

Lecture.

ON DIET IN DIABETES.¹

A LECTURE ON ALIMENTARY THERAPEUTICS.

BY PROF. DUJARDIN-BEAUMETZ, M.D.,
Physician to the Cochin Hospital, etc., Paris, France.

IN the last lecture we had under consideration the hygienic treatment of gout and gravel. I propose to devote the present lecture to the subject of diet in diabetes. For the diabetic, diet constitutes the sovereign curative means, it being only by the application of rigid dietetic regulations, that we can, in a great number of cases, cause the disappearance of sugar from the urine; hence we need to spend considerable time on this subject. But in order to establish on scientific basis the alimentary regimen of diabetes, it is necessary that I should briefly sum up the data in our possession respecting the pathogeny of this affection.

Till the discovery of glycogenic function of the liver, and the immortal labors of Claude Bernard, the etiology of diabetes was involved in great obscurity. Claude Bernard gave us our first insight into the causes of this disease, and now, for almost forty years his pathogenetic doctrine, despite the most searching criticism, still remains master of the field.

Bernard showed us this capital fact that in the physiological state in all mammals and in man sugar is found in the blood. This is what he calls *physiological glycæmia*. When the figure of glucose in the blood exceeds certain limits—3 per 1000, it passes out in the urine and determines glycosuria.

Whence comes this physiological sugar? It has two sources: either it results from the food, or it is produced by the liver. In previous lectures, I have shown you that amylaceous substances when modified by the salivary diastase, and by a special ferment of the pancreas, amylapsin, enter the economy in the state of glucose, and that the sugars, inverted by the intestinal juice, also reach the circulation in the state of glucose. We have here a constant source of glucose furnished to the blood. When the quantity of these amylaceous or saccharine aliments is too great, all the glucose formed is not burned in the economy, the figure of physiological glycæmia is exceeded, and there results a temporary glycosuria, known under the name of *alimentary glycosuria*.

The other source of sugar is the liver. In 1848, Claude Bernard first called attention to a new function of the liver, and since then, on many different occasions, he has elucidated his important discovery and its practical consequences. The glucose contained in the blood deposits in the liver a substance similar to starch, *glycogen*, which, under the influence of an hepatic ferment, is transformed into glucose; this constitutes the glycogenic function of the liver.

The liver, with respect to physiological glycæmia acts the part of a regulator of this function. When too much glucose is furnished by the food, the liver stores up, under the form of glycogen, the excess which is not utilized. When elements suitable for making sugar are not furnished by the food, it is then that the liver furnishes it to the blood, so as always to maintain an equal quantity of glucose in the economy. But let some disturbance of a nervous order come in to modify the cellular exchanges in the liver, then

this organ makes more sugar than the normal proportion, and this excess enters the blood; the figure of 3 per 1000 is exceeded, and glycosuria results; in a word, hyper-glycogenesis produces hyper-glycæmia. Claude Bernard even realized experimentally this hyper-glycogenesis by wounding in animals certain parts of the fourth ventricle.

Such were the bases on which Bernard established the pathogeny of diabetes, and, as I told you in the beginning, physiologists have more or less modified this pathogenic doctrine, but without overthrowing it.

Thus it is that Pavy has denied the transformation of glycogen into sugar, is a physiological fact. According to him, (as also to Schiff, Meisner, Tschirnow and Seegen), this is a fact of pathological order; the glycogen accumulated by the liver, serving in the normal state, to make, not sugar, but fat. Bouchard, Jaccoud, Lecorché, and Esbach have also completed the doctrine of Claude Bernard.

Lecorché, to whom, by the way, we are indebted for an excellent treatise on diabetes, assigns an important part to the increased secretion of urea which almost always accompanies glycosuria. According to him, the liver in diabetic persons under an influence which escapes us, undergoes an exaggeration of its glycogenic functions. It now makes sugar, not only out of amylaceous and saccharine matters, but also from all sorts of albuminoid substances, and even from the muscles of the diabetic patients, transforming the albuminoid into glycogen and urea.

