

pass now to the consideration of the hygienic and medicinal means applicable to the treatment of diabetes.

The dietetic treatment of diabetes deserves the first place. Ever since John Rollo, at the end of the last century, first called attention to the influence of foods in the production of glycosuria, all authorities have felt the obligation to regulate rigorously the diet of diabetic patients. At their head is Bouchardat; after him I will mention especially Seegen, a German writer, and Cantani, an Italian, and what I have now to offer respecting the hygienic régime of this affection will be based on a careful study of the contributions of these three men.¹

The hygienic treatment is founded on the endeavor, as far as possible, to exclude from the food all substances capable of forming glucose. This glucose may be derived from sugar in the ingesta, or from starch which has undergone conversion in the alimentary canal. These glycogenous principles, then, should be suppressed. All this, however, though simple in theory, is difficult in practice.

I told you in a former lecture, when on the subject of Digestion, that an adult man loses by day 20 grammes of nitrogen and 310 grammes of carbon, and that in order to avoid emaciation he must obtain in his food this quantity of nitrogen and carbon; it is well always to have these figures before you when you wish to lay down dietetic rules for your diabetic patients. The 310 grammes of carbon are furnished by sweets, feculents and fats, and the suppression of the first two of these alimentary substances must considerably modify the conditions of alimentation. For, in order to suffice for this combustion of 310 grammes of carbon, if a man eats nothing but meat, he must consume two kilogrammes, so that a diabetic patient confined to a diet exclusively of animal food must be made to eat about four pounds a day! This enormous amount of meat is not without its inconveniences; by the quantity of nitrogenous material not utilized it augments waste-production, and provokes lithæmia; it moreover fatigues unduly the functions of certain portions of the digestive tube.²

Therefore Cantani, while suppressing entirely sugar and starch, has replaced these principles by fat, establishing thus what he calls *adipo-albuminous* diet; but as sometimes these oleaginous substances, which ought to be absorbed in great quantity, are of difficult digestion for certain stomachs, he first submits

¹ Rollo, on Diabetes Mellitus, London, 1790. Seegen, on the Diet Cure of Diabetes (Wien. med. Woch., 1873). Bouchardat, du Diabète-Sucrè, Paris, 1875. Cantani, on the Diet Treatment of Diabetes, 1876.

² Bloch has studied the action of régime on diabetic patients. He has shown that animal food is capable of diminishing the proportion of sugar in the urine without causing it to disappear; fasting has the same effect; and, moreover, the absorption of fats is very active in diabetic patients. So, according to him, a flesh diet, while causing sugar to disappear, hastens denutrition. (a)

(a) Bloch, Absorption of Fats in Diabetes, etc., Deut. Arch. f. Klin. Medicin, Bd. xxv., Hft. 4 and 5, p. 470, 1880.

them artificially to the action of the pancreas, and administers to his patients *pancreatized fats*.

The régime of Cantani is difficult to follow in all its rigor; there are so few who can for a series of months subsist on meat and fat alone, for Cantani aims to have this adipo-albuminous diet continued till the complete disappearance of sugar from the urine.¹

¹ This is the alimentary régime of Cantani:

Broths. Made with any sort of meat.

Beef. Muscle, brains, tongue, etc.

Veal. The muscle, all the internal organs, brain, sweet-bread, lungs, kidneys, but not the liver.

Mutton. The same as above.

Fowl and game of all kinds. Fish, frogs, and crustaceans.

Salt or canned meats or fish, but in moderation.

All the above may be either boiled, roasted, broiled, or fried in fat, and salted to the taste. They may be seasoned, but no sugar or starch must enter into the composition of the seasoning ingredients; also no wine, vinegar, butter, or lime juice. Olive oil and animal fats may be used freely, and dilute acetic acid may be substituted for vinegar, and citric acid for lime juice.

The quantity of food should be about 600 grammes a day, of cooked meat, and more if the scales show that the patient continues to emaciate.

In cases where denutrition is very pronounced, in very lean patients, 60 to 200 grammes of *pancreatized fat* are given daily; this is prepared as follows: Cut into small pieces the fresh pancreas of a beef creature or sheep, intimately blend with it a small quantity of fat, and leave it for three hours or so submitted to this artificial digestion, then cook slightly.

