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THE
DIETETIC TREATMENT OF DIABETES

BY
B. D. BASU
MAJOR, I.M.S. (RETIRED)

SEVENTH EDITION
(Revised and enlarged)

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TO
MY BROTHER
Rai Bahadur Sris Chandra Vidyarnava
WHO
STIMULATED MY INTEREST IN THE ANCIENT
LEARNING OF INDIA
THIS BOOK
IS AFFECTIONATELY DEDICATED

PREFACE TO THE SEVENTH EDITION.

WHEN I was a student at Guy's Hospital, London, it had on its staff, the late Dr. Pavy who was then considered a great authority on Diabetes. But regarding his researches Sir William Gull said:—

“What sin Pavy or his fathers before him had committed that he should be condemned to spend his whole life seeking the cure of an incurable disease”?

On my return to India, I followed the instructions of Dr. Pavy in the treatment of Diabetes. But I observed that the anti-diabetic diet prescribed by him hardly did any good to diabetics. I noticed also the fact that diabetic patients belonging to those castes which do not take meat live longer than those addicted to flesh foods. I tried to explain the longevity of Indian diabetics in a paper which I wrote in 1898. Extracts from this paper are given in this book on pages 46-49.

The more I studied the subject, the more I became convinced that Diabetes Mellitus is a manifestation of alimentary toxæmia and that the increase of sugar in the blood is the Nature's antidote of the toxin. Recent researches have confirmed my view that sugar is not a poison.

I have drawn the attention of the profession to *pre-glycosuric* or *Pre-diabetic* stage and also to splenic glycosuria which have not been hitherto recognised by investigators of the subject in the West.

I believe I have been the first in this country to have advocated vegetarian dietary in the treatment of diabetes.

ALLAHABAD :
24th March, 1916.

B. D. BASU.

EXTRACT FROM PREFACE TO THE SIXTH
EDITION.

The necessity of causing enquiry to be made into the etiology and pathology of Diabetes is recognised, as is evident from the facts that a philanthropic gentleman of the Madras Presidency has placed in the hands of the Government of that Presidency, a sum of fifty thousand rupees for investigating the causes of prevalence of the disease in this country ; and that the governing body of the Indian Research Fund Association has approved of the programme of an investigation into the etiology and pathology of Diabetes commenced in Calcutta by Major McCay, I. M. S. The desirability of such investigations is admitted by all. But the proper treatment of the disease demands the establishment of Sanatoria in the different provinces of India. In these institutions the urine analyses and dietetic experiments should be made by skilled medical officers who take interest in the subject.

ALLAHABAD :
1st July, 1915.

B. D. BASU.

WHAT IS DIABETES?

Hindu Physicians of yore were perhaps the first in the world to diagnose what is called diabetes.* Notwithstanding the researches of physiologists, pathologists and physicians in modern times it is perhaps not too much to say that the etiology and pathology of this disease remain as obscure to-day

* The following note from the *British Medical Journal* of January 17, 1914, pp. 155-156 gives an account of the knowledge of Diabetes possessed by the Arab physicians of Mediæval ages:—

In a report on an essay of Dr. Dinguizli of Tunis, on diabetes as described by the ancient Arab physicians, presented to the Academie de Medecine on December 30th, 1913, Professor Albert Robin points out that the discovery of diabetes mellitus is usually attributed to Thomas Willis in 1674. Polyuria of various kinds had been named without any attempt to discriminate them by Aretaeus of Cappadocia, Celsus, and many other ancient authors. Dr. Dinguizli, a distinguished Arabic scholar, in studying the *Canon* of Avicenna, who lived in the tenth century, found in it not only a description but a treatment of the disease which he called "diabetissa." He says:—

"This affection expresses itself by the expulsion of the water as it has been swallowed after a short lapse of time. This water is expelled by the organs which excrete the urine in the form of fluid that is very clear and colourless owing to its short contact with the constituent elements of the sanguineous humour. In this affection food and liquid nutritious substances, are to the excretory organs, and in particular to

as they were in the days of Charaka and Susruta. Very truly has Sir J. F. Goodhart observed :—

“Diabetes shall be my between maid—in part functional, in part, perhaps, otherwise. What morbid anatomy have we

the renal apparatus, what solid food is to the digestive apparatus, particularly the stomach when that organ is dilated.”

The Greek authors apply the names “diascos,” “karamis” and others to diabetes. In true Arabic speech diabetes should be called “Donarah,” or “Zalc El Goliah,” which signifies increase in size of the kidney. Avicenna describes the symptoms as follows :—

“Persons suffering from diabetes have an irresistible desire to drink without succeeding in satisfying a thirst which is always painful and imperious. The desire to pass water is incessant. They pass urine as abundantly as they absorb liquid. Nutrition in them is irregular and capricious. Thus one sees diabetics eat abundantly without the food doing them any good, as is shown by the loss of flesh from which they most often suffer.”

The cause of diabetes, according to him, is generally a chill, or it may be the consequence of inopportune drinking of very cold water. The liver is attacked and its function as a source of heat supply is disorganized, owing to exaggeration in organic combustions. The relations between the kidney and the liver become irregular to such a degree that the kidney withdraws from the liver humours in greater quantity than it can store. It is interesting, says Professor Robin, to note that Avicenna speaks of animal heat and organic combustions, and that he assigns to liver a preponderant part in the production of these two phenomena. He also speaks of the part played by the nervous system, by the liver, by the digestive apparatus, and, particularly, the stomach, in diabetes. He seems to have noted the sweetness of the urine in diabetes for he says that when exposed to the air it quickly dries,

not sought in this disease and have not found it? Long, indeed, have many of us hovered over the alterations, we had *hoped* to find and have not found them. Changes in the nervous system, in the pancreas, in the liver, in the blood, and so on. “* * * The question has now to be answered, what causes this seemingly inveterate sugar craze on the part of the proteins? This curious reversion, may we call it, to a plant-like metabolism in thus compounding with carbon to the rejection of its natural affinities. Is it nervous inco-ordination, or toxic disorganisation, or what? Again we seem to be driven back, cancer like, upon a *loquacity of function*, upon some misapplied vital energy behind the scenes with which as yet we cannot grapple.” [Harvein Oration on the passing of morbid anatomy; delivered at the Royal College of Physicians of London on St. Luke's day, 1912.]

Diabetes Mellitus (that is, voiding a large amount of urine containing excessive quantities of sugar and nitrogen and sometimes of acetone), is not a specific disease. Structural lesions of the pancreas, the liver or some portion of the nervous system,—have been known to be associated with this dis-

leaving a residue, which has a sweet taste like honey and resembling particles of bran. By way of treatment, Avicenna recommends the patient not to make a constant and exclusive use of fruits and sweet food, giving as a reason that the sugar increases the combustion in the body, and, as a consequence, also increases the animal heat. He recommends opium and oily fruits. He also advises the administration of various vegetables (semencine, a strong aromatic drug, imported from Aleppo and Barbary), fenugreek, and lupine. All these plants were reckoned as aphrodisiacs by the Arabs, and it may be conjectured that Avicenna prescribed them as remedies for the sexual frigidity which is common in diabetes.

order. But how this is brought about is not clearly understood.*

Had we known the true pathology of Diabetes

* The following are the recent views regarding the Origin of the Sugar excreted in Pancreatic diabetes.

As an exclusive proteid diet for dogs, codfish was chosen; when boiled, it is free in winter and spring from glycogen and glucosides, and contains only traces of fat. Dogs without a pancreas so fed create in a month 30 per cent, of their body weight of sugar, or a weight greater than all the proteid of their body. The sugar must originate either from the fat or proteid of the body or of the food. In spite of the food, the body wastes "to a skeleton," only heart and brain remaining unaffected. The liver enlarges enormously to 5 per cent of the body weight or five times more than in ordinary starvation; it is normal in composition. In diabetics the liver is always richest in fat. There is no constant proportion between the sugar and nitrogen of the urine, and so the origin of sugar from proteid is doubted. The sugar is believed to originate in the liver cells, which are capable of turning fat as well as glycogen into sugar. The liver overgrows owing to the large amount of work it has to do in relation to proteid ingested: its sugar-forming function is simultaneously increased. Any stimulus of the liver such as ammonium carbonate or neutral soaps increases the sugar formed.—*Journal, Chemical Society*, 1905, A. II. 469.

IRON IN THE DIABETIC URINE.