Jaccoud adopts the same view; he divides diabetes into two stages. At the onset, there is only glycosuria; then at a more advanced period there is azoturia and glycosuria; this is what he describes under the name of *azotized diabetes*.

On the other hand, Bouchard, returning to the notions of Dechambre, Reynoso, and Mialhe, who considered diabetes as due to insufficient utilization of the sugar produced, labors to show that hyper-glycæmia results from the fact that the organism does not accumulate the sugar incessantly furnished by the liver. He points out the fact that the liver produces daily about two kilogrammes of sugar, of which seven hundred and ninety-eight grammes only are burned by the respiration. The twelve hundred grammes remaining ought to be utilized by our tissues. Let some circumstance intervene to modify the molecular exchanges, these twelve hundred grammes of sugar will not be employed by nutrition, and glycosuria will appear. Hence Bouchard refers diabetes to the general troubles of nutrition, which he has described under the name of *retarded nutrition*.

Lastly, in a very original and quite recent work, Esbach has modified the theory of Claude Bernard. According to him, the diabetized liver produces a particular kind of glucose which loses the property of being destructible. He opposes this non-destructible sugar, which he calls *diabetose*, to the sugar furnished by the liver in the physiological state, to which he gives the name of *assimilable glucose*.

As you see, gentlemen, the new theories of the pathogeny of diabetes have but little modified Claude Bernard's doctrine. Basing ourselves on these data, we can establish on a scientific foundation the alimentary hygiene of the diabetic.

This hygienic treatment must fulfil the two following great conditions: On the one hand, it must reduce to their minimum foods, which introduced into the

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economy may furnish glucose, and on the other, energize as much as possible the combustion of the glucose formed in the economy.

But before entering into the details of this treatment, I must say a few words about the prognosis of diabetes. This prognosis is entirely based on the effects of an antidiabetic regimen rigorously followed. Never forget, in fact, that it is not the quantity of sugar voided daily in the urine which constitutes the gravity of the prognosis in diabetes; it is the greater or less facility with which the sugar disappears under the influence of diet.

In this respect we meet with three forms of diabetes which I have called *mild diabetes*.

DIABETES OF MEDIUM INTENSITY, AND GRAVE DIABETES.

In his interesting studies on diet in glycosuria, Duhomme has given to these three forms the names of simple uroglycosis, mixed uroglycosis, and complex uroglycosis.²

In mild diabetes, by the simple fact of an appropriate alimentary treatment the sugar disappears rapidly and completely from the urine, whatever may have been the quantity previously voided. I have for my part seen great numbers of diabetics who were losing daily from four to eight ounces of sugar, and who, after eight days of treatment according to Bouchardat, excreted none at all. It should be understood that in these patients the least infraction of diabetic rules brought back the glycosuria; these are the mild cases.

In diabetes of medium intensity, you will diminish considerably by rigid dieting the quantity of sugar voided, without, however, causing it to disappear entirely, and there will always be an amount in the urine varying between ten and twenty grammes. Bouchardat calls these cases "*petits diabétiques*, that is, *little diabetics*. Often certain medicines will cause, in these patients, complete disappearance of the sugar.

Lastly, in the grave forms of diabetes, whatever may be the rigorouslyness of your dietetic rules, the quantity of sugar eliminated is always considerable, and when the food which these persons eat does not contain the elements proper for making sugar, the substance of their muscles is transformed into glycogen and urea. These are the lean diabetics, the azoturic diabetics all condemned to a sure and speedy death.

