GLUTEN-FREE DIETS

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Following the report of Dicke in 1950 that many children with the coeliac syndrome might be successfully treated with a diet free from wheat and rye flours, it was established that it was wheat and rye gluten which was harmful (Anderson *et al.*, 1952; Dicke *et al.*, 1953). Subsequent reports have confirmed the effectiveness of a gluten-free diet in nearly all children with the coeliac syndrome (Ross *et al.*, 1955; Sheldon, 1955).

In children with the coeliac syndrome who are intolerant of gluten the enteropathy is thought to be the principal disorder. This is also true in adults with idiopathic steatorrhoea; and in a proportion of such patients, as well as the children, the withdrawal of gluten from the diet leads to a return of normal intestinal function (Anderson *et al.*, 1954; French *et al.*, 1957). It has been suggested (Frazer, 1955) that "gluten-induced enteropathy" might be used as an inclusive term applicable to all patients, regardless of age, in whom a demonstrable enteropathy can be shown to be caused by gluten.

It has not yet been established what level of gluten intake is without effect in a gluten-intolerant individual nor whether there is a dose/response relationship. It seems to be the general experience (Lawson, 1954) that a low level of gluten intake must be maintained for effective therapy, and for these reasons it seems advisable to make a gluten-free regime as complete as possible. Gluten intolerance appears to persist for a long time, and it may be necessary for a gluten-free diet to be continued indefinitely.

There are several kinds of gluten, though all are plant proteins. In medical practice the word "gluten" is usually taken, as in this paper, to refer only to wheat and rye glens. There is also a gluten in maize, but it seems to be harmless. The amount of protein in oats is low, and its importance in relation to gluten-induced enteropathy has not been finally evaluated. It is not excluded from a gluten-free diet at present, and we have not observed any ill effects from its inclusion. If in the future it appears that oats should be excluded, this could readily be done, because oat flour is rarely used except in porridge, breakfast and baby cereals, and certain cakes.

We here deal only with gluten-free diets and not with other therapy which may be needed, particularly in the early stages of treatment, in gluten-induced enteropathy.

Construction of a Gluten-free Diet

The objective is to provide a pleasant and nutritionally adequate diet without using any food containing even traces of wheat or rye flours. There are two main problems in the construction of such a diet. Firstly, flour is used in so many processed foods that the selection of suitable foods presents difficulties. Secondly, ordinary flour is an important source of protein, calcium, iron, thiamine, and nicotinic acid in the average British diet. This source is lost when gluten-free

flour, which is almost pure wheat starch and lacks other nutrients, is used. In practice the nutritional value of a gluten-free diet might be lower still, because the withdrawal of wheat flour also involves removing useful items of cheap protein- and vitamin-containing foods such as fish fried in batter, sausages, and pies. It is difficult to assess the nutritional consequences of the withdrawal of wheat flour from an individual's diet, because there is a wide variation in the intake of flour, depending mainly on personal preference and income group.

With this proviso in mind the data in Table I will serve as a guide. All the nutrients of which flour is a significant source are listed. The figures for the percentage provided

TABLE I

	Protein	Calcium	Iron	Thiamine	Nicotinic Acid	Riboflavin
Proportion provided by flour in national diet*	29%	24%	27%	31%	26%	7%
	g.	g.	mg.	mg.	mg.	mg.
Adults						
Average daily intake (1954) minus flour†	60.7	0.85	11.0	1.0	10.3	1.7
Recommended daily intake for sedentary man†	69.0	0.8	12.0	1.0	10.0	1.5
Daily intake from a suitable gluten-free diet (Table II) ..	76.2	1.25	12.7	1.1	24.0	3.0
Children						
Average daily intake (1954) minus flour (under 15 years) ..	28.4	0.5	5.0	0.45	5.75	0.9
Recommended daily intake (7-9 years)‡	68.0	1.0	10.0	0.8	8.0	1.2

* Page 80, *Domestic Food Consumption and Expenditure: 1954*. Annual Report of the National Food Survey Committee. H.M.S.O., London.