Drinks. Water, pure, or artificial seltzer water, to which from 10 to 30 grammes daily of rectified spirits may be added, and some aromatic waters (fennel, canella, balm, mint, orange) if desired.

If, after a month's trial, this régime does not cause the glycosuria to disappear, it will be best to make the patient fast 24 hours, taking nothing but water and some rich broth. Then the above regimen is resumed, but in half the quantity; little by little it is increased till the normal quantity is attained. But if the glycosuria reappears, another day of fasting, then the half diet again; which is not to be increased, unless the scales show that the patient is losing flesh.

In very recent cases, or cases of little gravity, eggs may be permitted, the liver of animals, cod-liver oil (two to four ounces a day), and shell fishes, such as oysters, snails, and clams. A little old red wine (Bordeaux wine is the best), a little tea or coffee without sugar.

Exercise in the open air, gymnastics, muscular labor; this régime should be rigorously persisted in for two months at least in light and recent cases; for three, six, and even nine months in the severer cases.

The return to saccharine and amylaceous articles of diet should be gradual, in accordance with the indications given below.

The following aliments may be permitted to a diabetic patient who for two months at least has had no sugar in his urine:

Gradual return to a mixed diet. Spinach, chiccory, endives, water-cresses, lettuce, dandelion, corn salad, olives, etc.

A little later. Chards, white beets, celery, artichokes, leeks, truffles, mushrooms.

A month after. Sweet almonds, nuts, pistachios, a little red wine.

Still later. Gooseberries, peaches, apples, and other fresh ripe fruits, fresh cheese, butter, etc. Little by little vegetables abounding in starch, such as potatoes, are allowed.

During the entire duration of this return to a mixed diet the quantity of these permitted aliments to be very moderate, and, on the least reappearance of glycosuria, the meat régime

Hence the dietetic régime of Bouchardat² is more generally adopted; the principal characteristics of this alimentary system consists in the substitution of gluten for starch, and in the employ of gluten-bread.³

This question of bread is of great importance. Habituated from their infancy to this sort of aliment, bread is to some persons quite indispensable, so that it is hardly possible for them to make a meal without it. This with our diabetic patients is a feeling which ought to be overcome. Insufficient alimentation is with these patients one of the gravest evils. You may by severe diet-restrictions cause sugar to disappear from the urine, but it is at the expense of the well-being of the entire organism. So your efforts ought to be directed toward instituting a regimen which, while excluding starchy and saccharine elements, may satisfy in a certain measure the taste and appetite of your patients.

Gluten bread and gluten cakes have been given to diabetic persons. Unhappily the mode of preparation of this kind of bread is not always what it

must be resumed in all its rigor. As for cane sugar, it must be absolutely prohibited at all times. (a)

² These are the general precepts of Bouchardat concerning the dietary of glycosuric persons:

Eat moderately and slowly; food should be well masticated.

As long as the quantity of urine passed in 24 hours exceeds a quart and a half, drink as little as possible.

Eat sparingly of liquid food, such as soups, broth, consommé; take your drink in sips: the sensation of thirst can sometimes be alleviated by simply rinsing the mouth with ice-water; if ice-water is drunk, let it be taken only in sips.

Combat the sensation of thirst by chewing parched corn, roasted coffee, or olives.

Two meals a day are preferable to three; let the one be at 10:00 a. m., the other at 6:00 p. m. Eschew repose, and especially sleep after meals; a good long walk after the repast is beneficial.

Never lie down for four or five hours after the last meal.

Abstain as far as possible from the use of tobacco.

As for aliments, avoid feculents and sugars.

Abstain from bread of cereals, pastries, rice, maize, potatoes, arrow-root, sago, tapioca; the starchy parts of all vegetables; peas, beans, lentils, nuts of all kinds, radishes, turnips, carrots, squashes, all kinds of fruit, and especially the saccharine fruits, such as prunes, grapes, figs, bananas, pears, apples, melons, should be interdicted; the same may be said of preserves of all sorts and all acidulated or saccharine drinks.

