Dietetic Treatment of Diabetes.

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In medical practice of recent years physicians are realizing more and more the truth of the statement that the health of the patient depends upon the food taken into the body. Let us consider for a moment what a food is. It is anything which when taken into the body is capable of repairing wasted tissue, or furnishing it with material from which to produce heat, nervous or muscular force. It is impossible to replace wasted tissue when nothing is given to the organism with which to replace the worn out body. Thus we see that feeding is one of the most important factors in the regaining of health to a sick person. In some cases it holds a more important place than drugs. The diet is very important in Uraemia, Anaemia, Albuminuria and Diabetes. Let us consider the last named.

Diabetes is a disorder of nutrition in which sugar accumulates in and is excreted by the urine in the form of grape sugar or glucose. For a case to be considered diabetes mellitus,

it is necessary that the form of sugar eliminated in the urine be grape sugar; that it must be eliminated for weeks, months, or years; and that the excretions of sugar take place after the ingestion of moderate amounts of carbohydrates. The disease runs a chronic course and the majority of cases terminate fatally in from two to four years.

Diabetes can be said to be of three kinds: glycosuria, in which there is more or less continuous traces of sugar in the urine, or the occasional or temporary passing of sugar in considerable amount, does not constitute true diabetes; polyuria or diabetes insipidus has nothing in common with the other two except in the fact that a large amount of urine is passed; and diabetes mellitus has been described above. Glycosuria may be caused by an excessive ingestion of carbohydrates or sweets. There is nothing dangerous about it except the tendency to run into other diseases. In polyuria the patient is to be shielded from weakness caused by excessive drains upon the body.

Diabetes is not a very rare disease but is said to be becoming more frequent. This fact may

be partly accounted for from the fact that every physician in diagnosing a case makes a careful analysis of the urine and thus any trace of sugar may be found. It is a disease of adult life; the majority of cases being from thirty to sixty in age. Of seventy-seven cases treated in John Hopkins Hospital, twenty-four occurred between fifty and sixty. It is rare in childhood but when it occurs, it is likely to prove fatal in a very short time. Heredity plays an important part and cases are on record of its occurrence in many members of the same family. Schmidt called attention to the possibility of the disease being contagious and there are instances of the man and wife having it - the woman contracting it after the man. Men are more likely to be affected than women, the ratio being three to one.

Hebrews are especially prone to it. In negroes it is quite rare but there the ratio in man and woman is reversed. In a considerable proportion of cases the subjects have been excessively fat at the beginning or prior to the commencement of the disease. It is a disease of the wealthy rather than the poor; of the city life than country, because of sedentary habits combined with over

indulgence in eating. It may occur with a variety of diseases such as gout, syphilis and malaria which are considered predisposing causes.

The disease is very prevalent in Italy where carbohydrates are so extensively used. In fact the cause and conditions are imperfectly known, but the theory most generally accepted is the eating excessively of starch and sugar. Many persons overload the system with sugar without knowing the danger incurred thereby. It is not a kidney disease as was once supposed but is a derangement of the other organs and the kidneys simply eliminate the waste. Among the other causes of the disease have been reported blows and shocks effecting particularly the nervous system; injuries to the back of the head, over the liver; exposure to wet and fatigue; convalescence from fevers; emotional strain, worry, mental fatigue and anxiety, tumors and haemorrhages at the base of the brain.

Claud Bernard conducted a series of experiments upon animals. He was the first to determine the amount of sugar normally present in the blood. According to his estimate, if the quan-

-tity of sugar does not exceed three in every thou-
sand parts of urine, the limits of health are not
overstepped and sugar is not excreted in the urine
as it is when the proportion is increased. He fed an-
imals heavily upon sugar, killed them and ex-
amined the blood from various parts of the body.
He found that a great deal of sugar was destroy-
-ed by the passage of the blood through the lungs,
and he found it to be carried by the hepatic vein
while the portal vein had only a trace. He demon-
-strated that the liver cut from the body and washed
free from blood by water, would, after standing a
few minutes, still yield sugar. He next searched
for the source of sugar formed by the liver and
descovered the substance to which he gave the name
of glycogen. Glycogen is a normal ingredient
of the liver cells in which it is stored in the form
of amorphus granules around their nuclei. When
treated by diastic ferments or boiled with di-
-lute mineral acids, it is converted into grape
sugar or glucose.

