WHITE AND BROWN BREAD.

BY

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IN a recent annotation on the above subject (*British Medical Journal*, July 27th, p. 156) reference was made to the discussion of the dietetic value of wholemeal bread by Drs. McCance and Lawrence in their report to the Medical Research Council on the carbohydrate content of foods.

"Discussions on the relative merits of white and wholemeal bread," they write, "are usually directed more by psychological bias than by experimental facts. People who neither know the facts nor are able to appraise them, people with vested money interests and cranks of all kinds, speak and write freely on the subject with ever-recurring waves of enthusiasm. So few of the facts, however, seem to be generally known, and the position could so fitly be discussed here, that we have devoted a section to the subject."

The editorial comment on this passage was as follows:

After this introduction we learn without surprise that the authors are unfavourable to the use of wholemeal bread. They remark that when allowance is made for the food calories lost in the faeces, wholemeal bread has a lower calorie value than white bread; and the argument that, white bread being deficient in vitamin B, its consumption is a common cause of digestive disorders, they meet as follows: "If the vitamin deficiency of white bread were the cause of so much constipation and the vitamins of wholemeal bread were the specific cure, then this could hardly have failed to attract the attention of physicians and the public, neither of whom are slow to apply such simple remedies." This argument, that a new idea cannot be true, because if it were true someone would have thought of it long ago, has been advanced against every new idea since the dawn of history, and we confess to some surprise at finding it in a serious scientific publication. We hold no brief for white bread or brown, but suggest that the authors would have done well to examine their own rationalizations a little more carefully before directing attention to the "psychological bias" of other people.

The annotation then proceeds to give the authors' final conclusions:

"Children," they write, "are very intolerant of high cellulose diets, and, for some, brown bread is far too irritating, even if given with the idea of relieving constipation. Appetite is such an important factor in all digestive considerations that no one who dislikes a food of unproved value should be forced to eat it if it can be avoided. In time of peace, of course, the grown-up population, if they have the choice, will never eat wholemeal bread unless they like it, no matter how specious the advertisement, but they may force their children to eat it in the belief that they are doing them good. One should, therefore, be cautious in advising wholemeal bread generally, and wait until careful unbiased experiments have been done on a sufficient number of men, women, and children. Thus only can accurate conclusions be drawn."

This matter of the relative dietetic value of white flour and whole-wheat flour—and of the breads made from them—has of late years assumed a considerable importance in India owing to the greatly increasing use, in towns and cities, of white bread and the decreasing use of the unleavened bread (*chapatti*) made by the people themselves from freshly ground whole wheat. A comparative study of the two flours was accordingly made in these laboratories in 1927. It is the purpose of the present note to provide readers of the *Journal* with a summary of the results arrived at, which, it is hoped, may help them to form their own opinion in regard to this much-disputed matter.

In the absence of a sufficient number of men, women, and children on whom careful unbiased experiments could be done, this study was made by feeding tests on young rats—a method which has, in the past, been employed with some success in the study of nutritional problems. It is one requiring close attention to experimental detail. In the first place it was necessary to have at hand a sufficiently large number of young rats of the same age—40 to 50 days. This involved arrangements being made for the birth of a large number of litters within ten days of each other. From these the 156 animals required for the first series of

experiments were selected. They were divided into twenty-six groups, there being six—three males and three females—in each. The animals comprising each group were taken from different litters, so that any inherited growth tendencies might be, as nearly as possible, the same in every group. In twenty-four groups the aggregate body weight of the six rats was 240 grams, in the remaining two it was 216 grams. Each animal was confined in a separate screened cage under conditions of the most scrupulous cleanliness. The cages were identical in size. Water for drinking and washing purposes was provided in abundance. The experiments, of which there were two series, were carried out at the same time—the first series during the spring and the second during the autumn of 1927; their duration was fifty-four days. It is essential to emphasize these particulars, for unless every condition—age, sex, hygiene, temperature, humidity, season, caging, bedding, housing, etc.—be the same, sources of error are introduced which make comparison of the results misleading.

