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Breakfast Foods and their Relative Value

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BREAKFAST FOODS AND THEIR RELATIVE VALUE

BROOKINGS, SOUTH DAKOTA

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INTRODUCTION.

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There are many breakfast food preparations on the market. They are so important, so many claims are made for them by the different manufacturers, so little seems to be generally known both as to their cost, actual and comparative, and their food values, that it is thought useful to make analyses covering all the different classes and at the same time to gather data which will enable all interested, especially housekeepers, to make an intelligent choice among the many kinds on the market.

This is not the first bulletin of its kind to be published. Other Experiment Stations and the United States Department of Agriculture have issued such from time to time. This one will in a way supplement those intending to bring information along this line up-to-date, since during the last 5 years or so many new brands and preparations have come upon the market, many of them being much alike, others differing widely in many respects.

The varieties reported on here were purchased in the stores at Brookings and represent all the different classes and the great majority of the brands sold in this state.

A short discussion of the elementary principles of nutrition is given and the analysis of a few common foods included for comparison. This should help to give a better idea of the value of breakfast foods.

This is a popular publication, not technical.

CEREAL FOODS IN GENERAL.

The cereals have been from the beginning among the most important foods of regular diets. We are all familiar with the extensive use of cereals in the form of white, graham and whole wheat bread and other preparations containing wheat flour; rye bread; corn meal; hominy; oat meal; rice; barley, macaroni and some others of less importance. Their advantage lies in that they contain the food substances; proteins, fats, carbohydrates and mineral matter, in large amounts and are comparatively easily obtained.

They differ from other foods of the vegetable kingdom—that is, principally from the fruits—in containing a low per cent. of water, and high per cent. of carbohydrates and proteins. The fruits often yield 75 per cent. and sometimes 90 to 95 per cent. water. The cereals are therefore more concentrated in food value.

They differ from the foods of the animal kingdom in containing carbohydrates (starch, sugar, dextrose) in large proportion (20 to 70 per cent.). The animal foods —the different meats especially—have practically no carbohydrates. The protein in the cereals is somewhat less than in the animal foods but the difference is not great. The kinds of proteins in each of these two great classes are somewhat different. The kinds in one however, can not be said to be better than those of the other. The legumes, such as peas and beans, are exceptional in the vegetable kingdom in containing a high protein content.

The fat content is generally less in the cereals. The per cent varies a great deal both in the vegetable and the animal foods. The average in the cereals being probably 3 to 4 per cent.

On the whole it can be said that the cereals are more indispensible than any other of our regular foods, milk excepted. The vegetarians doubtless have arguments in their favor but the ease of digestability of the flesh foods

and their peculiarly appetizing flavors are strong arguments favoring a mixed diet.

The following table shows the comparative food value of some of the common cereal and flesh foods. The chemical analysis is taken from "Food Inspection and Analysis" by Leach:

	% Water	% Protein	% Fat	% Ash	%Carbo-hydrates	% Fiber	Fuel value lb. in Cal.*
Wheat	13.65	12.35	1.75	1.81	67.91	2.53	1568
Oats	12.37	10.41	5.32	3.02	67.78	11.19	1649
Corn	13.12	9.85	4.62	1.51	68.41	2.49	1650
Rye	15.06	11.52	1.79	1.81	67.81	2.01	1551
Barley	13.77	11.14	2.16	2.69	64.93	5.31	1505
Rice	13.11	7.85	.88	1.01	66.52	.63	1420
Beans (dried)	12.6	22.5	1.8	3.5	59.6	4.4	1605
Beef (round)	65.5	20.3	13.6	1.1	....	....	950
Chicken (edible portion)	74.8	21.5	2.5	1.1	....	....	505
Eggs (edible portion)	73.7	13.4	10.5	1.0	....	....	692
Fish (pickerel edible portion)	79.8	18.7	.5	1.1	....	....	370

*For definition of Calorie, see p. 14.