Bernard found that the quantity of sugar
which he should collect from the hepatic vein at
any time did not increase when the animal was
fed on a large amount of sugar. This led him to

argue that the liver arrested the sugar ingested, on its way to the general circulation and this acts as a regulator of the amount of sugar in the blood. As man takes his food at irregular intervals the liver acts as a store house and stores the sugar as glycogen, giving it out when needed. In this way the excess of sugar taken in or an excess of sugar obtained from the digestion of starchy food, is kept from entering the system immediately and is given out when required for force production. The ultimate destination of sugar reformed from the glycogen of the liver is its consumation either in the capilaries or intercellular spaces, or in the muscular or other tissues of the body, by an obscure process of nutrition, which results in its splitting up into carbonic acid and water with the evolution of heat. To support this view he proved that there is less sugar in systemic than arterial blood. The foregoing experiments have given rise to three principle theories regarding the origin of diabetes, which follow. 1.st That it is due to impaired glycogenic function, and the sugar taken as food is at once passed into the general circulation unaltered. 2.ond That it is due to increased glycogenic function; there is

an overproduction of sugar from glycogen, the latter being derived both from sugar and peptones and the newly formed sugar is swept into the blood. 3rd That it is due to conditions of absorption of carbohydrates and of the functional activity of the liver which may remain normal, and yet the final combustion of sugar by the tissues or its assimilation by them may be imperfect and lead to its accumulation in the blood and subsequent appearance in the urine. These three conditions imply diminished activity of liver, increased activity of liver, or a normal liver the fault being in the other tissues of the body.

Pavy has proposed another theory in part to account for diabetes. It is that the intestinal epithelium of the villi ordinarily exerts a granular control over the sugar absorbed from the bowels and converts it into glycogen and fat as it reaches the blood. Failure to perform this function results in an excess of sugar in the blood. Pavy holds that this failure is due principally to the faulty nerve action affecting the calibre of the arterioles with hyperoxidation, which favors the too rapid convertion of carbohydrates into glucose. If the liver of an animal be cut out into small fragments

to prevent fermentation, very little sugar will be found in it. But if left at body heat, it is found that the formation of sugar continues for at least an hour owing to a process of fermentation which changes it from glycogen.

The symptoms of diabetes in acute and chronic cases are much the same but the acute is usually in a young patient. The chief symptoms are extreme thirst, a large quantity of urine voided and rapid emaciation and loss of strength. Thirst, which becomes very great, is caused mainly by the absorption by the blood-vessels of the fluids of the tissues, and is most intense one or two hours after meals, when sugar formation is most active. Ten to fifteen quarts per day will not even relieve thirst. The saliva is thick frothy and acid and often contains sugar. The mouth becomes sticky and dry and often there is a sweetish taste. The tongue is at first moist sticky and coated with papillae; later it may become dry, dark red and fissured. The appetite is excessive; at other times changing and at others fails entirely.

The urine voided is between two or three times the usual amount. It may exceed the amount

of liquid taken in, and hence must come from the tissues. As a rule the more sugar present the paler the urine, and it grows turbid soon after standing from the development of the yeast fungus. The sediment if present is usually light and the odor may resemble hay or whey. The urine may be tested by inverting a tube of urine after having placed some yeast in it, in a saucer of urine. If the urine contains sugar, the fermentation by the yeast will take place and the gas in the tube will drive out the urine. The urine is sweetish with an acid reaction. Urea is present above the usual amount because the patients food consists largely of proteid. The quantity of sugar varies; an average may be stated as from thirty-two to thirty-five parts per thousand of urine but the total may exceed even five hundred grams per day.

Because of the fact that so much water is eliminated in the urine, there is scarcely any perspiration and the skin becomes dry and wrinkled, the face drawn and pinched, and the eyes hollow. From lack of intestinal secretion the bowels become constipated although diarrhoea may alternate with constipation in later stages of the disease. In advanced cases the breath has a

sweetish sickening odour and the dyspeptic symptoms are prominent with decay of teeth. Loss of weight and emaciation sooner or later become extreme. The attack by other diseases upon the weakened system is a later symptom. The diabetic coma is one of the worst signs and sometimes death ensues while in this condition.

As the disease exists in people who lead sedentary lives we would expect that a moderate amount of exercise is necessary to its cure. By increasing the amount of exercise, we increase the oxidation of the food and prevent to some extent the sugar from being thrown off as a waste product before it has been reduced to the simpler elements. The patient needs rest after exercise and especially just before and after meals. Plenty of sleep should be taken.

The patient should bathe frequently and for those who can endure it, the cold baths are recomended. They should be short quick shower baths followed by a vigorous friction of the surface; a cold mitt friction is also good. Massage treatment after a bath is beneficial and the muscles should be well kneaded. As the skin

is dry the patient is easily susceptible to a change of temperature and they should always wear flannel or silk next to the skin.

