confirmed this observation and has noted further that the phosphatase excretion in all types of jaundice is also but slightly increased. This implies that an early case of obstructive jaundice would show a relatively low phosphatase figure, but no case of obstructive jaundice of less than a week's duration has been met with in the course of the work. The point might be settled by ligature of the common bile duct in animals, but opportunity to do this has not occurred. At the same time, the idea that the whole of the differences observed may be accounted for solely on the duration of the jaundice is untenable, since several of the toxic cases were of long duration. The optimum *p*H for the blood phosphatase in jaundice is the same as that for the phosphatase in osteitis deformans, and it may well be that the same enzyme is concerned in the two conditions, being produced in the liver and concentrated at the site of bone formation. In this connexion it is interesting to recall the observation of Buchbinder and Kern,[10] who found that a low blood calcium and osteoporosis followed the ligature of the common bile duct in dogs, which findings have been attributed to inefficient absorption of calcium from the intestine owing to the absence of bile. Reasons are given by Kay[5] for thinking that in bony diseases the high blood phosphatase is a result, not a cause, but in obstructive jaundice the high blood phosphatase precedes any bony change, so that it is possible that in these cases the increased blood phosphatase leads to some disturbance of calcium–phosphorus metabolism.

Finally, it is necessary to draw attention to two classes of case in which the phosphatase activity of the blood may not elucidate the cause of jaundice.

1. When the patient is already suffering from a disease in which the phosphatase is raised, as in Case 51, already discussed, in which jaundice developed during the course of Graves's disease. Apart from obstructive jaundice, however, the phosphatase is considerably raised only in conditions in which extensive bony changes are occurring.[4 5]

2. Cases in which the jaundice is slight, where there may be difficulty in deciding whether the phosphatase figure is raised or not, owing to the fact that the method of phosphatase estimation has a fair margin of error. The accurate but more elaborate method described by Kay[11] might be of use in such cases. Further, the final phosphatase figure depends to some extent on the initial figure before the onset of jaundice, so that a low initial phosphatase and a trifling obstructive jaundice might leave the figure within normal limits. This, however, is not the class of case in which the type of jaundice is of great practical importance, whilst it is clear that the method is capable of differentiating correctly most of the cases ordinarily met with. On this account it seemed worth while reporting it at this stage, in order that it might be applied and further tested by others interested in the subject.

SUMMARY

1. The current description of the direct and biphasic van den Bergh reactions is criticized and suggestions made for its improvement. The results of the reaction in a series of cases of jaundice are presented as evidence in support of the view that the reaction fails to differentiate obstructive from toxic and catarrhal jaundice.

2. The obstructive nature of a jaundice can be recognized by the increased phosphatase activity of the blood, which occurs strikingly in this type alone. The procedure adopted to recognize this increase is outlined, and the results obtained in a series of fifty-two consecutive cases reported. These results demonstrate that, by the method described, toxic, infective, and catarrhal jaundice may be readily distinguished from jaundice of the obstructive type.

3. The relation between the phosphatase activity of the blood and its bilirubin content is discussed. A modification of the modern theory of jaundice and the van den Bergh reaction is proposed, which appears to explain the facts better that the present view, and to allow also of an explanation of the above relationship.

The earlier portion of this work was carried out at Sheffield Royal Infirmary during the tenure of a maintenance grant from the Medical Research Council. I would like also to acknowledge the readiness with which the various physicians and surgeons allowed my access to their icteric patients, the assiduity of the house-physicians in collecting icteric blood, and the kindness of Professor H. S. Raper in reading through the original manuscript of this paper.

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RELATION OF EXCESSIVE CARBOHYDRATE INGESTION TO CATARRHS AND OTHER DISEASES *

BY

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Elsewhere[1] attention has been drawn to the fact that in a large boarding school for girls the incidence of cases of catarrhal illness of more than seven days' duration was greatly reduced during the war years. The following table shows the average incidence of such illness in the ten years 1904–13 and in the four years 1914–17.