The bases of the experimental diets were: (a) white flour, manufactured in India from wheat grown in the Punjab; and (b) whole-wheat flour (*atta*) made, day by day in the laboratory, from fresh Punjab wheat of good quality, the manner of its preparation being that in general use by the people of India. The two flours were made up with water into cakes of unleavened bread (*chapatti*); these were lightly cooked on an iron plate over an open fire in the manner customary in India. Of these cakes the animals in the respective groups received as much as they cared to eat. In each experiment one group received white flour *chapatti* as the basal diet, and another group, of precisely the same body weight, received whole-wheat flour *chapatti* as the basal diet. The supplements made to the two basal diets in the different experiments were: *nil*; butter (1.25 grams); dried yeast (5 per cent.); butter and dried yeast; tomatoes and greens *ad libitum*; tomatoes, greens, and butter; meat residue (10 per cent.); whole milk in varying amounts (1 c.cm., 2 c.cm., 5 c.cm., 10 c.cm., and *ad libitum*); and whole milk *ad libitum plus* dried yeast. The results are shown in Table I.

TABLE I.—Showing the Average Percentage Increase in Body Weight, on the Fifty-fourth Day of Experiment, of Animals fed on Basal Diets of White Flour and Whole-wheat Flour to which various Supplements were made.

Supplements to Basal Diets.	Increase in Body Weight: per cent.	
	White Flour.	Whole-wheat Flour.
I. Nil	10.6	65.0
II. Butter (1.25 grams per rat daily) ...	26.2	97.1
III. Dried yeast (5 per cent.)	107.9	121.8
IV. Butter and dried yeast	116.3	177.7
V. Tomatoes and greens (<i>ad libitum</i>)	41.3	69.1
VI. Tomatoes, greens, and butter ...	35.2	85.8
VII. Meat residue (10 per cent.)	17.5	67.2
VIII. Whole milk (<i>ad libitum</i>)	209.6	220.4
(a) " (1 c.cm.)	32.2	81.6
(b) " (2 c.cm.)	43.4	59.9
(c) " (5 c.cm.)	119.5	143.1
(d) " (10 c.cm.)	149.1	177.2
IX. Whole milk (<i>ad libitum</i>) and dried yeast	244.6	242.1

It is seen from this table that in every instance but one (IX) whole-wheat flour was superior to white flour as the basal article of diet. It was only when the animals were provided with as much whole milk as they cared to drink, together with 5 per cent. of dried yeast, that white flour was as good as whole-wheat flour. In this case the animals consumed on the average 20 c.cm. of whole milk daily; these two diets (IX) were, in fact, "milk diets."

The results of this series of experiments leave no room for doubt as to the superiority of the whole-wheat flour over the white flour.

A second series were carried out in which white bread, obtained from the local bakery and containing approximately 2 per cent. of yeast, was compared with whole-wheat unleavened bread (*chapatti*), made from the rapidly grown Nilgiri wheat, which is of inferior quality. The experimental details in this series were similar to those in the first. The results are given in Table II.

TABLE II.—Showing the Average Percentage Increase or Decrease in Body Weight, on the Fifty-fourth Day of Experiment, of Animals fed on Basal Diets of White Bread and Whole-wheat Unleavened Bread to which various Supplements were made.

Supplements to Basal Diets.	Increase or Decrease in Body Weight: per cent.	
	White Bread.	Whole-wheat Unleavened Bread.
I. Nil	21.2	55.7
II. Vegetable margarine (<i>Cocogem</i>) (1.25 grams)	2.4	12.7
III. Butter (1.25 grams)	15.4	51.7
IV. Tomatoes and greens (<i>ad libitum</i>)	56.3	68.1
V. Tomatoes, greens, and vegetable margarine	47.2	94.5
VI. Tomatoes, greens, and butter	51.7	97.3
VII. Meat residue (10 per cent.)	39.1	63.9
VIII. Whole milk (2.5 c.cm.)	71.2	80.5
IX. Whole milk (2.5 c.cm.), vegetable margarine (1.25 grams)	49.2	102.1
X. Tomatoes, greens, and milk (2 c.cm.)	92.9	139.6

The results of this series show that in every instance whole-wheat unleavened bread, though made from wheat of inferior quality, was superior to baker's white bread as the basal article of diet for growing rats. It is clear that the amount of yeast used in the manufacture of white bread (approximately 2 per cent.) did not make the bread equal in nutritive value to the whole-wheat unleavened bread, and that no matter what supplement was made to the two breads wholemeal bread always maintained its superiority over white bread. The pernicious effect of *Cocogem* will be noted, especially in those diets having a low vitamin B content.

Although the results of the two series are not strictly comparable, for the reasons that the experiments were carried out at different seasons of the year and that the whole-wheat flour used in the one was of different quality from that used in the other, yet it will be evident from a careful study of the tables that the results of the two series are complementary.