This is a strictly dietary disease and all attempt to cure by drugs have failed. However cures have been effected by dieting. As has been said the carbohydrate changes to glucose or sugar and produces chiefly the heat and energy of the body. The sugar and starch changed to maltose and dextrose is absorbed in the intestine and carried by the blood to the liver. Now in order to keep the urine free from sugar we must reduce the carbohydrate and restore the power to assimulate them. This is done by resting those functions of the body that are used in their digestion.

Sometimes by withdrawing the carbohydrates for a time, one can succeed in re-educating the tissues in their power of dealing with sugar, and a return to ordinary diet does not increase the amount of sugar excreted. Most people are in a habit of obtaining one half their energy from carbohydrates - thus the supplying of energy in another form becomes a problem. Fat is a compact form of energy and yields for a given weight two and one half times as many calories as proteid.

In all probability it can not be converted into sugar. Proteid, on the other hand is more bulky: it can of a certainty produce sugar and there is good reason to believe that the products of its decomposition lead to the production of acetone in the blood and may lead to diabetic coma. Fats can at least fulfil the proteid-sparing function of the carbohydrates. If the normal amount of proteid is given, it will require two hundred grams more fat than the daily dietary allows. The severity of the case has much to do with the dietetic treatment. Some cases may be benefited by restricting the amount of carbohydrate while others may be so severe that their use must be prohibited. A diet test must be used in order to ascertain to which class a patient belongs. A diet of meat, fish, eggs, green vegetables and butter answers the purpose well. The urine is examined while on an ordinary mixed diet in regard to the quantity of urine and amount of sugar excreted. The patient is restricted in diet for about ten days and the out put of sugar carefully watched, then an ordinary diet is given for a while. If he still continues to excrete sugar, one concludes that he belongs to the severer class of cases. After the sugar disappears, one may find

out the patients toleration for carbohydrates by gradually adding known quantities of bread or other carbohydrate to a strict diet. This may be done until the maximum amount of carbohydrate that may be assimulated, is reached. The larger the amount of bread which can be added without causing sugar in the urine, the milder the case. The diet must be determined by the class to which the particular patient belongs. 1. In mild cases the diet should contain somewhat greater amount of protid than normal along with a large proportion of fat and as much carbohydrate as may be tolerated without the appearance of sugar in the urine. 2. In more severe cases in which, on a carbohydrate-free diet the sugar disappears but comes back again when any starchy food is taken, the diet should resemble the above, but should contain an extra quantity of fat. 3. In the severest cases of all, in which sugar is excreted in the urine even though there be no carbohydrate in the food, the diet should consist of a smaller proportion of protid than normal, along with a small portion of carbohydrate and as much fat as the patient can be induced to digest. There is really no special diabetic diet for each case must be treated upon its own merits.

We will consider the foods separately. Proteids. The proteid diet must be obtained from animal foods of which there is a great variety. Meats fishes and eggs may be indulged in freely. Four to six eggs may be taken daily. Clams, oysters, mussels and liver contain glycogen which is a carbohydrate. Authorities differ as to the advisability of their use. Of milk products cheese may be allowed in any case.

Fats. The best sources of fat are, butter bacon and the fatter meats (pork), fish (eg. eel, mackerel and sardines in oil), suet, drippings, salad oil, eggs, cheese, and thick cream. Of these butter should be largely represented in the diet. There should be at least half a pound of butter and half a pint of cream in the dietary every day. If a small quantity of carbohydrate is allowable in the diet, fat is taken so much easier. Toasted bread may be soaked in butter and cream, or potatoes may be made into puree with butter and cream. A given quantity of mashed potato if cooked by steam, should easily take up half its weight of butter and a quarter its weight of cream. Green vegetables however prove the most efficient butter carriers, spinach heading the list, others are cabbage,

asparagus and string beans. Mashed greens, from which the water has been removed as much as possible by squeezing in muslin, should take one-fifth their weight in fat and salads may be piled with dressing. Egg may be made rich by scrambling in butter, and butter melted can be used as sauce for white fish. Cream is preferable to milk and should be used as a substitute for it when possible. If carbohydrate foods are excluded there is more difficulty in getting the patient to swallow an adequate amount of fat. The use of alcohol at meals aids greatly in the digestion of fats, and some writers recommend the use of chalk (30 grams three times a day), with the same object. However, this is apt to produce constipation which is a thing to be carefully avoided in diabetes. In some cases it may be necessary to resort to the giving of cod-liver oil, in order to supplement the fat of the diet, but as far as possible this should be avoided

Carbohydrates. Green vegetables contain so little carbohydrate that they may be allowed in every case. Asparagus, celery, young rhubarb, tomatoes, brussel sprouts, cabbage, cauliflower, vegetable marrow, cucumbers, mushrooms, horseradish,

cranberries, lettuce, olives, onions, parsley, spinach, string beans and water-cress are in the list. If richer carbohydrate foods are allowed, bread and potatoes should be selected as the elimination of these from the diet is always keenly felt by the patient. Potatoes weight for weight contain only about one-third as much starch as bread and so may be given much more freely than the latter.