† Page 62, *ibid.*

‡ Page 45, *Manual of Nutrition*, published by the Scientific Advisers' Division (Food) of the Ministry of Agriculture, Fisheries, and Food, 1955. H.M.S.O., London. (Based on recommendation, British Medical Association, 1950.)

by flour are for the population as a whole, and the effects of its exclusion have been calculated, using the levels of intake for adults and children separately.

The recommended levels of intake are shown and also the actual intake provided by a suitable gluten-free diet (Table II) in which alternatives to gluten-containing foods have been used. It will be seen that the removal of flour from the adult dietary reduces the intake of protein to below that recommended and the intake of other nutrients to near the recommended level. In the child, the intakes of all the nutrients listed are reduced well below the recommended levels because the national levels of intake are already marginal. It follows, therefore, that in constructing a gluten-free diet, not only must attention be directed towards excluding all gluten-containing foods but care must also be taken to see that the diet contains adequate calories, protein, calcium, iron, thiamine, and nicotinic acid, which may otherwise be deficient, particularly for a child.

In Table II are listed quantities of different foods which might be eaten by an adult as one day's gluten-free diet. They yield 2,500 calories (sufficient for a man in sedentary

TABLE II.—A Possible Single Day's Gluten-free Diet for an Adult

	Grammes	Homely Measures
Bacon	40	One rasher
Cabbage (cooked)	50	One tablespoonful
Cheese	40	One and a half ounces
Cornflakes	30	Three tablespoonfuls
Gluten-free flour	140	Five ounces
Honey	15	One teaspoonful
Lettuce	20	Four leaves
Margarine	30	One ounce
Marmalade	15	One teaspoonful
Meat	100	One medium steak or chop
Milk	600	One pint
Potatoes	120	Four medium ones
Rice (dry)	20	Three teaspoonfuls
Sardines	30	Three
Sugar	40	Six teaspoonfuls
Tomatoes	100	Two medium ones
Yeast	15	One dessertspoonful

work) and other constituents as shown in Table I. Such a diet is also nutritionally adequate in other respects. About 20% of the iron, thiamine, and riboflavin in this diet is

provided by yeast, and if for any reason the patient does not eat gluten-free bread (which usually incorporates the yeast) an adjustment should be made. The yeast can be taken as a drink with fruit juice or replaced by an additional egg plus half a pint (280 ml.) of milk. In the child greater care is needed, as is evident from Table I. Particular emphasis should be placed on a high consumption of milk and dairy products. If the child's appetite is poor, calcium, iron, and vitamin B complex supplements should be given.

Tables III, IV, and V have been found useful when advising patients what foods may or may not be eaten. In Appendix 1 are given alternative foods for different meals, and in Appendix 2 recipes using gluten-free flour for popular foods which would otherwise be excluded from a gluten-free diet.

TABLE III.—Foods Forbidden in a Gluten-free Diet

As a general rule, any processed, prepared, or tinned food must be assumed to contain gluten unless definite information is available to the contrary.