Wheaten or rice flour should not be employed as an ingredient of gravies and sauces; but gluten flour, yolks of eggs, butter or cream should be used instead. (b)

³ It was in 1841 that Bouchardat first called attention to gluten-bread. To obtain gluten the flour is first washed for some time (20 minutes to several hours, according to the purity of the flour) in a metallic sieve, No. 120. A paste is first made, and it is this paste which is submitted to constant irrigation. The fresh gluten thus obtained equals about one fourth the weight of the meal employed. The gluten should be used fresh and made into bread or cakes for glycosuric patients.

Boussingault and Mayet on analyzing the gluten cakes and this flour have shown that they still contain a considerable proportion of starch; from 16 to 44 per cent.

Bran bread has been highly extolled by Camplin in the treatment of diabetes. (Camp-

(a) Cantani, Du Diabète et de son Traitement, traduction Charvet. 1880.

(b) Bouchardat, Traité sur le Saccharine Diabète, Paris, 1875.

should be, and when these culinary products have been analyzed, as they have been recently by Boussingault and Mayet, it is seen that they contain from ten to 40 per cent. of starch. Therefore there has been a disposition to substitute for bread of gluten badly prepared, bran bread, as recommended by Camplin, or bread or biscuits of sweet almonds, as Kronser and Pavy have advised, or bread made of parched flour after Dannecy's formula, or the bread which Dahmen counsels.

You would do well, gentlemen, to use all these products, as well as the crust of ordinary bread and stale bread, for it is not so much the amount of starch and sugar contained in bread that is to be taken into account as the quantity which the patient eats. The dry gluten bread recommended by Bouchardat and the almond cakes and the bran cakes being generally hard and firm, the patient, whose gums are almost always affected with that diabetic gingivitis which loosens the teeth, is able to eat but a small quantity, and this is the reason why I prefer bread crust or hard, stale bread, for the patient can eat but a little of it. Add, moreover, that gluten bread is much less agreeable to the palate than ordinary bread, and that this circumstance contributes to minimize the quantity of this kind of food taken with meals.

Pastries ought absolutely to be prohibited. Do not forget, in referring to the interesting analyses of Boussingault and Mayet, that there is an alimentary preparation, *échaudé* or *simnel*, which has as much starch as ordinary bread (the first containing fifty-three and the second fifty-five per cent.), and this should be proscribed. Other kinds, as *brioche*, may be permitted as including no more starch than the gluten biscuits, or about forty per cent.

These same analyses enable us to establish a diabetic régime from the point of view of feculents; potatoes, turnips, and rice contain relatively a small proportion of sugar (seven to eight per cent.), while gluten bread has 27.70 per cent.; hence the former are less objectionable in this respect than the latter. But I repeat, all depends on the quantity of these aliments taken by the patient. If the diabetic eats largely of potatoes, notwithstanding the small quantity of

lin, on Diabetes and its treatment, London, 1864.) This is his recipe for bran cakes: Take three ounces of wheat bran, three fresh eggs, two ounces of butter, one pint of milk, stir well together, and flavor with nutmeg or ginger. Place this dough in hot cast-iron baking pans, well buttered, and put in an oven for half an hour. Eat these biscuits instead of ordinary bread.

Pavy's bread of sweet almonds is made by first treating the almonds, reduced to fine powder, with boiling water slightly acidulated with tartaric acid, which deprives them of six per cent. of sugar. Of the paste thus obtained biscuits are made.

Dahmen's bread is made as follows: Soak wheaten groats half an hour in cold water; knead the dough thus formed in a stream of cold water, desiccate the glutinous residue, and triturate in a mortar. Take 165 grammes of this powder, mix thoroughly with one third quart of sour milk, add 125 grammes of melted butter, ten eggs, a little salt, and some carbonate of ammonia. When this mixture has acquired a pasty consistency place in French roll pans, well buttered, and consign to a hot oven till well cooked. (a)

(a) Berlin. klin. Woch., September, 1880.

sugar in them, he will obtain the same amount of sugar as if he were to eat sparingly of gluten bread.¹

As for soups, I would advise you to keep clear of those made with gluten grains, as well as all rich broths. Here Boussingault has given us interesting facts showing that there is a large percentage of feculent matter in these soups.