	1904–13	1914–17
	Per cent.	Per cent.
Spring terms	4.15	0.6
Summer terms	1.1	0.5
Autumn terms	2.05	1.3
Average per annum	2.6	0.8

This suggests that perhaps the duration of catarrhal illness is affected by some article of diet the consumption of which was reduced during the war. Do we know of any foodstuffs which in excess aggravate this condition? Many observers believe that children who have a low tolerance for carbohydrates are especially prone to catarrhal affections. H. C. Cameron[2] has described the catarrhal child as having an excess of water in the body, and has attributed the tendency to lymphoid hyperplasia in all situations and to catarrhal inflammation of the "swollen and oedematous mucous membranes" to this cause. He finds that evident and permanent improvement follows restriction of carbohydrate food.

McClendon[3 4] has demonstrated water retention after high glucose feeding both in man and in animals. Ramsay[5] has described the occurrence of visible congestion and exudate in the retinas of patients whose carbohydrate intake is in excess of what they can tolerate, and has pointed out that this is an index of the state of the capillaries elsewhere in the body. Occasional albuminuria (so

* Read to the Fife Branch of the British Medical Association, December 8th, 1932

often observed in children of the exudative diathesis), and the state of the lymphoid tissues and mucous membranes described by Cameron, afford evidence of this. Ramsay has further shown that phlyctenular ophthalmia —a condition only found in children of the exudative or catarrhal diathesis—is rapidly benefited by the restriction of carbohydrates and the withdrawal of all sugar from the diet. Not only does the ocular condition rapidly improve on such a dietary, but the associated retinal congestion, albuminuria, and catarrhal states disappear. It is of interest to note that the initial lesion in the phlyctenule consists of capillary congestion and exudation of lymphocytes, and that the complications, such as ulcer of the cornea, are invariably associated (like the catarrhal states of the respiratory mucosa) with the pathogenic activity of cocci. The well-known susceptibility of the diabetic to severe coccal infection indicates some association between the latter and hyperglycaemia.

Observers[6] from the Rowett Research Institute have recorded that a study of the diet and health of two East African tribes revealed the fact that the mortality from bronchitis and pneumonia was ten times as great in one tribe, which was cereal-eating, as it was in the other, which was mainly carnivorous in habit.

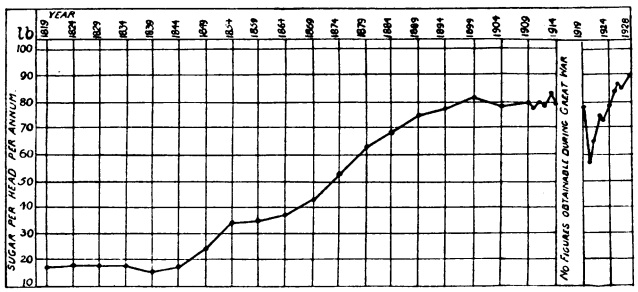
It may be concluded that the tendency to suffer from "a variety of chronic catarrhal and exudative processes"[2] is associated with intolerance of carbohydrates, especially of sugar. As a corollary to this it may be assumed that even in persons of high tolerance a similar liability to chronic catarrhal inflammation will result if the absorption of carbohydrates is sufficiently excessive.

National Consumption of Carbohydrates and its Modification during the War

The carbohydrate part of our diet consists of the cereals and all starch-containing foods, on the one hand, and of sugar (sucrose) on the other. During the war there was little restriction of our starchy foods ; indeed, we were encouraged to eat more of these than in peace time. There was, however, a great restriction in the supply of sugar. Imports of this commodity fell from 32 to 18 million hundredweights, although the military ration was maintained at a high level.

Is there any evidence that our consumption of sugar in peace time is excessive? Sugar has only been in use in any quantity within comparatively recent times. It was unknown in Northern Europe until the eleventh century, and was first brought to England from Mexico by Admiral Hawkins in 1563. Even in Pepys's day it was a rarity, because he records in his diary that " Hither came Gilb. Holland and brought me a stick rapier and Shelton a sugar loaf " (7 lb.). Indeed, up to the end of the eighteenth century sugar was not in common use. At the beginning of the nineteenth century the manufacture of sugar from beet was encouraged in France by subsidies granted by Napoleon. From 1819 to about 1845 the consumption of sugar in Great Britain was in the neighbourhood of 17 lb. per head per annum, but since that time it has increased enormously, as is shown in the accompanying graph. During the war and in 1921 (owing to trouble in the Continental beet industry) consumption fell. Since 1928 it has increased still further, and in 1931 we consumed in this country 96 lb. per head per annum.