Neumann and Mayer have described four cases of diabetes in which there was a constant relation between the sugar and the iron in the urine. This is important, in view of the possible origin of sugar from nucleic acid. Three cases are, however, now recorded in which the proportion varied from 1.7 to 3.4 mg. iron per 100 grams of sugar.—*J. C. S.* 1905 A. II. 469.

Mellitus, we should have been perhaps in a position to treat it more properly than we can at present.

But if we regard diabetes or glycosuria as not a disease by itself, but a manifestation of several pathological or functional changes in the animal organism, we shall be in a position to understand its true significance. Glycosuria, like fever or pyrexia, should be considered as a symptom, and, as in fever, the aim of the physician is not so much to reduce the high temperature as to cure the disease of which pyrexia is one of the symptoms, so in diabetes the physician should not rest content with merely trying to reduce the quantity of sugar in the urine, but to treat the condition or conditions of which it is a product.

Conditions leading to Glycosuria.

In a paper on Experimental Glycosuria, read before the 69th Annual Meeting of the British Medical Association held in Cheltenham in July and August, 1901, and afterwards published in the *British Medical Journal* for October 12, 1901, the late Dr. Pavy mentioned the following conditions as producing glycosuria :—

Bernard's puncture of the floor of the fourth ventricle ; extirpation of the superior cervical sympathetic ganglion, of the first thoracic ganglion, and division of the thoracic sympathetic chain (Pavy) ; extirpation of the cœliac plexus (Klebs and Munck) ; section of the medulla spinalis on a level with the brachial plexus (Pavy) ; stimulation of the central end of the cut vagus (Bernard) ; stimulation of the depressor nerve (Filehne) ; section and stimulation of the sciatic nerve (Schiff).

The administration of phosphoric acid (Pavy); lactic acid (Goltz); hydrochloric acid (Naunyn); uranium salts (Cartier, Chittenden); potassium cyanide (Frerichs); phosphorus (Araki); chloral and chloralamid (Feltz and Ritter, Manchot); nitrobenzol and nitrotoluol (Ewald, Magnus-Levy); o. nitro-phenyl-propionic acid (Hoppe-Seyler); phloridzin (v. Mering); thyroid extract (Dale-James); strychnine (Schiff); methyldephinine (Reshop); morphine (Bernard); caffeine (Jacobi); curara (Bernard); carbon monoxide (B. W. Richardson); nitrous oxide (Lafont); amyl nitrite (F. A. Hoffmann); respiration of oxygen (Pavy); excessive aëration (Pavy); chloroform and ether inhalation; partial mechanical asphyxia (Pavy); partial asphyxia by restricted supply of oxygen; restraint glycosuria of cats (Bohn and Hoffmann) and of frogs (Velich); intravenous and subcutaneous injection of sugar (Bernard); excessive ingestion of sugar (Pavy, Worm-Muller); re-absorption of sugar from mammary gland—lactosuria (Blot); excision of the pancreas (di Dominieis, Minkowski); ligation and fistula of the thoracic duct (Biedl).

Classification of Glycosuria.

Glycosuria may be classified as regards the conditions leading to its production as follows:—

I. **Simple**, occurring by taking a large quantity of Saccharine or carbohydrate stuff.*

II. **Alimentary**.—In which some portion of the alimentary system or organs concerned in meta-

* Thus, according to Age Th. B. Jacobsen of Copenhagen (*Chemical Abstracts*, for March 20, 1914, p. 1144):—

“Ingestion of large amounts of Starch or Sugar can cause an increase to 0·16—0·17% (of Sugar in the urine) in normal persons. The increase is more rapid and likely to be greater after consumption of sugar than after that of starch.”

bolism is at fault. There is very often some disorder of the stomach.*

Chronic duodenitis is said to cause diabetes.†

Affections of the liver ‡, the pancreas and also of the spleen often cause glycosuria.

* "I.-Dietrich has examined the gastric juice of 40 cases of diabetes and found normal conditions only in 25%. There was severe gastric catarrh or achlorhydria in 67.5%. The sugar disappeared completely from urine in 3 out of 9 cases of diabetes in which lavage of the stomach was practised without enforcing an antidiabetic diet. There is much to indicate that more than one organ concerned in the metabolism of carbo-hydrates must be involved in the causation of diabetes, that the pancreas is not the one to be affected first."—*Chemical Abstracts*, June 10, 1914, p. 1980.

† The duodenum in Diabetes Mellitus.

To the *Practitioner* for May 1915, Dr. N. Mutch contributes a paper in which he brings forward evidence to show that:—

1. Diabetes mellitus is associated with great enlargement of the duodenum which cannot be accounted for wholly by coincident intestinal stasis.

2. A profuse growth of *Streptococcus brevis* was obtained from the duodenum of a boy suffering from severe diabetes. Such an infection was not found in any other condition.

3. Ileal stasis is usually present in diabetes mellitus, and in proportion to its severity, affects the prognosis adversely.

4. The urine of diabetic patients usually contains one or more products of the action of *B. Coli* on tryptophane and tyrosin.

He is of opinion that chronic duodenitis is the determining factor in the production of Diabetes Mellitus.

‡ Drs. Marcel Labbe and Ambroise Bouchage of Paris (*The Lancet* for Jan. 3, 1914 pp. 13-15) have considered the question of hepatic diabetes under five headings:—

1. The glycosurias that occur during the course of hepatic lesions.

Affections of Tonsils and Pharynx also cause glycosuria.*

III. Toxæmic.—Phloridzin, chloroform, epinephrine, dyspnœa and other poisons mentioned above by Dr. Pavy are known to cause glycosuria.

But it is alimentary toxæmia, of which we will

2. The hepatic congestions in overfed people.
3. The post-infectious or toxic hepatic disorders.
4. The 'diabete sans dinutrition' with enlarged liver of the overfed.
5. The hepato-pancreatic cirrhosis with severe diabetes.

They are of opinion that :—

"Hepatic diabetes supervenes, as a rule, in heavy eaters. It is preceded often by obesity, sometimes by gout or renal lithiasis. It is a mild diabetes without any nitrogenous waste; it is accompanied by the usual manifestations, *i.e.*, hypertrophy of the liver, subicteric complexion, and the presence, in the urine, of excess of biliary pigments, of brownish red pigment, of urobilin, ammonia, and the amino-acids. The nitrogen index is low."

The cause of this hepatic diabetes may be a general infection that attacks the liver, an intoxication such as by alcohol, which has an affinity for liver cells. More often, according to our observations, it is due to overfeeding, especially on meat."

* *Glycosuria in four cases of acute pharyngo-tonsillitis*, by C. Farmachidis of Genoa.

"F. observed the appearance of transitory glycosuria in 4 cases of acute pharyngo-tonsillities in which acute affection of the tonsils, and not the febrile process, was the immediate cause of glycosuria; experiments with dogs and rabbits showed that simple mechanical irritation of the tonsils (especially in dogs) was sufficient to produce hyper-glycemia and distinct glycosuria."—*Chemical Abstracts*, for April 10, 1914, p. 1301.

speak presently, which causes glycosuria in very large number of cases.

IV. Affections of Glycogenic centres.

—Thus tumors of the floor of the fourth ventricle cause glycosuria.

V. Affections of the Nervous system.

VI. **Functional or Emotional.**—Messrs. O. Folin, W. Denis and W. G. Smillie of Boston “found sugar in the urine of 22 insane patients out of a total of 192. Of the 22, the majority suffered from depression, apprehension or excitement. More direct evidence of the existence of emotional glycosuria in man was obtained by testing for sugar in the urine of students before and after important examinations. Of 33 students, 6 or 18% had traces of sugar in the urine passed immediately after the examination. It seems reasonably certain from the results obtained that pronounced mental and emotional strain may produce temporary glycosuria in man.” (*Chemical Abstracts* for August 10, 1914, p. 2742, from *J. Biol. Chem.*)

VII. Influence of Ductless Glands.—

Affections of ductless glands, such as of thyroids, as in exophthalmic goitre, of the pituitary body, as in acromegaly, of the Adrenals, of the female organs of generation, as in ovarian tumors, as well as of Parathyroids are known to cause glycosuria.

The spleen is a ductless gland, and so its affections also cause glycosuria. Splenic glycosuria has not been laid stress upon by investigators in the West,

since affections of the Spleen are comparatively rarer in Europe than in India.

VIII. Influence of age and sex.—There is *Diabetes innocens* of younger individuals, in which, as a rule, the excretion of sugar in the urine remains below one per cent., while there exists a pronounced, although not absolute, independence from the diet.