It should be noted from the above table that the cereals give much more fuel value per pound if the fat meats are excepted. The flesh foods, however have more proteins or muscle-building materials.

CEREAL BREAKFAST FOODS.

The use of corn and oat meal as breakfast preparations led the way about twenty years ago to the beginning of what has proved to be a well-developed cereal breakfast food industry. Without going into the history of it, one can say that advance along this line has been fast and has kept pace with progress in other lines. During these 20 years or so almost a multitude of breakfast foods have been put on the market. Many of them had their merits, others had not and consequently they have fallen by the wayside. New processes have been discovered and efficiency in manufacture brought about so that at the present time a breakfast food that stays on the market for any length of time must have exceptional merits. The data which follow show that there will be further weeding out in the course of time.

Of the brands on the market ten years ago we now find but three or four, the others have given way to better ones and perhaps several have only become tired of their names and changed them.

As far as the writer can estimate there are now 30 to 35 brands sold in South Dakota. The table here given shows the analyses of 26. It was not possible to find more than 29 upon the market in the stores at Brookings. Three were found after the 26 were analyzed, however it was found that these 26 represented all the different classes of breakfast foods so no further determinations were made. All were bought in packages, none were found on the market in bulk.

Laboratory No.	TRADE NAME	MANUFACTURERS	Kind	Price per pkg.	Net wt. claimed	Net wt. found	CHEMICAL ANALYSIS						Cost per pound Cents	Cost per 1000 Calories of food value Cents	Cost per lb. of protein cents
							% Water	% Fat	% Fiber	% Protein	% Ash	% Carbohydrates			
					Grams	Grams									
1	Dr. Price's Rolled Oats	Price Cereal Products Co.	Raw	10c	624	602	6.55	7.84	1.17	15.81	1.70	66.93	7.2	4.0	45.4
2	Post Tavern Porridg	Postum Cereal Co	"	15	794	852	7.11	.58	.34	10.75	.56	80.66	7.7	4.6	71.6
3	Monarch Food of Wheat	Reid, Murdock & Co	"	15	794	810	10.05	.81	.25	11.87	.38	76.64	8.1	5.0	68.0
4	Cream of Barley	American Barley Co.	"	15	680	803	5.52	.83	.68	10.44	1.02	81.51	8.1	4.8	77.0
5	Cream of Wheat	Cream of Wheat Co	"	15	794	774	8.66	.91	.40	11.00	.44	78.59	8.6	5.1	85.1
6	Cream of All	Price Cereal Products Co.	"	15	794	759	6.62	1.06	.44	12.00	1.32	78.56	9.0	5.1	74.7
7	Wheat Hearts	Dakota Cereal Co	"	15	709	692	7.05	3.15	1.57	16.12	1.82	70.29	9.5	5.6	58.9
8	Pettyjohn's	Quaker Oats Co	"	15	680	656	6.96	2.19	2.05	13.31	1.68	73.81	9.9	6.0	74.3
9	Sims	Sims Cereal Co	"	15	681	673	9.10	.90	.56	13.37	.76	75.31	9.9	6.3	74.3
10	Dr. Price's Rolled Rye	Price Cereal Products Co.	"	10	454	440	8.64	3.39	1.77	11.62	1.80	72.78	9.9	6.0	85.1
11	Cream of Rye	Minneapolis Cereal Co	"	15	539-567	560	10.24	1.48	1.80	11.62	1.66	73.10	11.7	7.4	100.6
12	Post Toasties—new	Postum Cereal Co	Ready to Serve	10	283	371	2.82	.17	.42	12.75	.74	83.10	12.2	6.8	95.2
13	Kellogg's Toasted Wheat Bis	K. T'sted Corn Flake Co.	"	10	283	361	4.80	.80	2.52	15.50	2.36	74.02	12.2	7.4	78.7
14	Kellogg's Toasted Corn Flks	" " " "	"	10	283	332	4.32	.26	.46	7.87	1.38	85.71	13.6	7.6	172.7
15	Washington Crisps	United Cereal Mills Co.	"	10	283-340	317	5.44	.26	.41	8.50	.98	84.41	14.0	8.2	165.6
16	Kellogg's T'sted Wheat Flks	K. T'sted Corn Flake Co.	"	10	227	303	5.40	1.35	3.81	13.62	2.78	73.04	14.9	9.0	108.8
17	Kellogg's Crumbles	" " " "	"	10	283	300	4.77	1.05	2.72	15.37	2.48	73.61	14.9	8.9	96.9
18	Grape-Nuts	Postum Cereal Co	"	15	397	428	2.75	.44	1.36	12.50	1.36	81.59	15.8	9.0	126.4
19	Dr. Price's Corn Flakes	Price Cereal Products Co.	"	10	255	254	8.78	1.64	1.82	8.10	.62	79.04	18.0	10.5	221.4
20	Uncle Sam	U. S. Breakfast Food Co.	"	25	567	597	3.87	18.61	3.71	18.50	2.60	52.71	18.5	9.0	99.9
21	Triscuit	Shredded Wheat Co	"	15	269	354	5.40	1.17	2.47	11.50	1.72	77.74	19.0	11.2	165.3
22	Shredded Wheat	" "	"	15	340	354	4.61	.96	2.61	13.50	1.72	77.60	19.0	11.0	104.6
23	Egg O-See	United Cereal Mills Co.	"	10	227	184	6.12	.92	1.47	11.20	1.74	78.55	24.4	14.4	267.2
24	Puffed Rice	Quaker Oats Co	"	15	141	177	7.18	.26	.30	8.25	.31	83.70	38.0	22.3	459.8
25	Quaker Puffed Corn	" " "	"	15	170	177	5.42	.26	.55	9.25	.34	84.18	38.1	22.0	411.5
26	Quaker Puffed Wheat	" " "	"	12	142	123	5.62	1.80	2.00	16.19	1.20	73.19	43.9	25.4	272.2