In a boarding school for girls (about 350 pupils) I found the consumption of sugar to be at the rate of over 2 lb. a week per head.[7] Individual houses showed variations between 1.2 lb. and 2.2 lb. It is suggestive that, for the term when these figures were obtained, the house with the lowest sugar consumption had a catarrhal rate of 5.5 per cent., while the house with the highest sugar consumption had a catarrhal rate of 24.6 per cent. The rate in the other houses was roughly proportional to the sugar intake. It was further observed that after a week-end holiday, during which an increased quantity of sweets was consumed, cane sugar could be demonstrated in the urine of more than half of the girls examined on return. Since that time several cases of chronic tonsillar hypertrophy and of chronic nasal catarrh, which were highly resistant to local treatment, have shown rapid improvement when sugar in every shape and form was withdrawn



Estimated quantity of sugar consumed per head of the population of the United Kingdom during each of the years indicated. Figures from Statistical Office of Custom House, London. (From *Edinburgh Medical Journal*, 1932, xxxix, 9, p. 557.)

from their diet. There are therefore good grounds for assuming as a working hypothesis that excessive consumption of sugar favours the persistence of the catarrhal state, and that the rationing of this substance during the war was the factor which determined the reduction in duration of catarrhal illness in this school.

It may be objected that, since the utilizable product of all carbohydrates is glucose, the case against sugar in particular falls to the ground. Many arguments, however, indicate that sucrose may be especially harmful when consumed to excess.

1. It is a pure chemical substance ($C_{12}H_{22}O_{11}$) devoid of all those accessory food factors (vitamins, salts, etc.) with which it is associated in the vegetables from which we extract it.

2. If absorbed unchanged (as has been shown to occur when consumed to excess) it is excreted by the kidney ; but it is not impossible that it exerts a toxic effect in its passage through the blood.

3. Its digestion and absorption (as invert sugar) is attained with much greater rapidity than is the case with starches. As MacLeod, Ramsay, and others have pointed out, velocity of glucose absorption is of even more importance than weight.

4. The laevulose fraction of invert sugar may, if it reaches the systemic blood, exercise a toxic effect. But apart from that, it is evident that the absorption of 50 lb. of laevulose annually (the product of 100 lb. of sucrose), which is greatly in excess of the amount derived from all natural foods, must throw an unwonted strain upon hepatic activity.

5. So far as sugar displaces natural foodstuffs, vitamin and other deficiency must result.

There is, however, no evidence of a corresponding decrease in the consumption of other carbohydrates, and therefore the bulk of the sugar we eat must be regarded as surplus—a surplus which raises the resting level of the blood sugar to an unnatural extent and at an abnormal rate. Excessive use of sugar is favoured by its pleasant taste, its value as a preservative, its failure to satisfy appetite either in virtue of its bulk or its vitamin content, and above all by its cheapness. Of the carbohydrates which we consume it is probably the most harmful when consumed in large quantity.

I suggest from the foregoing, therefore, that restriction in the use of sugar would result in improvement in the national health as regards catarrhal illness.

It is not to be supposed, however, that the evil effects of excessive carbohydrate intake are limited to the

aggravation of catarrhal illness. A consideration of some of the results which may follow the habitual absorption of an excess of glucose into the blood seems justifiable, even though at present it is largely speculative.

EFFECTS UPON THE PANCREAS

Habitual excessive absorption of glucose must be met by habitual hyperinsulinism.[8]

(*a*) In these circumstances any sudden reduction in glucose absorption (as, for example, at the onset of an acute febrile illness) will result in a comparative hypoglycaemia, with the production of diacetic and oxybutyric acids from incomplete combustion of fats. May not the habitual over-consumption of carbohydrates be responsible for the increasing frequency of acidosis among modern children?

(*b*) The undoubted benefit which many modern children derive from glucose feeding can only be explained by some degree of hypoglycaemia, indicating (since in starvation hypoglycaemia does not occur) over-activity of the islets of Langerhans.

(*c*) Many cases of severe spontaneous hypoglycaemia are now being reported in adults. In some of these the symptoms, which were temporarily relieved by glucose or adrenaline administration, have disappeared when a partial pancreatectomy was performed.