As for green vegetables, I think that they may safely form a part of the dietary of diabetic patients, and in this opinion I am supported by Bouchardat. Water-cresses may be freely indulged at meals, also dandelion greens, artichokes, spinach, celery, cooked salads, etc. I know that green vegetables include notable quantities of saccharine matters, but they contain also potash, which is good for diabetic patients.

As for fruits, you should be very chary in their employ. The analyses of Mayet are very conclusive in this regard. Nevertheless, melons, raspberries, gooseberries, and even oranges may be permitted under certain restrictions.²

As for alcoholic beverages, there are certain which are permitted, and others which are forbidden. Champagne, malt beer, and ale are interdicted; the same may be said of the effervescent, non-intoxicating drinks, lemonade, ginger beer, etc. Bordeaux and Bourgogne wines may, however, be allowed, as well as coffee and tea without sugar.

But you must avoid the deleterious effects of alcohol on the economy. A great many diabetics, to satisfy their intense thirst, drink great quantities of wine and other alcoholic preparations. Such excesses are very detrimental. Bouchardat would limit diabetic patients to one quart of wine a day.

¹ Amount of sugar in 100 grammes:

Turnips	7.00.	Lentils cooked and drained	22.50.
Baked potatoes	8.30.	Rice cake	25.00.
Rice (cooked in water)	8.00.	Fresh gluten bread	27.70.
Peas (boiled)	12.00.	Lancry's gluten bread	31.15.
Pea soup	15.60.	Bread of the Vichy Company	31.00.
Beans	16.00.	Ordinary bread	60.00.
Carrots	16.60.	Ordinary flour	71.00.
Chestnuts	20.00.	Ordinary starch	83.00.

² The analysis of Boussingault shows that cabbages, chiccory, turnips, carrots, beets, potatoes, and spinach contain from two to four per cent. of potassa.

The analysis of Mayet shows that the following fruits contain the per centage of glucose herewith given:

	In 100 grammes.		In 100 grammes.
Gooseberries.....	1.50 to 8.00.	Peaches	10.50.
Melons	7.50.	Figs.....	15.00.
Raspberries	1 to 8.00.	Prunes.....	16.00.
Oranges	10.00.	Dried prunes.....	42.00.
Cherries	10.25.	Dried figs.....	71.00.
Dried raisins	76.00.	(a)	

(a) Mayet, Note on Sweet Fruits from the Point of View of their Introduction into the Dietary of Diabetics, Union Med., 1873.

This subject of drinks is a very important one, for it is a pressing indication to diminish the excessive thirst which plagues diabetic patients, and many of them will keep demanding of you what they shall drink. I am much in the habit of ordering Vichy water, or water holding in solution from five to ten grammes of Seidlitz salts, or even mild bitter infusions, as of cinchona, hops, quassia, camomile, but it is well to urge the patient not to yield to his thirst, but to combat it as far as possible.

Apropos of these beverages I ought to mention the employment of glycerine in the treatment of diabetes. This triatomic alcohol gives good results in this disease, if we may trust to the experience of Schultzen, Harnach, and Holtz. In fact in the case of those patients who cannot tolerate the entire suppression of sugar in their drinks glycerine may sufficiently replace it, but it is necessary to protest against the large doses which have been recommended, but we have demonstrated (Audigé and myself) that glycerine may become toxic. (a)

Therefore, to recapitulate, these are the rules on which you should found the alimentation of diabetic patients; total abstinence from sugar and from sweetened food; diminution as complete as possible of amylaceous substances; animal food and fresh herbs, care being taken to select such vegetables and such feculent articles as have the least quantity of saccharine matters; almost entire abstinence from bread; Bordeaux wine, bitter drinks; no distilled liquors nor sweetened beverages.

The diabetic invalid, habituated to good cheer, or ordinarily a high liver, will ask of you not only general indications but also particular details respecting the manner of varying his daily bill of fare. You will be able to satisfy this demand by consulting the "menus" of Bouchardat, that I place in part before you,² and which should guide you in the choice of your culinary preparations.