In this table the 26 varieties are arranged according to their cost per pound as indicated in column 14. Accordingly they arrange themselves in column 4 so that all the raw kinds come first—meaning that they are cheaper than the ready-to-serve varieties. The cost varies from 7.2c to 43.9c per pound. None of the raw varieties cost over 11.7c while none of the ready-to-serve cost less than 12.2c. Rolled oats still remains the cheapest as it always has.

Of the ready-to-serve New Post Toasties ties with Kellogg's Toasted Corn Flakes in cost per pound but from column 15 it shows that one gets more food value per pound from the first named so it must be given first place here. Of the flake preparations No. 23 costs twice as much as No. 12—a large difference.

The puffed preparations (rice, corn and wheat) are in a class by themselves as regards price, being on the average twice as costly.

Relative to food value column 15 corresponds well to column 14. Rolled oats gives most food value for the money and the puffed wheat the least. One must, of course, take into account that the raw preparations must be cooked before they can be served, but even considering that phase one is justified in comparing them as is here done.

Each package was labelled as containing so many pounds or ounces net. This was computed into grams (1 oz. = 28.35 grams) and is shown in column 6. Column 7 shows the weight found in this laboratory. 10 of the 26 varieties were short in weight. 7 of these were the raw kinds. They are more apt to shrink in weight than the ready-to-serve. The writer can see no reason why shrinkage should be allowed—if it is allowable—on net weight.

INTERPRETATION OF THE CHEMICAL ANALYSIS.

Water is present in the raw breakfast foods from 5.52 per cent. to 10.24 per cent. In the ready-to-serve from 2.75 per cent. to 8.78 per cent. The crispness of the second class depends on the per cent. of water. These foods take up water from the air upon being exposed to the open air, consequently to regain crispness they must be heated in the oven. The loss of crispness is now largely overcome by sealing the package with oiled paper.