(*d*) Actual enlargement of the islets has[9] been demonstrated in many cases.

(*e*) Since over-activity of an organ is apt to be followed by failure of function, and hypertrophy by atrophy, the increasing frequency of diabetes may be subject to a similar explanation. Each of these states may be traced to over-stimulation of the islets of Langerhans as a result of habitual excessive glucose absorption.

EFFECTS UPON THE SUPRARENAL AND PITUITARY SECRETIONS

(*a*) The chief physiological antagonist of insulin is suprarenal secretion. Habitual hyperinsulinism will thus be associated with habitual hyperadrenalism. A second antagonist is pituitary secretion. In addition to their actions upon blood sugar both of these secretions have pressor effects. May not the increasing frequency of hyperpiesia be attributable to over-activity of these glands?

(*b*) Adrenaline encourages the production of abnormal lipoids from cholesterol. Recent work indicates that the earliest change in arteriosclerosis is a deposit of lipoids in the vessel walls. This suggests that arteriosclerosis, too, may have some relation to excessive carbohydrate ingestion.

EFFECTS ON FAT STORAGE

Apart from endocrine disturbances, we know that when glucose is absorbed in excess of the normal capacity of the liver and muscle to store glycogen, that excess is deposited as fat. In America, where the consumption of sugar (112 lb. per head per annum several years ago) is considerably higher than our own, the increasing frequency of obesity is causing alarm.

Thus there is a group of diseased conditions—obesity, arteriosclerosis, and diabetes—which have long been associated clinically, and which are increasing in modern times, although the general death rate is falling. Is it not possible that this increase is directly associated with excessive carbohydrate intake, which is largely, if not entirely, due to the prodigious increase in the use of sugar?

EFFECTS ON DIGESTION

A further result of excessive ingestion of carbohydrate food is the occurrence of indigestion. Not only may those processes fail which are concerned with the conversion of starch into glucose and sucrose into invert sugar, but, when active, they may give rise to abnormal fermentative reactions in the intestine. Substances are thus produced and absorbed which are capable of toxic effects such as the capillary disturbance described by Maitland Ramsay. If the failure of digestion is sufficiently severe only a fraction of the ingested carbohydrate becomes available for absorption, and in the midst of plenty there is famine. In such cases, as the following will show, the patients, though large eaters, are undernourished.

The patient was a girl, aged 15, listless, pale with a muddy complexion, and a frequent sufferer from febrile catarrhal attacks. She was thin, and failed to gain weight though a heavy eater, especially of starches and sweets. In 1931 she developed renal glycosuria. As this persisted to an unusual extent she was seen by a specialist, who greatly reduced her starchy intake and prohibited sugar. He warned me that the amount of carbohydrate he had permitted was probably quite insufficient for her school activities, and that the latter would have to be restricted to prevent loss of weight. On the altered diet, however, she began to gain weight rapidly, became more alert and active, and was able to play all games. Her appearance and complexion rapidly improved, and in the last year she has only suffered from one slight cold and has been free of glycosuria. As I interpret it, she had suffered from carbohydrate indigestion with its accompanying toxaemia, and, when her digestion improved as a result of carbohydrate restriction, her malnutrition disappeared.

CONCLUSION

I submit that our carbohydrate intake is excessive, and that such excess is mainly due to the prodigious increase in the consumption of sugar in the last half-century. Clinical data have been advanced with regard to catarrhal illness, but I must leave it to others to supply them for or against the association between sugar consumption and the diabetic group of diseases referred to. It is from the general practitioners that such data must be obtained.

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PATHOLOGICAL CHANGES IN ACUTE PANCREATITIS SEEN DURING LIFE

BY

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The following three cases of acute pancreatitis are described because the appearances in the abdomen seen at operation differed from those which have so far been seen at necropsy in the Bernhard Baron Institute of the London Hospital, and also from any given in the literature to which I have had access.

CASE I

Female, aged 52. Complete removal of right breast for carcinoma five years before. For three weeks before admission she had been suffering from vague indigestion and flatulence, and had noticed that the stools were pale and bulky. Two days before admission she was seized with violent upper abdominal pain, referred to the back and to the left shoulder, which caused her to collapse. She vomited twice at the onset. On admission she appeared to be very ill.