¹ Schultzen, of Dorpat, has counseled the use of glycerine in diabetes, which he considers a powerful adjuvant to the ordinary alimentary regimen. The same may be said of Garnier; both give twenty to twenty-five grammes (or somewhat less than an ounce) daily. Harnach recommends still larger doses, from 180 to 360 grammes a day (or from six to twelve ounces), and affirms that these quantities have no injurious effect, have no influence on the amount of sugar eliminated, and rather favor the amelioration of the patient. Holtz believes that glycerine has not merely a neutral effect as far as the glycosuria is concerned, but that it decidedly lessens sugar excretion. (b)

² [The "menus" of Bouchardat are omitted, as being more applicable to the gourmands of France than of this country. In brief, soup with cabbages and leeks, without bread or flour, are permitted, also rich broths with gluten crackers. Meats of almost all kinds are allowed, with *hors d'œuvre*, as before given (*vide supra*); eggs, shell fish, salads, and *entremets* of gluten cakes, waffles of gluten flour or pure bran, jelly with rum, *kirsch*, or coffee without sugar, omelets with rum (not sweetened), and vanilla. He also specifies as allowable, among the *entremets*, artichokes, cabbage with salad oil, griddle cakes of gluten flour, with

(a) Dujardin-Beaumetz and Audigé, on the Properties of Glycerine. (Bull. gen. de Ther., t. xci., pp. 51 and 135.) Also, Experimental Researches on the Toxic Power of the Alcohols. Paris, 1879.

(b) Garnier, on Glycerine in the treatment of Glycosuria, Comp. Rend. de l'Acad. des Sc., 10 Mai, 1875. Harnach, on the Treatment of Diabetes by Glycerine, Deutsch. Arch. f. klin. Med., vol. xv., p. 449. Holtz, Ueber Diabetes, Petersburger. Med. Woch., No. 3, 1880.

but do not forget that the rules which I have just prescribed, and which have been also adopted by Seegen,³ are not absolute, and that you will be compelled in many circumstances to make compromises in the rigorous application of this dietetic regimen, for if it is dangerous for a diabetic to eat feculent and saccharine substances, it is more so to see him reject all kinds of food with disgust. In fact I cannot do better than to remind you of what has taken place in our female wards, where we had lately occupying No. 1 a lady patient suffering from the grave form of diabetes, and whom we have sent to Vichy. This woman, much emaciated, was losing more than 400 grammes of sugar a day. We desired to submit her to an exclusive regimen of meat and herbs, but she could not make a meal without bread, and gluten bread, as well as other kinds of hard bread, were intolerable to her. Therefore this privation of bread had resulted in loss of appetite, and if under the influence of abstinence we indeed did see the sugar diminish, we observed at the same time a circumstance of great gravity, namely, enfeeblement of the forces. On this account we yielded to the desire of the patient, and allowed her a small quantity of bread with each meal. What we did you will often have to do, but take care always to test the results of your dietetic prescriptions by daily analyzing the urine, and in this analysis the saccharimetric process of Duhomme will render you great service in enabling you expeditiously to examine each day the effects of alimentation. The hygiene of the diabetic does not exist exclusively in attention to diet, it is necessary also by physical exercises, varied and multiple, to energize the combustion of hydro-carbonaceous matters. Here, moreover, it is Bouchardat⁴

Parmesan cheese; chicory, lettuce, and other herbaceous vegetables; asparagus, spinach, mushrooms, etc. If tea and coffee (which should never be sweetened) have no influence favoring the glycosuria they may be indulged in. Alcoholic liquors should be used with great moderation. Of wines (a quart a day for a man, a pint for a woman), choose the old red wines or the old white wines (Madeira, Chablis, Pouilly, Sauterne, Rhine, etc.)—TRANS.]