Baking powders	Farinoca	Mincemeat
* Baby cereals ("farex," "robrex," etc.)	Farley's rusks	Mustard
* Beans, baked, canned	* Fish canned in sauce	* Oatmeal
Bemax	* Fish pastes	Ovaltine
Bengers food	Glacé fruits	* Oxo
Biscuits	* Golden raising powder	Pastry
* Blancmange powders	* Gravy makers and browning	Peanut butter
Bread	* Groats	* Pepper
Breadcrumbs	Horlicks	Pies
* Breakfast cereals	* Horseradish sauce	* Pickles in sauce
Buns	* Ice cream	* Porridge oats
Cake and pudding mixes	* Ice-cream cones and wafers	* Potato crisps
Cakes	* Ice-cream powder	* Potato salad
Cake decorations	* Infant and invalid foods	Puddings, canned
* Canned meats	* Instant desserts	Ryvita
Caramels	* Junket preparation in tablets	* Salad dressings
* Celery salt	* Lemonade powder	* Sandwich spreads and pastes
* Cheese spreads	Lemon cheese	* Sardines in sauce
* Chocolate	Lemon/orange curd	* Sauces
* Chocolate, drinking	Lemon-pie fillings	Sausages
Chocolate and coffee spreads	Luncheon meats	Semolina
Christmas puddings	Macaroni cheese	* Soups, canned
* Chutney	Macaroni products	Soup powder
* Coffee essences	Macvita	Spaghetti
* Cornflour	* Malt	* Spices
* Cream, artificial	Malted milk drinks	Stuffings
Crispbread	Marshmallow creme	Tomatoes in sauce
* Curry powder	Marzipan	* Tomato juice
* Custard powder	* Mayonnaise	Trifle
Dessert powders	* Meat-pastes	* Vegetable salad
Energen rolls	* Meat, canned	Vegetables canned in sauce
Energen bread	* Meringues	Vermicelli
Farola		Vitawheat

* Foods marked with an asterisk are sometimes available in a gluten-free form, and appear in Table V.

TABLE IV.—Foods Which Are Acceptable

Almonds	Fish canned in brine, oil or water	Milk, fresh
Bacon	* Fruit, fresh, all kinds	Milk, tinned or dried
Beer	Fruit juices and squashes	Olives
Bicarbonate of soda	Fruit tinned in syrup	Peels
Bovril	Gelatin	Pickles, clear
Boiled sweets (clear only)	Ginger	Prunes
Butter	Glucose	Raisins
Calves-foot jelly	† Gluten-free flour	Rice
Capers	Herbs	Sago
Caraway seeds	Honey	Salt
Cheese	Jam	Suet
Chicory	Jam setters	Sugar
Cloves	Jelly (crystals, cubes, etc.)	Sultanas
Cocoa	Junket (rennet)	Table waters
Coconut	Lard	Tapioca
Coffee (fresh or instant)	Lemon juice	Tea
Colourings	Lemonade (bottled)	Treacle (golden syrup or molasses)
Cooking-fat	and aerated waters	* Vegetables, fresh or dried, all kinds
Cooking-oil	Lentils	Vegetables canned in brine or water, all kinds
Cream, dairy or tinned	Lime juice	Vinegar
Cream of tartar	Margarine	Wines and spirits
Dried fruits, all kinds	Marmalade	Yeast, bakers'
Eggs	Marmite	
Essences	* Meat, fresh, all kinds	
* Fish, fresh, all kinds		

* Frozen foods, provided they are not already prepared in any way, may be used instead of fresh.

† For supply and uses, see below.

Gluten-free Flour

Gluten-free flour (that is, wheat flour from which all gluten has been removed) may be obtained in 7-lb. tins (7s. plus postage) from Energen Foods Ltd., Pound Lane, Willesden, London, N.W.10.

Bread made from gluten-free flour and yeast may be obtained by post from Birkett and Bostock Ltd., Dept. T.R.D., Coronation Bakery, Stockport, Cheshire, cost (1957) 1s. 3d. per 12-oz. loaf, plus postage. This firm also supplies wheat starch, gluten-

free rusks, sweet biscuits, shortcake, and "Tendercake Dry-Mix" (price, 1957, 1s. 6d. per lb.). The latter contains all the ingredients, except water, for gluten-free bread; instructions are enclosed.

Local bakeries will sometimes bake gluten-free bread if there is a sufficient and regular demand, but most patients prefer to bake their own.

TABLE V

The following manufacturers have assured us that their products listed below are gluten-free. Only a selection of firms have been contacted, and doubtless others would be equally co-operative if approached. Some of these manufacturers also market gluten-free foods listed in Table IV.