It is outside the scope of the present note to analyse these results further; nevertheless, there is one point to which attention may be drawn, since it may have a practical bearing in regard to the dietaries of growing children. The point is this: when the diet contains a considerable amount of fat, in the form either of margarine or of butter, then it is essential that the vitamin B content of the food be proportionate to the amount of fat, otherwise growth is retarded. Vitamin B appears to be necessary for the utilization of fat; wholemeal of poor quality may not contain enough of the factor for this purpose.

The object of this note has been to advance "experimental facts," in regard to white and brown bread, which indicate clearly that, as the basis of diets for growing rats, white bread is inferior in dietetic value to the unleavened bread (*chapatti*) made from freshly ground wheat. The latter, with milk, milk products, vegetables, and fruit, constitutes the diet of certain races of Northern India who, so far as physical efficiency is concerned, are amongst the finest of mankind. Their children, invariably breast-fed in infancy, know no other bread than whole-wheat *chapatti*, which they begin to eat from the age of 2½ years onwards. It does not appear to exercise any irritating action on their intestinal tracts. If, as stated by Drs. McCance and Lawrence, "brown bread is far too irritating" to the intestinal tracts of some English children, may it not be that their intestinal tracts are at fault rather than the wholemeal?

PURIFICATION OF SWIMMING-BATH WATER.

THE report by Messrs. E. A. Sandford Fawcett and H. T. Calvert, and Dr. J. Alison Glover, on the purification of the water of swimming baths,¹ to which we drew attention in the *Journal* of October 26th (p. 773), is concerned with the methods by which pollution in swimming baths occurs, the validity of various tests which have been adopted to estimate the extent of pollution, the transmission of infection by the water of swimming baths, and the devices by which the purity of such water may be maintained.

SOURCES OF POLLUTION.

Dangerous contamination of swimming-bath water appears to be derived mainly from the persons of the bathers, records of epidemics caused by water polluted from other sources being very few in number. Contamination from surface drainage percolation, fallen leaves, dead animals, and so forth, occurs mainly in open-air baths, particularly those with unlined sides and bottoms. The green growths which often appear in such baths actually have a beneficial effect, their powerful oxygenating action serving to purify the water from organic pollution. So effective are they that in the ponds at Highgate and Hampstead, which are seldom emptied, chemical analysis has shown that little change in the water is produced even by a large number of swimmers. Dust and soot blowing in through the windows of baths (especially those which have been placed near refuse incinerators for the purpose of obtaining power and heat) form, when the water is at rest, an uninviting scum on the surface of the bath. Despite the fact, however, that this scum may contain considerable numbers of *Bacillus coli*, the pollution is significant aesthetically rather than hygienically. A large proportion of filth found in the water is carried in by the boots of bathers and spectators; the side paths of the pools are regularly used by the bathers, and as a result they are almost always covered with a water suspension of visible dirt, a considerable quantity of which is then transferred to the pool from the bathers' feet. The authors of the report suggest that this source of pollution could be avoided by so designing the bath-house that the entrances to the dressing-rooms from outside are entirely separate from the paths by which the bathers enter the water.

The costumes of bathers contribute largely to the defilement of swimming-bath water; on some costumes there have been found more than one million bacteria per square inch, though with proper cleansing the figure should not be more than 500. An adequate precaution is to wash a bathing costume thoroughly with soap in warm water, rinse it three times, disinfect it, and then let it dry completely. Even greater than the bacterial contamination of costumes is that of towels; the proper cleansing, disinfection, and drying of towels is therefore a matter of importance.

By far the most serious sources of pollution are the hair, skin, and mucous membranes of the bathers themselves. The polluting matter is of three kinds: particulate matter, including fragments of recently discharged mucus; matter in solution; bacterial pollution, which may be considerable even in waters which appear attractive. The material in each of these categories requires separate consideration; the first brings about rapid depreciation of the water, rendering it opaque, greyish-black in colour, and offensive in smell; the second may be less important, and in baths which are efficiently filtered and sterilized the soluble constituents may be increased considerably without affecting the usefulness of the water. These two together, however, may have the effect of gradually converting the water into a culture medium in which bacteria—the material in the third category—are able, at the temperature at which indoor swimming baths are usually kept, to undergo rapid multiplication. The first form of pollution soon demands its own remedy; the second can be considerably reduced by making it a rule that all bathers before entering the water must take a shower bath, and by enforcing the use of soap, followed by a thorough spray of clean water, this procedure would be rendered still more effective. The third, which is the most important, requires separate consideration.

¹ Ministry of Health. *The Purification of the Water of Swimming Baths*. London: H.M. Stationery Office. 1929. 1s. net.