³ The alimentary régime of Seegen is very similar to that of Bouchardat, only it is more strict. He allows without restrictions all meats, all kinds of fish, mollusks, and crustaceæ, gelatine, eggs, cream, butter, cheese, pork, spinach, lettuce, chicory, asparagus, pumpkins, cresses, artichokes, mushrooms, nuts, and among the beverages, soda water, tea, coffee, Bordeaux and Rhine wine, and all the other wines such as are mostly devoid of sugar and alcohol. He also permits in small quantity, cauliflowers, carrots, parsnips, cabbage, green beans, raspberries, gooseberries, strawberries, oranges and sweet almonds; in very trifling quantity, milk, cognac, bitter ale, milk of almonds, lemonade without sugar. He absolutely forbids all farinaceous substances (except a very small quantity of bread, which the physician may permit in certain instances), sugar, potatoes, rice, tapioca, sago, arrow root, semoule, legumes, green peas, beets, sweet fruits, especially grapes, cherries, peaches, prunes, apricots, and all dried fruits, sweet and frothy wines, sherbet, cocoa, chocolate, etc. (a)

⁴ These are Bouchardat's views respecting exercise:

Considering the importance of exercise, it is well to recommend such exercises as will tempt the patient to indulge in them every day.

Among these we recommend to persons fond of the chase, fencing, military exercises, rowing, skating, lawn tennis, ball playing, billiards, croquet; in a word, all the active sports,

(a) Seegen on Saccharine Diabetes. Leipsig, 1870.

who has furnished the best indications to follow in the forced exercise of diabetic patients, and you will find described with a great deal of humor the main features of these forced exercises in the spirited work of Jules Cyr. All that can augment the forces of the economy ought to be employed in these cases, and it would be well to vary these exercises according to the needs of the patients. Gymnastics, fencing, forced marches, work in the garden, manual exercise, carpentry, all have their place and their use. You may even add to these means, inhalations of oxygen, baths of compressed air, inhalations of compressed air, in a word, all measures which may increase the organic combustions in rendering more active the respiratory functions. In fine, Bouchardat has also insisted on the necessity of special attention to the functions of the skin. You know, in fact, that in grave cases of diabetes the skin becomes dry and rugose, hence warm baths followed by massage are useful in such cases, and may be taken two or three times a week.

With this hygienic treatment you can in mild cases cause the glycosuria absolutely to disappear. In diabetes of medium intensity you will considerably lower the amount of sugar, but you will have to conjoin certain medicines, and it is these medicaments which I am now going to consider. I propose to pass rapidly over the pharmaceutical agents whose medicinal action in diabetes is not satisfactorily demonstrated, to dwell more particularly on three of them which possess marked curative virtues. I refer to the alkalies, arsenic, and bromide of potassium.

Certain antiseptic remedies have been much vaunted these late years, such as salicylic acid and carbolic acid.⁵ Ebstein and Muller, Ryba and Plumert, Fischer and Peters have recommended this method of treatment. According to Fürbringer, these anti-fermentescible substances are much superior to the

without omitting the ordinary manual labors, such as sawing, splitting wood, employment in the garden, digging, chopping, the care of animals, etc. For women we prescribe all the active labors of house-keeping, especially those which require walking about. For both men and women, long daily walks are beneficial, and if they exert themselves occasionally to run it is no harm.

Exercise which requires constant standing without walking is rather to be avoided as favoring swellings of the lower extremities, etc., and of all exercises those should be chosen which agree the best with the patient, and are sufficiently active to cause frequent perspiration, frequent changes of the undergarments being desirable, and all necessary precautions to avoid catching cold. (a)

⁵ Wilhelm Ebstein and Julius Muller have employed carbolic acid in diabetes and obtained favorable results, especially in the diabetes of fat people; the dose which they gave was five grains daily in peppermint water (in divided doses). Salicylic acid had no effect whatever. In the experience of Purgesk phenic acid was without result, while salicylic acid, in doses from five to ten grammes a day, proved curative. Peters has also employed salicylate of soda in fourteen cases, in doses of eight to ten grammes a day. He affirms that by this means light cases can be cured, and grave cases considerably ameliorated. In Kamen's trials the result was *nil* as far as the glycosuria was concerned; in some cases serious gastric troubles resulted from the salicylic medication.

(a) Bouchardat, on Saccharine Diabetes. Paris, 1875.