Alfred Bird and Sons Ltd.: Blancmange powder. Custard powder. Instant postum. Instant whip. Rice toasties.
Brown and Polson Ltd.: Cornflour.
Cadbury Bros. Ltd.: All products at present except biscuits.
Cerebos Ltd. (Saxa): Bisto. Pepper. Spices.
Chocolate Tobler Ltd.: Toblerone and all assorted packs and bars.
Crosse and Blackwell Ltd.: Baked beans. Browning. Celery salt. Chef tomato ketchup. Fulcream custard powder. Herring in tomato. Mayonnaise. Rennet essence. Salad cream. Sandwich spread. Sweet mango chutney. Sweet mixed pickles. Tomato ketchup.
Fray Bentos (Oxo) Ltd.: Beef: pressed, rolled, and brisket. Chicken breasts in aspic. Corned beef. Crab. Cream of tomato soup. Lemco. Minced chicken. Ox tongues.
J. S. Fry and Sons Ltd.: All products at present except "Tiffin."
H. J. Green and Co. Ltd.: Blancmange powder. Carmelle. Complete custard mix. Cornflour. Custard powder. Gravy salt. Lemonade powder.
H. J. Heinz and Co. Ltd.: Celery salt. Chutney. Gravy browning. Ideal sauce. Junior fruit dessert and pineapple. Mayonnaise. Piccalilli. Pickle: Ideal, Mixed, Royal. Potato salad. Salad cream. Sandwich spread. Soups: cream of asparagus, cream of celery, cream of green pea, cream of onion, cream of spinach, cream of tomato. Strained: apples, apricots with rice, beetroot, carrots, rice pudding. Kipper spread. Chocolate pudding, cream cereal, egg custard with rice, green beans, peas, pineapples with rice. Tomato juice. Tomato ketchup. Vegetable salad. Worcestershire sauce.
H.P. Sauce Ltd.: H.P. baked beans. H.P. pickle. H.P. salad cream. H.P. tomato ketchup. H.P. tomato soup.
Keen Robinson and Co. Ltd.: Robinson's patent barley and patent groats. Ready-cooked groats and baby rice. Robsoup—chicken and bone and vegetable varieties. Three Bears oats.
James Keiller and Son Ltd.: All chocolate and sweet packs.
Kellogg and Co. Ltd.: Corn flakes. Rice krispies. Sugar-frosted flakes. Sugar ricicles.
Kraft Foods Ltd.: Processed cheeses, all varieties at present. Caramels. Mayonnaise. Miracle whip. Salad cream. Salad dressing. Tomato chutney. Tomato ketchup.
J. Lyons and Co. Ltd.: Bev. Boiled sweets. Chico. Chocolate, all varieties. Custard powder. Meringues. Mousse, all flavours. Ready Brek. Strawberry in melba sauce.
Nestlé Coy. Ltd.: Chocolate—all varieties except cracker milk bars, crispette biscuit centres, and turkish delight chocolates. Lactogen. Milo chocolate food drink. Nesquik instant chocolate. Swiss Knight petit gruyère cheese.
Quaker Oats Ltd.: Oat krunchies. Quaker one-minute oats.
Rowntree and Co. Ltd.: Aero. Beechnut chewing-gum. Elect cocoa. Fruit gums. Fruit pastilles. Milk motoring chocolate. Polo fruits. Polo mints. Sunchoc.
A. R. Scott Ltd.: Scott's porage oats. Piper oatmeal. Scott's baby cereals: M.O.F., ready-cooked groats.
Smith's Potato Crisps Ltd.: Potato crisps.
A. Wander Ltd.: Vimaltol.
Ice cream: J. Lyons and Co. Ltd.—all varieties except Wonder Ice Cake. Midland Counties Dairies Ltd. Tudor Dairies Ltd., Henley. T. Wall and Sons Ltd.—all varieties except Gaycakes.