As you see, the prognosis depends entirely on the results of diabetic treatment. What, then, should be the diet in diabetes? Exclusive regimens, have been proposed, and mixed regimens. The former are two in number; the adipo-carneous, and the milk regimen. Cantani has the most earnestly advocated a rigorous flesh and fat diet treatment; he allows nothing but meat and fat. The fats are designed to take the place of the carbo-hydrates, of which he deprives his patients entirely. The patient can eat no vegetable, no starchy food of any kind, and no eggs. Salt is permitted, as well as salt meats and salt fish. To this treatment, Cantani conjoins the usage of lactic acid. This is administered under two forms: as pure lactic acid, in the dose of fifteen to thirty grains in four ounces of water, and half an ounce of fennel water, three times a day, or in the form of an alkaline lactate, eight grains of bicarbonate of soda being

added to four ounces of the lactic acid solution above mentioned. This dose of lactate of soda is repeated every hour or every two hours. Lastly, at the end of a certain time, fifteen or twenty days, if the sugar is not all gone from the urine, Cantani orders a twenty-four hour's fast.

Cantani's treatment has had few partisans, and this for several reasons. First, by reason of the repugnance of patients to eating nothing but meat and fat, a repugnance such that many of these prefer to remain diabetic rather than persevere with such a diet. Moreover, an exclusively meat diet notably augments the azoturia of these patients, already predisposed thereto by the fact of their diabetes. Likewise the uric acid gravel with which many diabetics are affected is markedly aggravated under this regimen. In fact, if we may trust Jaemiche, Caplick, Bond, Windl, and Ebstein, the meat diet determines the presence of acetone in the urine and thereby favors acetonæmia in the diabetic.³ I discard, then, for these reasons the exclusive adipo-carneous regimen.

Donkin, an English physician, was the first to advise an exclusive milk diet in diabetes. This is his method of treatment; he begins with four to six pints of skim-milk a day, and gradually increases to twelve pints. Of these twelve pints, seven or eight only should be taken liquid, the rest is ingested in the state of curds. The milk should be drunk tepid. At the end of a fortnight, according to Donkin, the sugar will have completely disappeared from the urine.⁴

I do not know whether cases of amelioration obtained by this method are numerous; Kultz, who has tried it, affirms that he has derived no good result. For my part I think it a dangerous treatment. Just think of giving to a polydipsic patient six quarts of milk a day! Think of giving him, moreover, a substance which contains a notable quantity of sugar! Such treatment can but aggravate the malady. I have always seen in diabetic patients that were allowed to drink freely of milk a marked augmentation of their glycosuria, and like Bouchardat, I discard milk from the dietary of the diabetic.

We are indebted to Bouchardat for the principle of the mixed alimentary treatment of diabetes, and in formulating these principles in so exact and practical a manner, my venerated master has earned the gratitude of the entire medical profession, for now we are able by diet alone to cause sugar entirely to disappear from the urine in a great many cases, and in all we obtain a marked amelioration.

In order that you may sufficiently grasp the importance of this regimen, I will consider it under three heads: bread, drinks, and foods allowed and forbidden.

Bread is an aliment which may well be called indispensable, so accustomed are we to it from our earliest childhood, and the introduction of gluten bread into the dietary of the diabetic, for which we are indebted to Bouchardat, is one of the most important parts of this alimentary regimen. Many patients, in fact, refuse to eat when bread is not given them, and you should not forget that voluntary or involuntary abstinence is always prejudicial to diabetic patients. Habitually gross eaters, the diabetic have need of a reparative and substantial diet, and when you come to cut off the necessary supplies of food, grave symptoms

³ Ebstein. Arch. f. Klin. Med., xxx, 1881. Cantani. Du Diabète Sucre, Paris, 1876.

⁴ A. Scott Donkin, in Lancet, 1877. Kultz. Experimentelles über Diabetes, (in Deutsch. Zeitschr. f. prak. Med., 1876, p. 150-152).

² Duhomme. On Diet in Glycosuria. (Bull. et Mém. de la Soc. de Thérapeutique. Séances des 23 Nov. 1881, 14 Mars., 1883, 13 Jan. 1886).

on the part of the patient are almost sure to supervene; he grows feeble, emaciates, and becomes a suitable culture soil for bacilli to thrive in. You ought, then, as far as possible, to respect the appetite of diabetic patients, and do nothing to impair it, and this is one of the causes which have led us to abandon the exclusive regimens.