The per cent. of fat varies greatly in these foods. "Uncle Sam" which claims to be a balanced ration, has by far the most fat. Post Tavern has the least. The fat corresponds well to the amount found in the grains from which each food is made.

The per cent. of fiber in most of the 26 varieties is medium in amount but in a few it is large. Only a medium amount is preferred, too great an amount is detrimental.

The protein per centage is fairly constant in all, Uncle Sam which contains flax seed shows an endeavor to excel in this as well as in fat. The wheat preparations usually run higher in protein than do the others.

The ash per cent. varies somewhat. It is that of the grains from which prepared.

The carbohydrate per cent. is high in all—a characteristic of cereals. This is practically all starch in the raw foods. In the ready-to-serve it is mostly starch but there are also some sugars and dextrins which have been produced from the starch by cooking or roasting. The starch in the roasted or so-called "predigested" foods is slightly more soluble than in the raw; however, this is not sufficient to warrant any of these foods being called predigested.

These foods are doubtless made from the grains, yeast, sugar, salt, etc., as claimed on some of the packages and none other, that is, they are not adulterated.

Only one package contained the chemical analysis on its label. The analysis corresponded closely to that made in this laboratory.

Some of the claims made for these foods are unwarranted. They can not be considered predigested, especially. There is a tendency to limit more and more the claims made. This is doubtless on account of scientific investigation and publication. The influence of pure food laws relative to misbranding is a potent factor.

All these preparations were received in good sanitary condition as bought. The contents of packages can not be touched nor left open after they leave the factories. They were fresh and crisp. It is the opinion of the writer that the processes at the factories are sanitary—at least this was the case in the two factories gone through. Buying in bulk seems to have gone out of fashion, so to speak, not even bulk rolled oats are kept on hand by grocers. The reason lies in the fact that consumers demand package service at a much greater cost.

The question must be asked, are the prices paid for the amounts of nutritive material obtained reasonable? We must admit that these breakfast foods either the raw ones properly cooked or the ready-to-serve, are nutritious and healthful. Many differ in taste and other properties all of which count much for an individual, but many are similar in these properties.

When these breakfast foods are compared with one another there is no reason why one should pay 24c per pound for one which a person does not relish better than one which cost 12c per pound, sanitary conditions, etc., being satisfactory.

The most exact standard of comparison will be found by comparing these breakfast foods with the ordinary preparations commonly sold in bulk. It will be noticed that these foods are prepared from oats, corn, wheat, rye and rice. These grains furnish us with oat meal, wheat flour, rye flour, corn meal and rice. The manufacture

of these grains into breakfast foods makes no addition to their nutritive values.

In columns 15 and 16 are given the costs of sufficient of these breakfast foods to furnish 1,000 calories of energy and one pound of protein. The same data for the common preparations from the grains in question are as follows:

	Cost 1,000 calories cents	Cost one lb. protein cents
Wheat flour	2	26
Oat meal	1.3	44
Corn meal	1	22
Rye flour	2	47
Rice grains	4	75

Column 15 shows that the cost of 1,000 calories in the breakfast foods is from 4 to 25.4 cents while the cost of a pound of protein runs from 45 cents to $4.60. This comparison shows at a glance, that the manufacture of these grains into breakfast foods has increased the cost enormously without adding any thing to their nutritive values. It is evident that an extensive use of these high priced foods forms one noteworthy item in the high cost of living.

Remembering that a man at moderate work absolutely requires daily about one-fourth pound of protein to repair and maintain his tissues and that he expends about 3,000 calories of energy, excessive costs of protein and energy as expressed in calories assume a startling significance.

It is the belief based on the data of these 26 varieties investigated, comparisons made therefrom and from publications similar to this, that whatever is paid above an average cost of those now on the market, is unwarranted. This limits raw breakfast foods to a cost of about 8c a pound and ready-to-serve to 16.6c. Even at these rates they must be ranked as luxuries. The puffed preparations are eliminated as being entirely too ex-

pensive. The puffed state of these cannot rightfully be claimed to be better than that of the other breakfast foods.