Summary

It is now widely held that most children with the coeliac syndrome and many adults with idiopathic steatorrhoea are intolerant of gluten and are much improved by a gluten-free diet. Such a diet may lack essential nutrients unless care is taken in its construction; milk and yeast are particularly useful in providing the protein, calcium, iron, thiamine, and nicotinic acid which is lost when flour is removed from the average British diet. With so many processed foods now available it is difficult to know which may be used. Lists of gluten-containing and gluten-free foods are given.

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APPENDIX 1

The following are suggested alternatives for different meals of a gluten-free diet:

Breakfast.—Porridge. Cornflakes. Rice krispies. Puffed rice. Oat krispies. Egg, boiled, poached, scrambled, or fried. Bacon, grilled or fried. Kippers. Smoked haddock, poached in milk or water. Kedgerree (flaked boiled fish, boiled rice, chopped egg, salt). Gluten-free bread or biscuit. Butter or margarine. Marmalade or preserves. Tea or coffee with milk and/or sugar.

Lunch.—Soups—bone stock. Any variety of vegetable. Marmite or Bovril can be used. To thicken add pearl barley, split peas, or gluten-free flour. Any type of fresh meat, roasted, grilled, fried, or braised. Stew (thicken with gluten-free flour). Tripe. Liver. Kidney. Heart. Fish, boiled, steamed, or grilled (if fried, dip in egg, then in gluten-free flour to coat). Fish in egg custard (egg and milk). Cold ham. Any variety of fresh vegetable. If white sauce is made, thicken with gluten-free flour. Gravy—natural juice of meat, thicken with gluten-free flour. Fruit, fresh or tinned. Sago or rice pudding. Custard (use recommended custard powder only). Jam tart (pastry made with gluten-free flour). Jelly, ice cream (recommended varieties). Blancmange and fruit (recommended custard powder). Sponge cake and custard (see recipe).

High Tea or Supper.—Omelettes. Bacon. Egg. Mushrooms. Soused herrings and salad. Sardines in oil and salad. Toasted gluten-free bread with grated cheese. Gluten-free bread. Butter or margarine. Jam or preserves. Cakes (as recipes). Biscuits (as recipes). Puddings as for lunch.

Bedtime Drinks.—Milk. Cocoa (recommended varieties). Fruit juice. Tea or coffee with milk and/or sugar.

APPENDIX 2

Gluten-free flour is used in the following recipes:

1. YEAST LOAF

- 12 oz. (340 g.) gluten-free flour.
- 12 oz. (340 ml.) lukewarm water and milk mixed.
- 1 oz. (30 g.) yeast started with 1 teaspoonful sugar.
- $\frac{1}{2}$ oz. (15 g.) cooking fat.
- 1 teaspoonful salt.

Add the salt to the gluten-free flour and rub in the fat. Mix the creamed yeast and sugar with the milk and water, and stir into the gluten-free flour thoroughly, seeing that no lumps are left. Allow the mixture to stand in a warm place for 20 minutes exactly. Pour the batter into two 1-lb. (two 450-g.) size bread tins, previously warmed and greased. Bake at Regulo 3 (320° F.) for 20 minutes, then turn up the gas to Regulo 7 (400° F.). Leave for 10 minutes. Take the loaves out of the tins, turn upside down on the oven shelf, and continue cooking for 15 more minutes.

2. SWEET LOAF

- $\frac{1}{2}$ lb. (230 g.) gluten-free flour.
- $1\frac{1}{2}$ oz. (45 g.) sugar.
- 2 oz. (60 g.) margarine.
- 3 teaspoonfuls gluten-free baking powder (Recipe No. 9).
- 4 oz. (115 ml.) milk.
- $\frac{1}{2}$ teaspoonful salt.

Sieve dry ingredients. Rub in margarine, then make a well in the centre and mix in enough milk to make a soft dough. Mix quickly and lightly and turn the dough into a well-greased shallow tin. Bake for 30 minutes at Regulo 7 (400° F.). When cool, cut into slices and serve with butter or margarine.