There is often glycosuria present in pregnant women.*

In the aged, there is glycosuria, said to be due to arteriosclerosis.

IX. Renal Diabetes.—Regarding this form of diabetes, Carl Van Noorden writes:—

“1. There are certainly kidney disorders which hinder the passage of sugar into the urine.

***Glycosuria in Pregnancy—**

It is generally due to hyper sensitiveness on the part of the kidneys to the sugar in the blood. Nothing is found to indicate any disturbance in the metabolism of sugar, and neither the spontaneous nor the alimentary glycosuria can be accepted as necessarily a sign of pathologic conditions in the kidneys. These statements are based on the metabolic findings in 16 women during and following a pregnancy. In contrast to these are tabulated the findings of 3 pregnant women with mild diabetes. The pregnancy had a seriously aggravating effect on the constitutional disease. The aim in dieting should be to reduce the glycosuria within bounds without acidosis, rather than to try to banish the sugar altogether.—*Chemical Abstracts*, for March 10 1914, p, 956.

Again, “at the onset of menstruation, there is a rise in the blood sugar, which becomes normal at the end of the menstrual period.” *Chemical Abstracts* for February 20, 1915, p. 478.

"2. There is an experimental form of diabetes dependent upon abnormal permeability of the kidneys. Phloridzin diabetes is of this nature and possibly other toxic glycosurias also.

"3. The existence of renal diabetes as an independent disease has not yet been proved."

"In case of (renal) diabetes there was least glycosuria on a liberal carbo-hydrate diet. Milk diet, rest or exercise caused no change, and the sugar content of the urine, was independent of carbo-hydrate supply. The proportion of sugar in the blood was subnormal and independent of the food. From this and other cases it appears that the existence of a clinical renal diabetes is established, and it differs from diabetes mellitus in cause, course, and prognosis."—*Chemical Abstracts*, for April 20, 1914, p. 1456, from C. D. De Langen's paper in *Nederlandsch Tijdschrift Voor Geneeskunde*, 2, No. 17 1443, through *J. A. M. Med. Assoc.* 62, 739-740.*

It is, therefore, necessary to examine the blood for sugar, for the sugar content of the urine does not give a true index of the amount in the blood.

Dr. Pavy very rightly said:—

"With such a chaotic list before us it is difficult to see upon what ground we stand with respect to the manner in which the several conditions act in producing glycosuria."

I will, however, restrict the term **Diabetes**

*"Certain toxic substances have the property of injuring the kidney without causing any accompanying hyper-glucemia, but with a glycosuria. Cantharidin, Uranium salts, Chromates, tellurates, HgCl_2 and aloin belong to this group. Small dose of cauntharidin produce glycosuria.** The other substances named have a much more delayed action; the glycosuria lasts longer, usually till death. Their effect is probably due to grosser lesions of the epithelium."—*Chemical Abstracts*, for March 20, 1915, p. 819.

to that form of glycosuria which is consequent on alimentary toxæmia.

Pre-glycosuric or Pre-diabetic stage.

By studying the history of diabetic patients in India, we are enabled to know that they show certain symptoms before the discovery of sugar in the urine. I call this stage PRE-GLYCOSURIC or PRE-DIABETIC.

In some, the symptoms are those of what is vaguely termed Indigestion or Dyspepsia. Constipation is an early symptom. Another symptom is burning sensation of hands and feet. Some suffer from polyuria or nycturia. Dilatation of the stomach may be observed in many. If the mouth is carefully examined, oral sepsis is discovered in not a few. The terminal end of the alimentary canal shows also, not unfrequently, the existence of hæmorrhoids. Hydrocele is also very often present. Many diabetic patients give the history of their having suffered from malaria and consequently enlarged spleen.

Affections of the skin, pruritus, fall of the hair and teeth are also some of the symptoms of the Pre-glycosuric stage.

There is often arterial tension or high blood pressure in pre-glycosuric stage. This occasionally causes arterial spasm producing convulsions. In India everyone after 40 years of age should be often examined with sphygmo-manometer for measuring blood pressure.

Pre-glycosuric stage deserves very careful attention at the hands of Indian practitioners, for much

can be done to prevent the occurrence of diabetes if the patient be properly treated at this stage.

Detection of Sugar in the Pre-glycosuric stage.

In the pre-glycosuric or pre-diabetic stage, sugar cannot be detected in the urine. But that does not mean that the sugar content of the blood is not above normal. In India in all cases of dyspepsia, it is expedient to examine the blood for sugar, to find out whether those cases will end in diabetes.*

* A simple method of estimation of the blood sugar has been mentioned by Dr. Oscar-Kraus of Carlsbad in the *Lancet* for May 2, 1914, from which extracts are given below :—

“The analysis of blood sugar is carried out in the following manner. The pulp of the middle finger is thoroughly cleansed with ether and alcohol and a prick made with a Francke's needle, and about 15 drops of blood are dripped into a special small glass receptacle. The latter has a mark roughly indicating 1 c. c. and a second indicating 2 c. c. There must always be an excess of 1 c. c. of blood. Then by means of a capillary pipette 1 c. c. is measured into a small beaker and the pipette washed out with very little distilled water.”

The sugar estimation consists of two parts :—

(a) *The de-albuminisation.*—This is carried out according to Max Alder's modification of Michealis' and Rona's method. The liquid in the beaker is cautiously heated, whilst stirring it up, until it begins to turn turbid. Then 4-5 drops of 10 per cent. ferrum oxydatum dialysatum duplex (Merck) are added, and subsequently a few drops of a saturated watery solution of potassium sulphate, with constant soft boiling and stirring. All of a sudden the albumin will accumulate on the surface, while the liquid beneath will become absolutely clear. It is then very easy to separate the clear liquid from the albumin by filtering it into another small beaker and washing twice

*Glycosuria—a manifestation of alimentary
toxæmia.*

By the analysis of symptoms and so-called complications of diabetes, we shall not perhaps be wrong in considering it, in most cases, as a manifestation of alimentary toxæmia. To my mind, it explains

with hot distilled water. This liquid will hold all the sugar contained in 1 c. c. of blood.

(b) *The titration.*

I. *Preparation of the Standard Solutions.*

1. *Copper standard solution.*—2 grm. of sulphate of copper are exactly weighed and dissolved in about 100 c. c. of water and cooled down. Then 400 grm. of sulpho-cyanate of potassium, 12 grm. of ignited carbonate of sodium, and 24 grm. of citrate of sodium are dissolved with the aid of heat in about 600 c. c. of distilled water and filtered. It is then cooled down and the copper solution added by slowly pouring it into the other solution with constant stirring. 5 c. c. of a solution of 5 per cent. of ferro-cyanide of potassium are now added and the whole is diluted with distilled water to exactly 1000 c. c. This solution, as compared with Fehling's solution, has the great advantage that it consists of a single liquid and keeps unaltered.

2. *Sugar standard solution.*—0.165 grm. of pure glucose is dissolved in a flask that holds 100 c. c. and is provided with a mark. Then a double tube is inserted and the bottle, neck downwards, is put into communication with a special burette by means of a rubber tube. This burette holds 1 c. c. divided into 100 sub-divisions.

II. *Testing the Standard Solutions.*—25 c. c. of the cuprous solution, with 25 additional c. c. of distilled water, are measured into a beaker and heated; then the sugar solution, still boiling, is poured into the beaker, at first rapidly, finally drop by drop. We generally use 3.35—3.36 c. c. to reduce 25 c. c. of the cuprous solution. The reaction is complete when

the occurrence of diabetes much better than any theory so far advanced. Of course, the nature of toxin like that of enzyme is not yet properly known. One of the earliest symptoms of diabetes is said to be cramps in the calves of legs. In India, almost every medical practitioner has seen cases of Asiatic cholera and cramps of the calves of legs associated with them. Their occurrence in both diseases is due to one and the same cause, *viz.*, alimentary toxæmia.

Again, eczema, psoriasis, boils, carbuncles and some other skin diseases, said to be so many complications of diabetes, are manifestations of alimentary toxæmia.

Several diseases are grouped as allied ones with diabetes. These are also manifestations of alimentary toxæmia.