By comparison with prices 15 years ago it is found that the price of breakfast foods has increased about 33 per cent during that time.

SUMMARY AND CONCLUSIONS.

There are 30 to 35 breakfast foods, both raw and ready-to-serve, upon the market in this state. These are all sold in sealed packages which reach the consumer under satisfactory sanitary conditions.

All the varieties investigated were wholesome and nutritious.

The net weight of contents of 10 of the 26 were not up to that stated on the labels.

All the way from 7c to 43.9c per pound is the retail price. The price is too great on some of these. By a little care those breakfast foods of desirable qualities can be selected at a saving of 30 per cent. to 100 per cent. More can be saved if not so much regard is paid to consumer's pecularity in taste.

The nutritive value for a pound of any of these foods does not vary so materially, one gets nearly as much food out of a pound of one as of another.

The price of breakfast foods has advanced during the last 15 years about 33 per cent.

None of the breakfast foods are strictly economical. Their sole claim for popularity is in their package form. The ready-to-serve kinds also save the trouble of cooking.

SUPPLEMENT.

PRINCIPLES OF NUTRITION.

In the elementary study of human nutrition it is convenient to regard man as a machine—a steam engine. Nutrition then resolves itself into four propositions. First: We want to know what this machine is made of so that we can repair it and build it up since it is continually wearing out by constant use; secondly: we want to know what sort of fuel is needed to keep it in working condition; thirdly: we must find that fuel or food and, lastly we must find out how much and in what proportions to give this food.

Thus we must know man, his needs and satisfy them rationally. This is in reality no small problem, it is intricate, but the average person should pay at least some little attention to it.

(a) Constitution of Man.

There are 81 elementary substances or chemical elements which make up all different kinds of matter known. The elements sometimes occur by themselves, that is free, but the great majority are combined with each other in different proportions to form an inconceivable multitude of compounds. Among these are our foods. The human body is built up of 24 of these elements. It cannot employ the others either for building material or fuel and we will therefore limit the discussion to those 24. They enter into the definite make-up of the great many different materials of which we are composed: thus bone, blood plasma and corpuscles, muscle, brain, nerves, etc., each of these of which are only collections of compounds of certain classes.

Inorganic foods. Water and mineral matter (ash) are classed as inorganic foods. In some respects

they are not foods at all but they are usually classified as such since they are highly important in maintaining life. They do not furnish any heat like the fats, carbohydrates and proteins do when they are burned in the body, but take a part in building up the body and serve as aids to the work of the organic foods.

Water. About two-thirds of the weight of the body consists of water. It is especially important as a solvent to convey the food in solution to the various parts of the body. It is present in all foods to a greater or less extent: less than 1 per cent. to about 95 per cent. Its necessity is so well known that it will not be further discussed.

Mineral matter or ash. This is the material remaining upon burning animal or vegetable matter to a white or gray ash. It is always a mixture of compounds (mostly salts) each of which consists of two to three elements as a rule. Thus common salt consists of sodium and chlorine; potash consists of potassium, and oxygen.

The body must have mineral matter for the formation of bone and to a less extent flesh, and to maintain the exact osmotic pressure between the liquids within and without the cells. Mineral matter is present in sufficient quantity in nearly all our foods so we pay little attention to it in the make-up of our diet.

Organic foods.

Protein. This is the term given collectively to the food compounds containing nitrogen. Besides nitrogen they all contain carbon, hydrogen and oxygen and usually either phosphorus, sulphur or iron or all of them, depending on the kind of protein. The proteins are the only muscle formers, but in addition they can take the place of fats and carbohydrates in being burned in the body to form heat energy. Man cannot live long without protein food. Protein is considered the most valuable part of foods, in fact foods are largely valued according to the per cent. of protein present. There is a multitude of different kinds both in plants and in ani-

mals. Protoplasm—the living substance—contains at least 20 different proteins. The white of egg is the typical protein, being an almost pure solution of the protein albumin in water.