If one wishes to use the other carbohydrate foods instead of bread the following equivalents may be remembered to advantage.

2 oz of bread contains as much carbohydrate as 2 oz pea flour.
" " " " " " " " " " " " 1/10 of rice
" " " " " " " " " " " " 1/2 of oatsor maize
" " " " " " " " " " " " 1/5 of corn flour
" " " " " " " " " " " " 10 or 15 of sweet fruits
" " " " " " " " " " " " 40 of apples.

Iceland and Irish moss are often recommended for diabetes but they are devoid of nourishment, while mushrooms analyses indicate considerable proteid they are nevertheless useless to the body.

Albuminoids. The use of gelatin is permissable in all cases but the amount of nourishment which can be obtained is very small. Jellies of course must be made without sugar. They

can be sweetened with saccharin.

Special foods. As milk contains a form of sugar, its use in the dietary is questioned, some claiming that it can be assimulated, others, not. An exclusive skim milk diet has been used even in severe cases with good results. The maximum quantity allowed was twelve pints a day of fresh milk. However the general opinion is that the addition of milk to an ordinary diet causes a decided increase in the amount of sugar excreted. It is true, too, that even if the sugar excreted is increased the patient usually feels better and his weight rises. One can have all the advantages of milk without its disadvantage by getting rid of the sugar which it contains. The preparation is called diabetic milk. It tastes very much like cows milk and may be added to tea and coffee or made in a custard with eggs. The use of such milk will be found to be a very great aid in feeding diabetics, especially when they are unable to take much meat.

The subject of bread is an important one to the diabetic. There are many breads on the market which are more or less free from starch. The gluten flours often contain as much starch as

as ordinary bread. Other substances used for making bread are oily nuts, bran, soja bean and casein. The almond and nut breads contain a great deal of fat while the bran bread is a carrier of fat, while it serves merely as bulk. A casein bread which has been in use recently is entirely free from carbohydrate. If given in the form of toast it is taken quite freely by patients.

There are a number of substitutes for sugar of which saccharin is the best. It is a coal-tar product and hence not a sugar. It is seven hundred times sweeter than sugar. It is not a food and its continued use is liable to affect the digestive ferments by interfering with the breaking up of the food substances. Most patients after a while prefer to do without it.

Condiments may be used to any amount where the flavoring of the dish may be benefited.

Alcohol.- Brandy, whiskey, rum, gin, wine, claret sour cider and champagne are all used, the preference being shown for brandy. While brandy has a generally constipating effect with the diabetic, it does not prove so on account of the fat in the diet.

Beverages.- As thirst is one of the chief symp

toms in diabetes, water may be freely used. Citric acid lemonade (10 gr to pint sweetened with ½ oz glycerine or a little saccharin) is a pleasant thirst-quencher but aerated waters should be indulged in more sparingly. Tea and coffee may be allowed freely without sugar. Cocoa though often forbidden, contains so little starch that it is not likely to harm.

Fruits and nuts give a good variety to the diet. All nuts are allowed excepting chestnuts and the following fruits are allowed: apples (sour), apricots, blackberries, currants, gooseberries, grapefruit, lemons, oranges, peaches, plums raspberries, strawberries. Grape fruit and oranges are exceedingly popular and seem especially to agree with the diabetic. There is rarely a stage of the disease when an orange or grapefruit can not be given once a day.

The patient is usually hungry and for that reason frequent feeding is desirable. Several lunches should be introduced besides the three meals. Where carbohydrates are allowed meals may be arranged so that there will be one chief dish and a side dish in which the carbohydrate is used. In cases where two oz. of potato

and two ounces of bread are allowed, the diet may be made up of the following: meat two to six oz., bacon two oz., fish two to six oz., butter six oz., green vegitables 2 oz., eggs two oz., diabetic milk two oz., bread two oz., potato two oz., This diet contains eighty-five gr. of proteid, two hundred and twenty-five gr. of fat, which not allowing for the carbohydrate will be two thousand, five hundred calories.

The disease may be prevented by active exercise and hygienic living. Where there is a predisposition to the disease it is best to diet to some extent according to the above rules.