Cataract is said to be a complication of diabetes. But is it not due to alimentary toxæmia?

the colour changes from light blue to faint canary. By a special device, a second, third, and fourth c.c. can subsequently easily be passed from the flask into the burette without removing the latter from the flame. The result will hold good for a long time, because the sugar solution will not be easily altered, provided a small crystal of thymol is added. The titration of the blood sugar takes place on the same principle. 25 c.c. of the standard solution are added to the blood filtrate and heated, and the end point will be obtained by addition of the sugar solution. The difference between the result of the test titration and the amount of sugar solution that it was necessary to add to the blood filtrate, when multiplied by 0.165, gives the percentage of sugar in the blood."

How alimentary toxæmia is brought about?

Alimentary toxæmia is brought about by—

- I. Errors in diet.
- II. Disordered conditions of the digestive juices.
- III. The toxins discharged by the bacteria in the alimentary canal.

I. Errors in diet.—When the quality of food-stuffs consumed is not good, it is known to produce toxic symptoms. Wheat and rice form the staple articles of food of the population of India.

As regards wheat, we have the high authority of Sir William Crookes, who, in his Presidential Address at the British Association for the Advancement of Science, in 1898, said that no other grain can take the place of wheat in the preparation of bread—the staff of life for man.* But with the export of wheat, the people of India, for the most part, have to depend on inferior food-grains for their bread. Regarding Indian wheat, Messrs. McDougall Brothers, at the request of the Government of India, in 1880, prepared a report, from which the following passages are taken:—

“Glancing at all the facts here elaborated, it is evident

* Sir William Crookes said:—

“We are born wheat-eaters. Other races, vastly superior to us in numbers, but differing widely in material and intellectual progress, are eaters of Indian corn, rice, millet, and other grains; but none of these grains have the food value, the concentrated health-sustaining power of wheat, and it is on this account that the accumulated experience of civilized mankind has set wheat apart as the fit and proper food for the development of muscle and brains.”

that these wheats afford a larger margin of profit, both to the miller and baker than any other.

“We venture to record a conviction that we have long held, strongly emphasized by the results of these experimental workings, of the measureless importance of the great resources of the Indian Empire being developed to the utmost in producing wheat for this country. Farmers here are finding that to live they must produce beef and mutton rather than grain, hence the greater need of resources of supply under our own control ; ***there is no doubt, an outlet in this country and the Continent for unlimited quantities [of Indian wheats].”

Accordingly, Indian wheats are being exported in large and larger quantities year after year. As a consequence, the Indian population, for the most part, have to live on inferior food-grains. Sir George Watt, the compiler of the Dictionary of Economic Products of India, does not try to traverse this statement, but thinks that he has proved his case, by writing in the following strain :—

“Indian wheat has for some years continued to undersell the produce of the old and established supplies, and is gradually assuming a recognised position in the grain markets of Europe. The outcry has, accordingly, in certain quarters, been raised against the objections to this new traffic. Philanthropy, that much abused ally of a weak cause, has been called to the rescue. The natural food and surplus stocks of the people, we have been told, were being drained away from them. For greed of the means to satisfy exotic desires of modern civilization, the people were being induced to part with their ordinary food, and were, in consequence, taking to the use of inferior and unwholesome grains.”

The injurious effects due to the export of wheat, obliging people to maintain themselves on inferior

and unwholesome food-grains cannot be disproved by sophisticated arguments. Steps should, therefore, be taken to reduce, if not actually to stop, the export of wheat.*

Again, the roller process of milling wheat is objectionable, since it deprives this cereal of some of its most important constituents. The evil is carried to excess by the bleaching of the flour.

Rice forms the staple article of diet—if not of the majority—at least of a very large population of India. In polished rice, the vitamine is got rid of, and thus

* Sir William Crookes gave the following as an appendix to the address above referred to :—

“ So long ago as April 16, 1891, the following statement by a leading Indian economist appeared in the ‘ Daily Englishman, of Calcutta.

“ People do not realise the fact that all the wheat India produces is required for home consumption, and that this fact is not likely to be realised until a serious disaster occurs, and that even now less than 9 per cent is exported. It is a self-evident fact that a slight expansion of consumption, or a partial failure of crops of other food grains, will be sufficient to absorb the small proportion now exported. Besides, we have a steady increase of consumption, in consequence of the natural growth of the population, as well as in the gradual improvement of the condition of a considerable part of the people in the cities. I believe that, comparatively speaking, India will in a few years cease to export wheat, and soon thereafter become an importing country.”

Even after the lapse of nearly a quarter of a century, the above still holds true, and it shows the inexpediency of exporting wheat from India.

its consumers do not get that nutriment which they would otherwise derive from it.*

Moreover, the Bengali mode of preparation of rice is open to the objection that salts are removed by throwing away the water in which rice is cooked.

Pure milk and *ghee*, which enter so largely into the Indian dietary, cannot be had in large towns in India, in sufficient quantities to meet the requirements of the people. There is, moreover, no article of diet which is not more or less adulterated.

The practice of adding preservatives to food-stuffs which are thus made unwholesome, should be strongly condemned.

* In the Journal, Chemical Industry, June 15, 1911, p. 707 it is stated that:—

In preparing rice for human consumption the husk is always removed, and the grain usually undergoes a further milling which removes the pericarp and subcortical layer more or less completely. As carried out in the hand-mills of the natives of rice-growing countries, this milling is imperfect and the product is generally brownish in colour, whereas the rice from modern machine-mills is quite white. The portions removed during milling contain a higher proportion of cellulose, fat and ash, than the remainder of the grain, and indeed the extent to which this process has been carried can be ascertained from the phosphoric acid-content of the product. Thus rice from which only the husk has been removed contains 0·7—0·8 per cent. of phosphoric acid (P_2O_5); undermilled rice contains 0·4—0·6, and overmilled rice 0·15—0·4 per cent. The nitrogen content of the grain is small (1·1·6 per cent.) and only slightly diminished by milling. Rice alone provides insufficient nitrogen for the needs of the human body.

People should take fresh foods and not preserved or tinned foodstuffs, for in their canning, vitamines are destroyed by heating them.

Tea drinking which has been introduced in recent years in India, is a very fertile cause of dyspepsia, leading to alimentary toxæmia. So also is the taking of ice and its preparations in the causation of dyspepsia.

It is the belief of many that diabetes has been prevalent in this country since the introduction of the potato. There may be some justification for this belief, if we remember the fact that the potato contains the poisonous alkaloid and glucoside known as *solanin*. Consumption of potato in large quantities disturbs the digestive system and thus gives rise to alimentary toxæmia.*

* Regarding potatoes, the golden maxim to be observed, is *Non-exposure to light*. It is stated in a well-known work on gardening :—

“If the weather is cloudy so much the better, for the tubers should be exposed to light as little as possible, and more especially not to bright sunshine. It is well-known that all the green parts of the Potato are more or less poisonous, and so the finest white floury Potatoes become, by exposure to light. Potatoes may be white, black, or purple, externally, and their flesh, notwithstanding, be white and good when cooked ; but expose them to the light for a longer or shorter period, according to its intensity, and the flesh of all will become green and unwholesome. Some persons dig up their Potatoes and leave them exposed to the sun's rays to dry, previous to storing ; but this is a bad practice, for three days of bright autumn sun will green newly-taken-up Potatoes to

In some provinces of India, cayenne pepper is used to such an extent, that its influence on digestion is detrimental to its consumers. So also the use of other spices which, though they stimulate the motor functions of the stomach, impair the secretory functions and thus inhibit the production of hydrochloric acid. The inordinate use of cayenne pepper and spices, therefore, causes dyspepsia and disordered digestion in the people of this country.

II. Disordered conditions of the digestive juices producing alimentary toxæmia.

The digestive juices are disordered from many causes, *e.g.* worries, anxieties, excitements, nervous disturbances, irregularities of diet, unmasticated foods, etc.

a very injurious extent; and this being the case, the tubers should not be exposed to the sunshine even for a single day.

"It should therefore always be borne in mind that from the time Potatoes are taken out of the ground till they are to be cooked, they should be exposed to light as little as possible. If, after having been dug up, they must lie on the ground in heaps for but one day, or even less, they should be protected from light till they are pitted. If stored in a shed, loft, cellar, or any other place, light should be entirely excluded; if in a building, to the interior of which light must be admitted, it should nevertheless be prevented from reaching the tubers by some close covering."—Thompson's "Gardener's Assistant," edited by William Watson. Part VI, pp 496—7.

As cultivators of the Potato in India observe the maxim of *Non-exposure to light* more in its breach than otherwise, it is easy to understand how unwholesome that article becomes by the action of the tropical sun.