Bread is an alimentary necessity, and you will recognize this fact by ordering gluten bread. But gluten bread is of variable quality, some bakers having more starch, some less in their gluten bread. The French gluten bread, which is dried in slices, contains the least proportion of amylaceous principles. Bouchardat was prone to order Cormier's brand. This kind of bread, however free it may be from starch, and however well it may fill the indications, often fails to satisfy the patient, who is apt to fancy most the bread which contains the least gluten. I am told that the Health Food Company of New York⁶ make an excellent flour, which retains well the salts of the wheat, while being comparatively free of the starch.

It is quite a common thing to see diabetic patients, who, despite the augmentation of glucose in their urine, affirm that they have not transgressed their dietetic rules. I have generally found, in the case of such patients, by pressing my inquiries, that they had been substituting for the gluten bread which I had prescribed a preparation like the French rusks (*échaudé*), which contains considerable starch. This is a great mistake; there is not much difference between this latter product and ordinary baker's bread, the former containing 54.1 per cent. of starch, and the latter 56 per cent.

It has been proposed to replace ordinary bread by almond bread, and this substitution has been especially recommended in Germany. If these almond loaves or cakes constitute a kind of bread that may be taken with safety by the diabetic, they are certainly not very palatable, and in France we make little use of them.

Dannecy, of Bordeaux, has proposed a mixture of bread-crust and meat-powder. Others, taking advantage of the difficulty which most diabetic patients experience in masticating their food, on account of bad teeth or the want of teeth, have advised bread-crust or toasted bread. Esbach, in a late article in the *Bulletin de Thérapeutique* (t. CIV., p. 201), has, however, shown that in equal weights, the crust of bread contains more sugar-producing substance than the crumb, and that it is a mistake to prescribe crust for the diabetic. The following table from Esbach sets this clearly before you:

	Sugar.
100 grammes of crust of ordinary bread produce	76 grammes.
100 " of crumb of ordinary bread produce	52 "
100 " of ordinary gluten bread furnish	18 "
100 " of good potatoes, boiled, give	17 "

I call your attention especially to the statement with reference to potatoes, which seems to me a little exaggerated, if we may trust the analyses furnished by Mayet, who maintains that 100 parts of cooked potatoes (baked, it is true, not boiled) yield only 8.30 of sugar, while 100 parts of gluten bread yield 27 parts.

I cannot too much insist on the utility of potatoes in the diet of diabetic patients who cannot dispense with bread. Of all amylaceous food substances, pota-

atoes contain the least starch, and for that reason, produce the least sugar, and the difference between gluten bread and potatoes is so greatly in favor of the latter, that you will do well, in most cases, to subject your patients to the English regimen, that is, suppressing bread, and substituting baked potatoes.

The subject of drinks is also one of importance, polydipsia being one of the results of this disease. Many victims of diabetes become intemperate, and this happens the more naturally, that they resist better than others the effects of alcoholism. Persuaded that they will find in alcoholic beverages a tonic which they need, they drink their wine pure, or mix brandy with their water. The quantity which they add may be small, it is true, but as the spirituous draught is constantly being repeated, a large amount will have been imbibed by the time the day is done.

In fine, so strong is the temptation to indulge in "bitters" and other liquors under which the diabetic patient labors when walking along the thoroughfares where drinking-saloons abound, that he is in danger of becoming an inveterate tippler. One of my preceptors, the late Chassaignac (I have had three who were diabetic), has often told me that he suffered a veritable Tantalus punishment when going through the public streets, and seeing in full view the liquor saloons and the tipplers inside, and notwithstanding the possession of a strong will, he found himself continually yielding to the propensity to quench his thirst at some of the drinking-booths which he passed.