3. WHEAT STARCH CAKE

- $\frac{1}{2}$ lb. (230 g.) gluten-free flour.
- 4 oz. (115 g.) sugar.
- 4 oz. (115 g.) margarine.
- 1 teaspoonful salt.
- 3 teaspoonfuls baking powder.
- 4 oz. (115 ml.) milk.
- 1 egg—optional.

Flavour with coconut, dates or cocoa.

Sieve the dry ingredients into a basin, rub in the margarine, then make a well in the centre and mix in enough milk to make a soft dough. Mix quickly and lightly and turn the dough into a well-greased shallow tin. Bake for about 30 minutes at Regulo 7 (400° F.).

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4. WHEAT STARCH BISCUITS

- 4 oz. (115 g.) margarine.
- 4 oz. (115 g.) sugar.
- 3 oz. (85 g.) gluten-free flour.
- 3 oz. (85 g.) ground rice.
- 1 egg.

Cream margarine and sugar, add beaten egg, gluten-free flour, ground rice. Mix to dough. Roll out thinly, prick all over and cut into shapes. Place on a greased tin. Bake for 15 minutes at Regulo 3 (320° F.). This mixture will make 1 lb. (450 g.) of biscuits.

5. SWISS ROLL

- 4 eggs.
- 4 oz. (115 g.) sugar.
- 2 oz. (60 g.) gluten-free flour.
- 2 oz. (60 g.) ground rice.

Beat eggs and sugar over hot water until light and fluffy. Fold in sieved gluten-free flour and ground rice; pour mixture in lined swiss-roll tin. Bake at Regulo 8 (450° F.) for 7 to 10 minutes.

6. CORNFLOUR CAKE

- 4 oz. (115 g.) cornflour.
- 1 level teaspoonful baking powder.
- 2 oz. (60 g.) butter.
- 3 oz. (85 g.) castor sugar.
- 2 eggs.
- Grated rind of 1 lemon.

Sieve the cornflour and baking powder together; cream the butter and sugar very thoroughly. Add the well-beaten eggs, then the cornflour and grated lemon rind. Beat all well together. Put into a well-greased tin and bake for about 30 minutes at Regulo 4 (360° F.).

7. PASTRY, SHORT CRUST

- 4 oz. (115 g.) gluten-free flour.
- 2 oz. (60 g.) margarine.
- 2 oz. (60 ml.) water.

Normal short-crust pastry method. Bake at Regulo 7 (400° F.) for 25 minutes. This pastry is not suitable for pies.

8. YORKSHIRE PUDDING

- 1 egg.
- 2 oz. (60 g.) gluten-free flour.
- 5 oz. (140 ml.) milk.
- Salt.
- Pepper.

Method as for Yorkshire pudding.

9. SPECIAL GLUTEN-FREE BAKING POWDER

- 3 oz. (85 g.) cornflour.
- $3\frac{1}{2}$ oz. (100 g.) bicarbonate of soda.
- 2 oz. (60 g.) cream of tartar.
- 2 oz. (60 g.) tartaric acid.

Mix all ingredients together and rub through a hair sieve. Repeat twice, then store in an airtight tin.

ANAEMIA AND THE ALIMENTARY TRACT

CONFERENCE AT ROYAL COLLEGE OF PHYSICIANS

[FROM A SPECIAL CORRESPONDENT]

The Royal College of Physicians of London launched a new and highly successful venture last week-end. This was a postgraduate conference on "Anaemia and the Alimentary Tract"—the first of a series which the College intends to arrange. The conference, which was held on July 25 and 26, was attended by 117 physicians and pathologists, and 20 papers by leading workers in this field were read and discussed. The President of the College, Professor ROBERT PLATT, explained that the purpose of these conferences would be to enable fellows and members of the College to hear about recent advances in certain specific branches of medicine.

Lesions of the Mouth and Oesophagus

Dr. R. ASHER (London) began by describing the lesions which might affect the mouth and throat in anaemia. The