The nervous strain connected with modern life is a well-known cause of disordered digestion. India is a country where, from time immemorial, people were accustomed to take their principal meal in the middle of the day after which they used to spend an hour or so in *siesta*, which allowed for the proper digestion of food. But under the altered conditions of their existence, they do not even find time to properly chew and masticate their food which they are obliged to bolt down as soon as they can, to attend to their studies or business in the middle of the day.* By proper mastication alimentary toxæmia is reduced to

* Regarding this, a well-known Indian daily said :—

“Many explanations have been made to account for the large number of deaths that take place among Indians from diabetes and also for the sufferings from this disease and from digestive disorders which are common to modern educated classes. It has been suggested by Major Basu in his book on “Dietetic Treatment of Diabetes” that much mischief has been done by the introduction of the English method of transacting all kinds of business between the hours of 10 A.M. and 6 P.M.”

“There is much to be said in favour of this theory which is supported by the fact that stomach disorders are practically unknown among people not used to modern office-hours of business and hurried meals. The question is worth further investigation of actual cases of persons who are subjected to this complaint. A very large number of people now-a-days, almost nine-tenths of those working in public and private offices, take meals in a hurried and unhygienic manner, and this has become a matter of habit with, of course, evil effects. It is worth while to make a change, at least experimentally, in the office-hours, restoring the time-honoured midday meals at leisure.”—*The Tribune*.

a minimum. In an account of some experiments initiated by Mr. Horace Fletcher which Dr. Ernest Van Someren in 1901 submitted to the British Medical Association, and afterwards to the Congress of Physiologists at Turin, it is stated that :—

“One fact, fully confirmed by the Cambridge observations, consists in the effect of the special habits described upon the waste products of the bowel. These are greatly reduced in amount, as might be expected; but they are also markedly changed in character, becoming odourless and inoffensive, and assuming a condition which suggests that the intestine is in a healthier and more aseptic condition than is the case under ordinary circumstances.”

Everyone should be taught to properly masticate and insalivate the food—it is one of the most necessary conditions of good health.*

Worries and anxieties are an important factor in the causation of toxæmia, and hence of diabetes. It is the Jews who are said to be victims of diabetes more frequently than any other community in Europe. There must be some common factor in the case of the

*That veteran scholar, Babu Pratap Chandra Ghosha of Vindhyâchala, very properly observes :—

“Either be a thorough Sâheb and masticate your food while talking and enjoying it for an hour or be a Hindu and observe perfect silence when eating * * . There are plain rules to be seated comfortably and with a pleasant and contented mind one should take his meals, never speaking ill of things taken and so forth. They are an interesting set for our conduct—nay tables and high seats and spoons and forks are enjoined. Spoons and ladles are directed to be used in serving and dressing food; nay not even salt should be served by bare hand.”

Jews and educated Indians to account for the prevalence of this disease amongst them. Perhaps from their peculiar political situations, both the Jews and educated Indians are subject to worries and anxieties of many sorts.

That this is an important etiological factor of the disease, may be gathered from its large prevalence in Germany of late. It is noticed in the *Lancet* for February 1913, p. 351:—

“The statistical records of Prussia show that the death-rate from diabetes has been increasing of late years. ** It is suggested that the increase is partly caused by the growth of luxury and the greater consumption of rich food and also by the nervous strain connected with modern life. *** With respect to individual trades and professions it has been found that persons engaged in the preparation and sale of food and spirituous liquors, soldiers and men belonging to the civil and ecclesiastical services had a higher death-rate from diabetes than other classes of the population.”

III. The most important factor in the production of alimentary toxæmia is the discharge of toxins by the bacteria in the alimentary canal. Constipation from any cause and intestinal stasis—by not allowing free evacuation of the contents of the intestines—bring about toxæmia.

One of the most important causes of alimentary toxæmia in India is undoubtedly the condition of the latrines generally all over the country. The civilization of a land is to be judged from the condition of its latrines. In rural tracts, no latrines are attached to dwelling houses, as their inhabitants go to fields for purposes of nature. This has its obvious advantages. But in towns the latrines generally are not

what they should be. They are ill-ventilated, filthy and not provided in sufficient numbers to meet the requirements of the members of a large household. Their condition is such that it is disgusting to many to visit them to answer the calls of nature. Latrines should be improved. If half of the time devoted to toilet were spent in water closets, it would greatly relieve alimentary toxæmia of persons calling themselves civilized.

Various, then, are the causes which give rise to alimentary toxæmia. Oral sepsis, piles, errors in diet, malaria, worries, anxieties, etc., are principally responsible for the occurrence of alimentary toxæmia amongst educated Indians.

Adulteration of food-stuffs in large towns, the difficulty of procuring good *ghee* and milk which enter so largely into Indian dietary, polished rice, exportation of wheat and consequently the subsistence of a large population of India on inferior food-grains, are mainly the different factors in the causation of Indian diseases and especially of alimentary toxæmia.

Blood pressure and Diabetes.—It has been mentioned above that in pre-glycosuric stage, there is often high blood pressure. In former times blood letting was practised at least once a year, which did not raise the blood pressure. But blood letting is a good old remedy now out of fashion. The researches of Dr. W. E. Dixon show that the urine of meat-eaters generally contains a large amount of a body which when injected into animals, very markedly raises their blood pressure. Beyond 40 years of age when

changes of a degenerative character take place in the arteries, all meat and animal proteins should be avoided. Thus meat-eating by raising the blood pressure is one of the causes of diabetes.

The wide prevalence of Malaria in different provinces of India also explains the occurrence of alimentary toxæmia. Malarial patients suffer from enlarged spleen which seriously interferes with pancreatic digestion. There are many who associate diabetes with the organic or functional disorder of the pancreas. If that be so, the enlargement of the spleen accounts for the occurrence of the pancreatic disturbance. According to Herzen, the spleen furnishes an internal secretion which causes in the pancreas the transformation of its inert trypsinogen into trypsin.*

The influence of the nervous system in the production of alimentary toxæmia is so well-known that it needs only a passing allusion.

Again, if pathological changes of the Pancreas be the real etiological factor in the production of diabetes, we know that pancreatitis is very often set up by oral sepsis.

By not assigning due importance to alimentary toxæmia as causing diabetes, it has been attributed to many different causes. It has been said that it is due to sexual excesses on the part of Indians. As

* Malaria, unless it gives rise to alimentary toxæmia, will not lead to glycosuria. This explains why the West coast of Africa and British Guiana which are Malarious are not diabetic.

a rule, they, and especially the educated portion amongst them, are not given to so much sexual excesses as inhabitants of the Western countries. It is the educated Indians who suffer more than uneducated ones from this disease. It passes one's comprehension why they should be more vicious than their uneducated brethren, as far as sexual morality goes.

Then, again, it has been said that Indians, being very fond of Saccharine food-stuffs, fall easy victims to diabetes. Consumption of a large quantity of carbo-hydrates and of sweets, no doubt, very often produces glycosuria and alimentary toxæmia, resulting in diabetes. But when we remember that Hindu priests generally, and the Choubey's of Muttra especially, as well as the laborers employed in Sugar factories in Mauritius and British Guiana, indulge largely in sweetmeats without their suffering from diabetes, we should not be justified in considering the disease as resulting from an excessive indulgence in sweet stuffs alone.

Is Sugar a Poison ?

The question naturally arises whether sugar present in the blood of diabetics act as a poison on the system and account for the complications and other symptoms of the disease. Is sugar in itself a poison ? No evidence of this exists. It is a normal constituent of the blood. It is not known to act deleteriously on animal or vegetable tissues. From the fact that it is a powerful antiseptic and used

as a preservative of foods, its importance can be judged as a very useful substance in domestic economy.

That in animal economy also it is useful to destroy toxicity of intestinal flora, is to be inferred from Metchnikoff's experiments in introducing bacilli in the intestines to produce sugar.

If we introduce sugar in the blood of healthy animals by injection or infusion for any length of time, the symptoms and complications of diabetes will not be set up.* The following sheds a curious sidelight on the treatment of diabetes by rectal injection of sugar. Before the German Congress of Internal Medicine, held at Wiesbaden, from April 15th to 18th, 1913,

"Professor Luthje (Kiel) reported that in cases of Diabetes Mellitus he had introduced solutions of sugar into the rectum by enema. In this way from 50 to 100 grammes of sugar daily were administered without pain and without increasing the sugar in the urine. The quantity of sugar in the blood, however, became greater, showing that the sugar was absorbed from the intestine." [*The Lancet*, for May 31, 1913, p. 1561].

