.62	...	1.71	3,894
Quaker Wheat Berries . . . . .	4	9.77	11.51	2.34	72.39	3.33	1.41	3,991
Toasted Corn Flakes . . . . .	4	9.77	5.52	1.49	80.79	.65	1.78	3,803
Quaker Puffed Rice . . . . .	1	10.16	5.20	.33	83.25	.70	.36	3,887

\*Includes Crude Fibre.

may not appear high, but when we consider the large quantities of food consumed by a family in a year, they represent an immense amount and form a sufficiently important part of our ordinary diet to warrant their careful study.

The origin of the present numerous varieties of breakfast foods may be traced back to the "porridge" made by simply boiling coarsely ground wheat and oats. These materials, while fairly satisfactory to persons of robust health, doing outdoor labor, were often found to so irritate the intestines as to cause increased peristaltic action. This may be an advantage to persons doing sedentary work, but it may be a positive injury to others. With the development of machinery capable of removing the coarse branny parts of the grain, this fault has been largely overcome. More recently there has been a demand for more tasty food of a nature that may be quickly prepared for the table, and a great variety of breakfast cereals of the ready-to-serve type have been placed on the market. These products are, in general, attractive and palatable, and afford a pleasing variety in the diet; and because of special treatment in the process of manufacture, the amount of labor entailed in their preparation for the table is materially reduced. This is doubtless one reason why they have become so popular; but, on the other hand, no class of foods has been so extensively advertised; and such an endless variety of wonderful virtues have been claimed for them that people were led out of curiosity to try them. Some of the breakfast foods are stated to contain several times as much nourishment as the same weight of beef; others are lauded as especially valuable as brain food, or nerve tonics, and very many are claimed to be particularly well suited for persons of weak digestion. There may be some truth in the last statement, but it is evident that many of the claims are utterly groundless. Yet these very fanciful statements have served the purpose of attracting attention, and have, without a doubt, increased the sales of these foods.

The grains commonly used in preparing the breakfast foods in this country are: wheat, oats and corn and to some extent barley and rice. These may be prepared simply by grinding, as in making "cracked wheat" and the corn meals from which the germ has not been removed, or we may have the cooked and malted, or, predigested foods. Intermediate between these two extremes we have the well known rolled oats, the various forms of wheat farinas, the prepared corn meals, etc.; the class of breakfast foods which are after all the cheapest and possibly the most generally used. It is extremely doubtful if the treatment of cereals with malt materials increases their nutritive value. Persons with weak

The wheat farinas are practically the cleaned middlings and form the part from which the high patent flours are made and naturally have a very similar composition. It is hard to understand why bread from patent flour should come in for so much condemnation from some quarters and the wheat farinas, made from practically the same part of the grain, be commended. Corn contains about 5 per cent of fat, but in the preparation of the finer grades of corn meal the germ with its high fat content is removed. This accounts for the low fat content of the corn meal.

The composition, as given above, does not show the changes that cooking, parching and malting processes have affected in the ready-to-serve foods, and, as it is because of these changes that so much is claimed for them, we studied this point somewhat fully. The object of treating these foods with malt is to increase the solubility, and consequently, the ease of digestion of the starch. The diastase of malt converts starch into dextrin and maltose—water-soluble compounds. Cooking in water, or by dry heat, as in toasting or parching, also tends to break down starch into simpler substances which are soluble in water. If, then, we determine the amount of a food that will dissolve in water, we must, to some extent, measure the efficiency of the malting and cooking processes used in the preparation of that food. In order that we might procure some data on this point, we determined the amount of the total solids soluble in water in some uncooked, cooked, and cooked and malted foods. We also analyzed the water extract to ascertain how far the decomposition process had proceeded. (For details see Bulletin 162, Ontario Agricultural College). Some of the results are as follows:

The above figures clearly show that there are per cent of dry matter soluble in water and the solution:

Food.	No. of samples Analyzed.	Total Solids.	per cent of dextrine sugar and proteins in the		
			Alcohol ppt. (dextrin).	Cuprous oxide ppt. (Sugar).	Soluble Protein.
Wheat Farinas . . . . .	13	6.60	.97	1.18	2.42
Rolled Oats . . . . .	19	6.68	2.53	none	.74
Shredded Wheat . . . . .	7	13.71	8.26	2.03	*
Quaker Wheat Berries . . . . .	4	27.00	22.58	3.47	2.28
Toasted Corn Flakes . . . . .	4	28.3	19.63	5.77	.32
Grape Nuts . . . . .	5	44.20	12.96	21.02	1.73
Malta Vita . . . . .	5	25.45	9.97	8.01	1.38
Force . . . . .	7	17.08	9.16	2.73	*
Norka . . . . .	1	28.17	12.42	10.89	*

\*No determination made.

wide differences in the solubility of the dry matter and in the quantity of alcohol precipitate (dextrin) and reducing substances (sugars) in the foods ex-

the farinas, wheat germ, and granulated oatmeals dissolved is about equal, while the partial cooking to which the rolled oats and wheat were incidentally subjected in the process of manufacture, has not been sufficient to materially increase the solubility of these foods. Or, if, as some contend, diastase is present in very small quantities in raw grain, possibly the solubility of the uncooked foods has been influenced by enzymic action.

Among the foods sold as being cooked sufficiently to be ready to serve, it will be observed that there are wide differences in the per cent of solids soluble in water. This indicates that some were much more thoroughly cooked than others. I is also evident that the cooking has not resulted in the formation of any appreciable amount of sugar.

Among the malted and cooked foods there are also wide differences in the percentage amount of soluble matter. It must be remembered that the amount of malt used and the length of time it is allowed to act must influence the quantity of the starch rendered soluble and also the amount of sugar formed. Some of these foods do not contain as much soluble matter as the foods that were cooked only. The same foods have no more, or very little more, sugar than the uncooked foods, which would indicate that very little change due to malting had really taken place. Certainly there is very little to show that some of these foods have been any more than cooked, and, it will be shown later, that the cooking, as measured by the solubility of the carbohydrates, has not been as thorough as is commonly practiced in preparing the ordinary farinas and oatmeals for the table. Further, it is apparent that the predigestion has not affected the solubility of the proteids, for the water extract of these malted or "predigested" foods contains no more of these valuable food constituents than that obtained from the cooked foods. This is as expected, for the malting process can affect the carbohydrates only and has no influence on the other constituents of the food.

In general it may safely be stated that the thorough cooking of cereal foods is quite as important as the proportion of the nutrients which they contain. The chief purposes of cooking are: first, to sterilize the material, so that any undesirable bacteria if accidentally present may be destroyed; second, to improve flavor—making the food more appetizing and thus increasing its digestibility by stimulating the flow of digestive juices; and third to change the structure of the material, especially the carbohydrates, that they may be more readily digested. Possibly the last may be regarded as the most important, because, starch, which forms a very large proportion of these foods, is enclosed in cells, the walls of which are composed of crude fibre. This crude fibre is practically indigestible, and unless the walls which it forms are broken, comparatively little of the starch is digested and absorbed. In the cooking process, the contents of the cells expand and the walls burst, allowing the contents to come in direct contact with the water, when it is at least partially converted into soluble forms. Thorough cooking of the cereals really consists in rupturing these cell walls and in securing a maximum quantity of starch in a soluble form. The solubility of the protein is generally lessened by cooking, especially at high temperature. Long slow cooking will soften the crude fibre and change the starch to soluble forms without materially decreasing the solubility of the proteids. Some experiments seem to show that, while the protein is rendered insoluble in the first part of the cooking, long continued action of the heat somewhat changes them into soluble forms.

To gather some information regarding the extent of the changes affected by the length of time the foods are cooked and to get some data for comparison with the foods sold as ready-to-serve, we cooked oatmeal, and wheat farinas for periods of twenty minutes, two hours, five hours, and eight hours, and

analyzed. The percentage amount of the solids of analyzed a water extract of each, prepared in the same manner as that previously outlined in the study of solubility. (Continued on page 19.)