Fats and carbohydrates. Fat as butter, lard, etc., and carbohydrates as sugar, glucose and starch are well known to everyone. They all consist of carbon, hydrogen and oxygen. Their function is to be burned in the body to form heat, giving off as as by-products water and carbon dioxide. This is the source of the carbon dioxide or what is commonly called carbonic acid gas, in breathing. Carbohydrates are more easily burned in the body and are less expensive to buy, but a proper proportion of fat in one's diet is beneficial for it is well taken by the body and can be stored up in the tissues to be drawn upon in time of need.

(c) Nutritive Value of Foods.

The nutritive value of a food is a measure of the amount of substances present which can serve as material to enable the body to grow and repair its tissues as they wear out and to supply the body with the heat energy needed to keep the body warm and carry on its activities.

The heat energy is expressed in units called calories. A calorie is the heat necessary to raise the temperature of a gram of water from 0^0 C. to 1^0 C. A thousand of these calories is equal to 1 large Calorie. (Designated with capital C.) By knowing the amount of heat needed by a body during a day and knowing also the heat which will be given off by a food-stuff such as sugar, when burned in the body, we can compute the amount of such food-stuff necessary to eat. It is now rather firmly established by numerous experiments of different investigators that:

One gram of protein when burned in the body gives 4.1* Calories.

One gram of carbohydrate when burned in the body gives 4.1 Calories.

One gram of fat when burned in the body gives 9.3 Calories.

* A later estimate makes this figure 5.65.

Thus fats give about 2.2 times as much heat energy as proteins and carbohydrates.

Carbohydrates and fats can furnish energy only while the proteins act in addition as building material for the body and are thus considered the most important food-stuff. Water and mineral matter, although absolutely necessary in other ways, cannot furnish energy. The mineral matter takes a part in the formation of the framework of the body as has been stated elsewhere and acts in the various body-fluids to keep definite osmotic pressure.

In the light of our present knowledge man must be considered as rightly guided by his appetite under normal conditions. Taking that into consideration it has become established that the following amounts of energy are needed daily for persons under the conditions stated:

For a man of average weight doing an average amount of work 2900 Cal. and 118 grams protein.

For a woman of average weight doing an average amount of work 2500 Cal. and 102 grams protein.

For a man doing heavy labor, 3500 to 5000 Cal. and 142-203 grams protein.

For a man doing light work, 2400 Cal. and 97 grams protein.

Thus the food consumed daily will vary, but giving from 2400 to 5000 Cal.

As a rough estimate one is said to require normally 40 Cal. for every kilogram (A kilogram is equal to 2.2 pounds) of body weight.

In order to keep the body in repair it seems necessary to consume 118 grams of protein, for a man doing an average amount of work.

Now it is found that it is best to apportion the diet properly between the proteins, fats and carbohydrates. One could take an excess of protein and in that way in-

crease the Calories so that less fat would be required but this would put unnecessary work upon the kidneys, through which the unnecessary proteins or end-products of such are eliminated, consequently one would not want to consume an excess of proteins. Likewise an excess of fat is not so easily digested and it is more expensive than carbohydrates, the latter of which are abundant in nature, are cheap, more easily digested and oxidized in the body. A small proportion of fats however is well taken by the body, in connection with the other foods, and can be and is stored up in the tissues for time of need. Thus a proper proportion between proteins, fats and carbohydrates should be struck. The following seems to be the best proportions, based on numerous experiments by worthy investigators, notably Voit:

Protein per day about 118 grams or .26 lb. for an average man.

Fat per day about 56 grams or .12 lb.

Carbohydrates per day 500 grams or 1.1 lb.

According to the above a person should consume in protein 17 per cent. of the daily heat calories needed; in fat 18 per cent. of the calories needed and in carbohydrates 65 per cent. of the calories needed.