If sugar is not a poison, what is its significance

* When I wrote this in 1913 the results of the experiments of Dr. Frederick M. Allen of Harvard concerning glycosuria and Diabetes—were not published. These have been lately given in a voluminous work of nearly 1200 pages. He arrives at the conclusion that the long-continued excess of sugar in the healthy organism does not produce any of the symptoms or complications of diabetes. He has not noted any specific toxic effect of sugar.

in diabetes as opposed to simple glycosuria? Nature always tries to set wrong right. Hence the proverb that every disease creates its own remedy. May it not be that sugar is produced in the system to get rid of the deleterious effects of alimentary toxæmia and to serve the purpose of an antidote?*

There are many practitioners who look upon high temperatures in fevers as necessary to kill the germs of those diseases. So perhaps may be the sugar in diabetes.

** Treatment of Wounds with sugar—*

“George Magnus Marburg of Munich examined a large number of commercial beet sugars for pathogenic bacteria, and in no case were they found; 89% of the sugars examined were sterile sugar (beet) solutions up to 30% concentrated, and in 20 cc amounts injected subcutaneously, introperitoneally and intra-articularly into rabbits were tolerated well, produced no necrosis and were absorbed by the following day. A 5. g. piece of sugar placed below the skin was completely dissolved in 35 minutes, and produced a transient œdema which had nearly completely disappeared in 60 minutes. The next day no necrosis was found at the site. Virulent streptococcus pus was sterilized by said sugar solutions. Sugar placed in a wound produces a marked secretion, is marked by deodorizing and favours healing. M. treated 100 cases (acute septic wounds, chronic osteomyelitis, and tuberculous processes, etc.,) with favorable results.” (*Chemical Abstracts*, for May 20, 1913, p. 1736.)

Such being the antiseptic properties of sugar, it is not difficult to understand the important rôle it plays in diabetes, in protecting the system from the deleterious effects of alimentary toxæmia.

Sugar—a local irritant.

But if sugar is not a poison, it acts as a local irritant which accounts for some of the cutaneous and other troubles, such as Herpes preputialis, cystitis, &c., often observed in the course of diabetes.

Pathological antagonism in relation to Diabetes.

Medical practitioners in India must have noticed the clinical fact that diabetic patients do not excrete sugar in their urine when they suffer from Bright's disease, Pneumonia, Tuberculosis, and other fevers. The occurrence of glycosuria cannot be explained as simply due to structural changes in the pancreas, nervous system, liver or any other organ. But if we look upon diabetes as a manifestation of alimentary toxæmia, then we are in a position to account for the disappearance of sugar in such diseases as mentioned above which might supervene on diabetes. The toxin which requires the formation of sugar in the system for its neutralisation is got rid off in the course of those diseases, and hence sugar is no longer required to prevent its deleterious effects. It is therefore that I look upon diabetes as a functional disorder, and hence curable.

Diabetic coma.

Very often, the closing scene of Diabetes is coma. It is due to toxic substances acting on the kidney. In evidence of this may be adduced the fact that the urine contains renal casts long before the occurrence of coma. The blood also wants alkalinity;

hence, the administration of alkalis, for example of bicarbonate of soda in large doses, has been found beneficial in diabetic coma.*

* Acidosis in Diabetes Mellitus.

The *British Medical Journal* for September 11, 1915, contains two important papers on the subject, one, on observations upon acidosis in Diabetes Mellitus, by Drs. A. P. Beddard, M. S. Pembrey and E. I. Spriggs, and the other on the significance of alveolar carbon dioxide determinations in the treatment and prognosis of Diabetes by Dr. E. P. Poulton.

The following is a summary of these two papers.

Drs. A. P. Beddard, M. S. Pembrey and E. L. Spriggs claim to have demonstrated that analyses of the carbon dioxide in the alveolar air of the lungs afford an index of the degree of acidosis, and a guide in treatment and prognosis. According to them in diabetes the partial pressure of the carbon dioxide in the alveolar air falls with increasing acidosis, and during coma reaches a very low point, and when low can be raised by the administration of sodium bicarbonate.

In diabetes there is an increased production of unusual acids, to counteract the effects of which the three following mechanisms are brought into play.

1. The acidity of the urine is increased.
2. There is an increased formation of ammonia.
3. The partial pressure of Co_2 in the alveolar air is lowered.

The venous blood gives off into the alveoli of the lungs its excess of Co_2 , and this is prevented from accumulating by the respiratory ventilation. In health the latter is so adjusted that the percentage of Co_2 remains at a constant value, between 5 and 6 per cent. The arterial blood leaves the lungs saturated with Co_2 , corresponding to its partial pressure in the alveoli.

In diabetes, when the acidosis is severe, the respiratory centre is stimulated by excess of acid, so that the pulmonary

Coma mostly occurs in those victims of diabetes who are made to take opium and flesh foods in the hope of being cured of the disease. As results of that drug and diet, kidneys are disorganized, proper elimination of toxins is interfered with, and the blood is made lacking in alkalinity. Hence opium and flesh foods should not be given to diabetics.

Treatment of Diabetes.

Almost every important drug of our *Materia Medica* has been credited some time or other as a remedy for diabetes. That such drugs might have proved beneficial in some instances may be easily understood, if we consider diabetes as a manifestation of alimentary toxæmia. Anything which relieves the latter, will prove beneficial in diabetes. This view alone can satisfactorily account for the large number of medicines said to have been successfully used

respiration is increased, and the diminution of Co_2 in the arterial blood compensates for the quantities of acetoacetic acid and B—oxybutyric acid in the circulation. Hence the amount of Co_2 in the alveolar air changes inversely as the amounts of these unusual acids present, and thus it can be taken as a measure of the acidosis.

The method of measuring the alveolar Co_2 is of the greatest importance in estimating the acidosis in the severer types of diabetes. For this purpose Fredericia's Carbon Dioxide Tensimeter is often employed.

Cases of Diabetes can be divided into two categories :—(a) *mild*, where the alveolar Co_2 pressure falls within normal limits (b) *severe*, where the alveolar Co_2 is lower than normal. In the latter, care should be taken to prevent the onset of coma.

in its treatment. Every individual case should be treated on its own merits, and attempts should be made to discover the cause or causes of alimentary toxæmia.

Spring waters containing Sulphur, probably in a colloidal condition and in a form not otherwise available in medicine, by their action upon alimentary toxæmia, are beneficial in Diabetes. In India, there are several springs containing Sulphuretted waters, such as of Guhya Pani—near Dehra Dun—which are useful in Diabetes.*

I have always laid stress on the exclusion of meat from the dietary of the diabetic and the substitution of the vegetarian diet, in the treatment of this disorder.

It is very gratifying to me to find that such has been the experience of many medical men in the West also. Because vegetarian diet is better calculated to relieve alimentary toxæmia, therefore it should be the dietary of the diabetic.

Fasting.

It is noticed that diabetic patients are improved by fasting. Of late, some physicians have been treat-

* Dr. R. Fortesque Fox concluded his lecture on British Resorts in Peace and War (published in the *British Medical Journal* for July 17, 1915) as follows :—

“India alone is richly endowed with medicinal waters of every description. No scientific report has ever, admittedly, been made upon them. There and elsewhere much remains to be done to investigate, make known, and utilize these natural resources of the empire.”

ing diseases by fasting. This fasting cure of course relieves alimentary toxæmia, and so proves beneficial in diabetes. Hence the importance of starvation and purgation in diabetes. There should be no over-indulgence in food.

Physical exercise for diabetics.

Diabetics are benefitted by physical exercise. This is also accounted for on the disease being considered a manifestation of alimentary toxæmia. Regarding the antitoxic action of exercise, Sir Thomas Lauder Brunton said in his Harveian Oration of 1894:—

“We are able to influence the circulation in muscles both by voluntary exertion and by massage, and we should expect that both of these measures would influence the constituents of the blood generally. Such, indeed, appears to be the case, for J. K. Mitchell (*A. J. of Medical Science*, May 1894) has found that after massage the number of blood corpuscles in the circulation is very considerably increased. We can thus understand why exercise either of the body or its parts may increase its power to resist infective diseases.”

It has been noticed that obese persons often suffer from diabetes. The accumulation of fat around the intestines, liver and the kidneys prevents their free movements and thus removal of poisonous products, the reabsorption of which causes toxæmia. Hence the necessity of physical exercise in the treatment of diabetes.

The care of the skin in Diabetes.

