

## SUGAR, WHITE AND BROWN

BY

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I have recently sent out a questionnaire to nearly 4,000 men and women whose names are in the *Medical Register* and who are characterized as having some Cambridge degree. My object was to obtain information as to the conditions under which they prescribed glucose by the mouth, and also as to their opinion of the effect of a comparable dose of cane sugar under the same circumstances. Many hundreds have answered, and have supplied me with a great deal of interesting and important material. This will be circulated as soon as the spate of replies ceases and I have had time to analyse them thoroughly. In the meantime I have been much struck by the comments of quite a number as to the variety of table sugars they recommend. Some specify "cane" sugar as distinct from "beet" sugar; others desire information as to the nature of the substances present in "brown" sugars, which they imagine are of dietetic importance and which are removed when the sugar has been refined; others distrust what they term "synthetic" sugar. I trust that this short article on the nomenclature of sugar and on modern methods of refining table sugars may remove certain misconceptions.

### Ordinary Sugar

The ordinary sugar of the table is sucrose, a compound with the formula  $C_{12}H_{22}O_{11}$ . By hydrolysis by very weak acids or by the action of the enzyme invertase it takes up a molecule of water and is split into equal parts of two sugars. One of these is glucose (or dextrose or grape sugar). The other is fructose (or laevulose or fruit sugar). The mixture of these two sugars is called "invert sugar," which is found in considerable amounts in jams made from cane sugar, which is largely hydrolysed by the acids in the fruits during boiling. It is also the chief constituent of golden syrup and of honey. In the United Kingdom sugar is obtained from sugar cane, which is imported, and from sugar beet, which is now largely produced at home.

White sugar is prepared in the refineries by dissolving in water either the imported sugar which has been extracted abroad from the sugar cane or the crude sugar from our home sugar-beet factories. The brown solution is filtered from large solid impurities and mixed with cream of lime, which is then precipitated by bubbling in carbon dioxide and heating. The solution containing the calcium carbonate precipitate is pumped through pressure filters, where the precipitate is removed, carrying with it various impurities entangled with and adsorbed on to it. The clear brown liquor is then passed through towers containing specially prepared bone charcoal. This removes the colouring matter and a considerable amount of other soluble non-sugar impurities which might interfere with subsequent crystallization.

The fine liquor obtained from the charcoal is almost water white. It is concentrated in steam-heated vacuum pans at low temperature. Sugar crystals are formed, and the conditions are so arranged that the crystal size is correct. The mixture of crystals and mother syrup ("massecuite") is discharged into tanks and stirred; it is then drawn into centrifugal machines and the mother syrup spun off through the perforated wall of the centrifugal basket. The wall of white sugar left is washed with a jet of boiling water, which is again spun off. The sugar is discharged to long cylindrical rotating dryers or "granulators." Thence it is carried to grading sieves and thence to the packing department. The mother liquors are worked up for further crops of crystals, which are dealt with in the same way. After a number of crops of sugar have been taken out the syrup becomes incapable

of yielding a white sugar because successive boilings have formed some caramel, slight inversion may have taken place, and the original impurities in the fine liquor have become concentrated. This refined brown syrup is treated in one of two ways. Either it is partly inverted, passed over charcoal to improve the colour, and turned into "golden syrup"; or it is boiled again to give several crops of refined brown sugar, sold as "pieces" or "soft" sugar. The final syrup from which no more sugar can be economically crystallized is called "molasses."

The degree of purity of ordinary white table sugar is quite remarkable. The sucrose content is 99.95 per cent., the solid non-sucrose material (mostly salts of the alkali metals) being 0.03 per cent., the remainder being moisture.

### Impurities in Sugar

Nowadays there is no difference in the product obtained after refining, no matter whether the crude material used was obtained from cane or from beet. It is the pure compound sucrose, which is generally known as cane sugar. There is no known chemical or physical test which can show whether pure sucrose has been obtained from the cane or from the beet. Cane sugar was the name given to the sugar (sucrose) extracted from the sugar cane—*Saccharum officinarum*—the plant from which sugar could be most easily extracted. The sugar cane has been a known source of sugar to mankind for at least 3,000 years. The popular name for sucrose is therefore cane sugar. Sucrose or cane sugar is present in all ripe fruits, in grasses (of which the cane is a gigantic example), and in many vegetables and trees. The sugar cane grows only in tropical or subtropical countries. Within quite recent times (about 150 years ago) it was found that one of the beetroots—*Beta vulgaris*—contained large quantities of easily extractable sucrose and would grow readily in temperate climates. This sugar was quite naturally called beet sugar, but it is sucrose all the same. Only the impurities differ in cane and beet sugars. The reason that beet sugar has got a bad name is that much beet sugar was in the past sold in an imperfectly refined state—as was and is much cane sugar. But whereas the impurities in impure cane sugar are pleasant to the taste, the impurities in impure beet sugar are disagreeable, and the relatively high percentage of potash salts in impure beet sugar reduced the sweetening power.

As to brown sugars generally, they contain sucrose plus a little invert sugar and water and a variety of impurities, which in the case of raw sugars may be definitely objectionable. They may consist of sulphites—a legacy from a method of attempting to decolorize the raw material, sand and clay, pieces of cane fibre, swarms of micro-organisms, and, worst of all, live sugar lice (*Carpoglyphus anomus*), the cause of the "grocers' itch" of the last generation. Some of the imported brown cane sugars have been carefully prepared for direct consumption and are clean and wholesome, but many contain most or all of the impurities mentioned above. The specially prepared brown sugars, whether imported or made in a refinery, contain as principal non-sucrose ingredients invert sugar up to a maximum of about 7 per cent. and moisture up to about 4 per cent. It is important to state positively that brown sugars do not contain any vitamins or other valuable accessory food factors that are removed in the process of refining, which converts the crude material into a pure sterile compound of uniform composition. It is also quite clear that the old-fashioned demand for "real" cane sugar is met by the purchase of ordinary white table sugar.

The Medical Research Council has appointed Dr. Donald Hunter, physician to the London Hospital, and Mr. Harold E. Clay, national secretary of the Passenger Services Group, Transport and General Workers' Union, to be members of its Industrial Health Research Board, in succession to Professor J. A. Nixon and Mr. R. Coppock.