I believe, then, with Bouchardat, that we should restrict as far as possible the use of alcoholic drinks in glycosuria. The patient should be allowed to drink freely, at his meals, of wine diluted with some alkaline mineral water, but he must not be permitted to drink between meals. If he must have something to quench his thirst, let it be weak tea or coffee, without sugar or milk, or some mild bitter ptisani, like infusion of chamomile or quassia. I prescribe milk for reasons I have before mentioned.

I come now to foods that are permitted, and those that are forbidden. In order to guide you in the choice of foods proper for the diabetic, and such as should be interdicted, you should always have before your eyes the following table, which shows the proportion of starch or saccharine material in various alimentary substances. I borrow the first of these tables from Dr. Nedats. Table I, gives you the proportion of starch in the principal amylaceous aliments:

	Per Cent.		Per Cent.
Rice	74.10	Wheat Bread	42.70
Corn meal	65.90	Oatmeal	39.10
Wheat flour	63.00	Peas	37.00
Wheat (unground)	59.60	Rye bread	35.25
Rye meal	59.84	Beans	36.00
Millet seed	57.90	Cucumbers	16.60
Buckwheat	50.00	Potatoes	15.50

You can compare this table with the following by Boussingault, the first column showing the per cent. of vegetable, albumen, gluten, legumin and the like; and the second column the per cent. of starch, dextrin, and the like principles.

Round gluten biscuits	44.9	40.2
Gluten cakes	21.3	64.7
Barley bread	18.9	66.6
French rusks	10.9	51.3
Maccaroni	9.5	76.4
Sago	9.1	74.7
Bakers bread of Paris	7.0	56.3
Rice	7.5	76.0
White Beans	26.9	48.8
Lentils	25.0	55.7
Peas	23.8	55.7
Potatoes	2.8	23.2

⁶ A reliable chemical examination of the diabetic biscuits sold by this Company showed that they contain 74+ per cent. of sugar-forming material, and under the microscope, the field was crowded with starch granules. This percentage of sugar-forming material is even higher than that of ordinary fresh bread, the moisture of which counts for much. Diabetics, or their advisers, had better have all so-called "diabetic foods" carefully examined before using them.

Lastly, Mayet has given in terms of sugar the quantity of starch contained in 100 parts of the following amylaceous substances, and these are his figures:—

	Per Cent.		Per Cent.
Turnips	7.00	Lentils	22.03
Baked potatoes	8.30	Rice cakes	25.00
Boiled rice	8.00	Fresh gluten bread	27.07
Peas	12.00 to 15.00	Vichy Company bread	31.00
Beans	16.00	Ordinary bread	60.00
Carrots	16.00	Wheat meal	70.00
Chestnuts	20.00	Starch	83.00

Stews may be permitted with some limitation, especially such as are fatty, and "bouillon" with poached eggs. Broth made with vegetables, and in particular with onions and cabbages is allowable, as well as "Julienne" soups, but neither turnips nor carrots must enter into their composition. You will also allow broth made with potatoes, to which beets may be added, but you will forbid pea-soup, and bean-porridge, also stews containing dumplings. Custards are also to be prohibited, as also other culinary preparations containing milk.

All kinds of meat are allowed, that is, the flesh of animals, fish, mollusks and crustaceans. Sauces which contain flour are to be interdicted, also those into which milk or cream enters as an ingredient. You will also forbid fish fried in meal.

All kinds of fatty foods are permitted; they may even be eaten very freely in order to furnish to the economy the carbo-hydrates that are necessary. All kinds of amylaceous and saccharine materials are, as before said, to be interdicted, except potatoes, which are even better for the diabetic than gluten bread.

The exclusion of sugar, as I have told you, is absolute, but there are some patients that cannot get along without some sugar; in such cases you can allow them to sweeten their tea, coffee and lemonade with glycerine.