The skin should not be deprived of its full breathing opportunities and prevented from throwing off the

poisons which come to its surface. In India, in certain seasons of the year, a bare skin is more conducive to health than with clothes on.

Baths are, very useful in the treatment of Diabetes. But some precautions are necessary to be taken in their administration. Hot baths, on account of the debilitating effects of heat, should be avoided as far as possible. Turkish baths should not be recommended for diabetics. These are harmful, because of their excessive scrubbing and soaping of the skin which removes certain of its protective elements.

Gastric lavage and douche.

The cases of diabetes reported to have been benefited or cured by gastric lavage and rectal douches can only be explained on the theory of its being due to alimentary toxæmia. To my mind, no other theory so satisfactorily accounts for the symptoms and complications of this disease as this one.

Since Metchnikoff pointed out the part which intestinal flora plays in the production of alimentary toxæmia, the alimentary canal has been mercilessly subjected to the knife of the surgeon. But the surgeon's knife is not essentially necessary to relieve the disorder.

The Importance of Yoga.

The holy sages of India found out for themselves the curability of alimentary toxæmia by means which we may adopt even now, with great advantage. They evolved the system of *yoga*, the practitioners of which were said not only to attain longevity, but

immortality. In recent years my brother, Rai Bahadur Śrîś Chandra Vidyârṇava, who is well-known for his Sanskrit scholarship in almost every country of the civilised world, has kindled the interest of the public in the study of this system of Hindu philosophy by his various writings on the subject. From the Introduction to his translation of the *Gheraṇḍa Samhitâ*, written more than twenty years ago, the extracts given below will show the importance of relieving alimentary toxæmia by methods practised by the votaries of *yoga*.

“ Although it is not possible within the short space at my command, to give the rationale of *all* these practices, and to justify them to a doubting public, I shall briefly illustrate the advantages of some of them. Thus to begin with *Vatasara*. It is the process of filling the stomach with air, and expelling the wind through the posterior passage. The greatest duct or canal in the human body is the alimentary canal beginning with the œsophagus (throat) and ending with the rectum. It is some twenty-six feet in length. This great drain contains all the rubbish of the body. Nature periodically cleanses it. *Yoga* practice makes that cleansing thorough and voluntary. If the cleansing is incomplete, then the foetid matters putrify in the stomach and intestines, and generate noxious and deleterious gases which cause diseases. Now वातसार (Vâtasâra) : by passing a current of air through the canal, causes the oxidation of the foetid products of the body ; and thus conduces to health and increases digestion. In fact, it gives a tone to the whole system. Similarly, वारिसार (Vârisâra) is flushing the canal with water, instead of air. It thoroughly purges the whole canal, and does the same work as an aperient or a purgative, but with ten times more efficacy and without the injurious effects of these drugs.”

The *Gheraṇḍa Samhitâ* describes the internal

washing under the term of *Antar-dhauti*, as follows :—

“ *Antar-dhauti* is again sub-divided into four parts :—*Vâtasâra* (wind purification), *Vârisâra* (water purification), *Vahnisâra* (fire purification), and *Bahiskrita*.”

It is not necessary here to quote any further from the *Gheraṇḍa Saṃhitâ* for the performance of the different processes mentioned above. Suffice it to say for our purpose that the sages of India thoroughly understood the danger of alimentary toxæmia and devised means to efficiently combat the evil results of the same.

The aim of *yoga* is *samâdhi* or suspended animation. To attain to this stage, the body should be cleansed of all its impurities. The various processes described in works on *Yoga* are meant to lead to this end. Thus the various *âsanas* or postures, mentioned in treatises of *Yoga*, are calculated to prevent chronic intestinal stasis, by the occurrence of ptosis. The abdominal organs depend mainly for the maintenance of their position on the support of the abdominal muscles. The different *âsanas* are so many exercises which develop the abdominal muscles, and thus reduce the possibility of the occurrence of ptosis to a minimum.

DIETETIC TREATMENT OF DIABETES MELLITUS.

It is with the present-day physicians customary to divide cases of Diabetes Mellitus into (1) the mild and (2) the severe forms.

Mild and severe forms of Diabetes Mellitus.

By chemical examination of the urine, as suggested by Gerhardt,* and test diet such as that of Von Noorden,† attempts have been made to distin-

* Gerhardt's test consists in the testing of the suspected urine with a solution of perchloride of iron; if diatetic acid is present, then a claret coloration is produced, the intensity of which depends on the severity of the case. This reaction is also produced when salicylates, aspirin or antipyrin are voided by the urine. So these drugs should be discontinued before examining the urine to determine the form of diabetes.

† This is meant for the recognition and estimation of the assimilative capacity for carbo-hydrates. Von Noorden says:—

“Of all the foodstuffs, carbo-hydrates exert the greatest influence upon the glycosuria. It is essential in every case to determine the precise amount of carbo-hydrates which the patient can tolerate. We call this the *tolerating power* of the individual.* * *

“I divide the foods into two groups:—

1. Principal articles of diet. These include substances which are practically free from carbo-hydrates. Foods and drinks of this group form the basis of the three meals a day.

guish the mild from the severe forms of the disease. The dietetic treatment is made to differ in those two classes. In the severe form it is said that a rigid

2. Accessory articles of diet. These include substances which contain carbo-hydrates.

** For the purpose of the test diet I always at first choose white bread, and of this I commence with 100 grammes per day, 50 grammes for breakfast and 50 grammes for lunch.

Von Noorden's standard test diet.

Breakfast.—200 grammes coffee or tea, with one to two table-spoonfuls of thick cream.

100 grammes of hot or cold meat (weighed after cooking).
Butter.

Two eggs, with bacon.

50 grammes of white bread.

Lunch.—Two eggs, cooked as desired, but without flour; or any other *hors d'œuvre* free from flour.

Meat (boiled or roasted), fish, venison, or fowl, according to taste, about 200-250 grammes altogether (weighed when cooked).

Vegetables, such as spinach, cabbage, cauliflower, or asparagus; prepared with broth, butter or other fat, eggs or thick sour cream, but without any flour.

20 to 25 grammes creamy cheese; plenty of butter.

Two glasses of light wine or red wine, if desired.

One small cup of coffee, with one to two table-spoonfuls of thick cream.

50 grammes of white bread.

Dinner.—Clear meat soup, with egg or green vegetable in it.

One to two meat dishes, as at lunch,

Vegetable dishes, as at lunch.

Salad of lettuce, cucumber or tomatoes.

Wine.

No bread.

anti-diabetic diet is not necessary. For my own part, I do not consider a rigid diet necessary, even for mild cases of diabetes. It is this craze for rigid diet which is responsible for much harm in this disease, since the

Drinks during the day (exclusive of wine), one to two bottles of aerated water.

"The total urine excreted during the twenty-four hours is collected, that of the day and of the night separately, and is examined quantitatively for sugar. Both the percentage contents, and more especially the whole quantity of sugar excreted in the twenty-four hours, is noted.

"Further investigations as to the quantity of acetone, oxy-butyric acid, ammonia nitrogen, follow as a matter of course. If on this fare, the only carbo-hydrate contents of which are the 100 grammes of bread, no sugar is excreted, the quantity of bread is then gradually increased until sugar does appear in the urine. If, on the other hand, sugar is excreted with this test diet, the patient is at first kept on the same fare until the daily quantity of sugar excreted has become nearly constant. Then the quantity of bread is gradually diminished * *

"When the urine becomes free from sugar whilst there is yet bread in the daily fare, it is with a case of the so-called *slight form of glycosuria* that we have to do, and the testing has taught us at the same time how high the tolerating power of the patient is. * * The greatest differences occur in this respect, and it is only an exact knowledge of them which enables us to properly prescribe the diet regulations necessary for each individual.

"When it appears from these test examinations that the urine only becomes free from sugar when bread is totally excluded from the dietary, we have then to do with the *severe form of glycosuria*" (pp. 174-177).

The object of the test diet is to show if the sugar comes from albumins. There is no need to subject Indian diabetics to

withdrawal of carbo-hydrates from foods produces acid auto-intoxication. This leads to acetonuria, which is due to the removal of carbo-hydrates from the food. The presence of acetone in the blood is mainly responsible for the occurrence of diabetic coma.