Vegetables are permitted in the regimen of diabetes, and Bouchardat has always insisted on the disadvantages of an exclusively animal diet in this disease. Vegetables are useful because they give variety to the diet of the diabetic, and because they furnish a valuable element, potash, to the economy. Boussingault has, in fact, shown that one kilogramme of the following vegetables contains potash in the proportion here given, the figures indicating grammes:

Cabbage	2.6	Beets	6.8
Chicory	1.7	Potatoes	3.2
Turnips	3.7	Spinach	4.5
Carrots	2.5		

Taking, then, as your guide the foregoing tables, you will order spinach, sorrel, beans, lettuce, cabbage, asparagus, celery, artichokes, dandelions, all the salads, etc. But you will forbid beets, carrots, and turnips, by reason of the sugar which they contain, and you will caution the patient to be chary of onions, leeks, and cooked artichokes. There remains the question of fruits, and in general they ought all to be proscribed. In fact, if you will refer to the analysis of Mayer, and which I place before you, you will see the large quantity of glucose which fruits contain, and with the exception of currants, they ought to be, as a rule, rejected.

PERCENTAGE OF SUGAR IN CERTAIN FRUITS.

Currants	1.50 to 18.00	Figs	10.00
Melons	7.50	Prunes	16.00
Raspberries	8.00 to 10.00	Dried prunes	42.00
Oranges	10.00	Dried figs	71.00
Cherries	10.25	Raisins	79.00
Peaches	10.50		

Such are the indications which will enable you to

decide upon the diabetic rules applicable to diabetes. These rules should be followed to the letter, and for a long period, if not during the entire life-time. Often repeated analyses of the urine, will enable you to decide how far the patient may return to his ordinary fare, also to ascertain if your rules are rigorously carried out, the least enfraction of them always producing an increase of the sugar excreted in the urine. Moreover, it will be your duty to point to the patient the great importance of this strict regimen, by which you will be able in a great many cases to clear the urine of sugar, and in all, to obtain a marked amelioration.

But dietetic rules do not alone constitute the hygienic therapeutics of diabetes. We must add varied muscular exercises, to which I shall refer when I come to speak of gymnastics and massage, and which have a large share in the results of the treatment, by enabling us to fulfil the second part of the therapeutic problem which we have to work out, namely, how we may best forward the combustion of glucose existing in excess in the blood.

Original Articles.

A CASE OF UNUSUAL DEFORMITY OF BOTH HIP JOINTS.¹

BY G. H. MONES, M.D.

THE patient, F. M., is a young man of sixteen years. He came to me some months ago at the Carney Hospital, complaining of pain and stiffness in both hip joints, from which he stated he had suffered for about two years.

On examination of the hip-joints it soon became evident that some unusual pathological process had been at work. As the patient stands facing you (see Fig. 1), you will notice that he is apparently well nourished, and that his muscles as a rule are well developed. The right side of the pelvis is slightly higher than the left, and the right trochanter projects somewhat more than its fellow. At a point about two and one-half inches below the anterior superior spine of the ilium on the right side is a rounded projection; on the left side is a similar one, but less marked. These projections are both on a lower level than the trochanters. The muscles of the thighs are not well enough developed to be in keeping with the rest of the body. There is knock-knee on both sides, particularly on the left, and both feet are flat.

The eversion of the right foot shows that the thigh on that side is strongly rotated out: the left foot is also somewhat everted.

If the patient be turned to the side (see Fig. 2) the first peculiarity noticed is the flattening and almost complete obliteration of the lumbar curve. The distance between the lower margin of the thorax and the crest of the ilium is considerably shortened, a fact easily appreciated by the touch if not by the sight. The trochanter occupies a position too high up and too far forward to be natural, and this observation has been verified by comparative measurements of the same parts on normal bodies.

The axis of support appears, therefore, to be too far forward, and the back part of the pelvis to be somewhat depressed by the weight of the body resting upon

¹ Read before the Suffolk District Medical Society, October 30, 1886.