Recent years have seen something like a revolution in the dietetic management of diabetic patients. Not very many years ago, medical men, as a matter of routine practice, used to deprive their diabetic patients of all carbo-hydrate foods. This can be gathered from the long lists of articles of food which were allowed, and of those which were forbidden, to diabetics, by such eminent medical men as Dr. Pavy, Sir William Roberts, and others. As specimens, the lists prepared by the two above-named physicians are reproduced below :—

PAVY'S.*

<i>Sanctioned.</i>	<i>Forbidden.</i>
Butcher's meat of all kinds, except liver.	Sugar in any form.
Ham, bacon, and other pre- served meats.	Wheaten bread and ordinary biscuits of all kinds.
Poultry and game.	Rice, arrowroot.
Fish of all kinds, fresh and cured, including the crus- tacea.	Sago, tapioca.
	Macaroni, vermicelli.
	Potatoes, carrots.
	Parsnips.

this test diet, for not only many of them are born vegetarians and teetotalers, and so will not partake the foods prescribed above, but acute cases of diabetes being rare in this country, most of them possess toleration for carbo-hydrates.

* "Food and Dietetics," 2nd edition, 1876.

Sanctioned.

Animal soups, beef-tea, and
broth (not thickened).

Eggs, cheese, cream cheese,
cream butter.

*Almond, bran or gluten sub-
stitutes for ordinary bread.*

Greens, spinach.

Turnip-tops, watercress.

Mushroom, mustard and cress.

Cucumber, lettuce, endive.

Radishes, celery.

*And the following only, in mo-
derate quantity, after boiling
in much water :*

Turnips, French beans.

Brussels sprouts, cabbage.

Cauliflower, broccoli, seakale.

Asparagus, vegetable-marrow.

Pickles, olives, vinegar, oil.

Jelly, flavoured, but not sweet-
ened.

Savoury jelly.

Blance-mange, made with cream
and not milk.

Custard made without sugar.

Nuts of all kinds, except
chestnuts.

Forbidden.

Beet-root.

Peas.

Spanish onions.

*Pastry and puddings of all
kinds.*

Fruits of all kinds, fresh and
preserved.

Beverages.

Tea, coffee, cocoa from nibs.

Dry sherry, claret, hock.

Dry Sauterne, Chablis, Bur-
gundy.

Milk, except sparingly.

Sweet ales, mild and old porter
and stout, cider.

All sweet and sparkling
wines.

Sanctioned.

Brandy and spirits, unsweetened.

Soda-water.

Burton's bitter ale, in moderate quantity.

SIR WILLIAM ROBERTS.

Butcher's meat.

Poultry and game.

Fish.

Cheese.

Eggs.

Butter, fat and oil.

Broths, soups, and jellies made without meal or sugar.

Cabbage, endive, spinach.

Broccoli, Brussels sprouts.

Lettuce, spring onions.

Watercress, mustard-and-cress.

Celery.

Substitutes for bread.

Bran-cake, gluten bread (and meal), almond meal, rusks and biscuits.

"Torrified" or charred bread.

Beverages.

Dry sherry, claret, bitter ale.

Brandy and whisky (in small quantities).

Tea, coffee, (no sugar), chocolate (made with gluten meal), soda-water, bi-tartrate of potash water.

Forbidden.

Port wine, unless sparingly.

Liqueurs.

All saccharine and farinaceous food.

Bread, potatoes.

Rice, tapioca, sago, arrow-root, macaroni, etc.

Turnips, carrots, soups, beans and peas.

Liver (contains much sugar-forming substances), and therefore

Oysters	} Containing enormous livers.
Cockles	
Mussless	

The "pudding" of crabs and lobsters.

All sweet fruits, as apples, pears, plums, gooseberries, currants, grapes, oranges, etc.

Port and all sweet wines.

Sweet ales and porter.

Rum and sweetened gin.

Rice and potato which were altogether banned from the dietary of the diabetic, are now made by several practitioners the bases of their treatment of this disease. The argument for the withdrawal of carbo-hydrates from the diet was a very simple one. As the urine contains sugar, so, it was thought, the exclusion of those articles from diet which are converted into sugar in the system, would lead to the cure of the disease. Preponderance of proteids—specially animal flesh—entered into the dietary of diabetics. But this did not cure those cases.* Extend-

* Thus Sir Thomas Lauder Brunton says that he has found raw meat of great use in the *Treatment of Diabetes*, but has never succeeded in curing a case with it. He writes :—

“It seemed probable that the glycosuria in many cases of diabetes might depend upon the non-conversion of glucose into lactic acid, and it occurred to me that possibly, either by giving raw meat or a glycerine extract of it, I might be able to cure the disease. In a paper, published in the *British Medical Journal* of February 21, 1874, I mentioned the result of this treatment in some cases in which I tried it at St. Bartholomew's Hospital. In none of them was a cure effected, but in some of them there was temporary benefit. These cases were, I believe, the first in which portions of a solid organ were administered for the purpose of supplying a ferment which would alter tissue change. Before that time only ferments obtained from the digestive canal had been used in medicine.”

“* * Encouraged by the success which attends this method of treatment by thyroid or other glands, I have again been trying raw meat in diabetes. The results which I have obtained are much the same as before. I find distinct amelioration of the symptoms, but I cannot say that I have yet succeeded in curing a case.”—Brunton's *Disorders of Assimilation*, pp. 9, 10.

ed experience has proved the harmfulness of the reckless administration of flesh foods to diabetics.

In recent years, vegetarian diet (especially, carbohydrates) has found favour with a very large number of medical men. Vegetarian diet for diabetics. Flesh foods are not considered so absolutely necessary in feeding the diabetic, as they were formerly.

It is a fact that diabetic patients who are vegetarians live longer than those who are meat-eaters.* Harmfulness of flesh foods in diabetes.

In the *Journal of the American Medical Association*, for July 23, 1898, Drs. Reginald, H. Fritz and Elliot, P. Joslin, published an account of the treatment of diabetes during the past seventy-four years, based on 172 cases treated in the Massachusetts Hospital. According to them, the dietary ordered to diabetics during the period of high mortality, that is, from 1840 to 1855, was as follows :—

“Lean meat, with a small quantity of stale, dry or roasted bread, avoiding all fatty, farinaceous and saccharine articles. For drink, cold water and weak tea.”

This clearly proves the harmfulness of meat in diabetes.

Diabetics require more potassium salts than healthy persons. Therefore, they should be given vegetables rich in such salts.

“Robin (*Bull, de L'Acadde Med.* ; No. 23 of 1895) recommends the food to be well salted on account of the loss of inorganic salts in diabetes ; to supply potassium salts he advises green vegetables, especially cabbage and endive, and also a weak solution of potassium tartarate to dilute the wine taken at meals ; and, to counteract the loss of phosphates of magnesium and calcium, he prescribes glycestro-phosphates of lime and magnesia. He also recommends bouillon on account of the inorganic salts which it contains.” (*B. M. J. Epitome*, 10-8-1895, p. 23.)

In a paper on "Diabetes in India," written several years ago, I attempted to account for this by the fact that the kidneys are not so often disorganised amongst vegetarians as they are amongst meat-eaters.* Extracts from this paper are given below:—

Diabetes in India.

"Almost every practitioner in India comes across cases of Diabetes Mellitus lasting for ten, fifteen, and, in some instances, even twenty years.

"Whether we regard diabetes as a manifestation of some morbid condition of the liver, the pancreas, or of some portion of the nervous system, it cannot be denied that the kidneys also share greatly in pathological changes in the course of this disease. Death in diabetes, if not brought about by some complications, such as pneumonia or phthisis, is almost always due to the kidneys not discharging their functions properly. The closing scenes in diabetes always point to the mischief in the renal apparatus.†

* When I wrote this paper in 1898, I did not fully understand the rôle which alimentary toxæmia plays in the causation of the disease. Of course, kidney troubles are not so common amongst residents of India as they are in cold countries and amongst meat-eaters.

† Some of my critics did not look with favour on this statement of mine. But the medical profession of late is coming round to share this view, expressed by me as far back as 1898. Thus Mr. C. B. Lockwood in a lecture on "Amputation for diabetic gangrene," reported in the *Lancet* for February

“If we bear this fact in mind, we shall be able to understand the longevity of diabetic cases in India, and also to rationally treat the disease.

“In the first place, kidneys have not to perform so much work in India as in Europe and other cold countries. The chief function of kidneys is to remove impurities from the blood. In India, the skin largely shares in discharging this function, and so the whole strain is not put on the kidneys.

“In the next place, kidney disease is not so common amongst Indians as amongst Europeans. This is due to Indians being accustomed to the vegetarian diet, which is non-stimulating, and also to their eschewing alcoholic beverages. Alcohol-consumers have to pay the penalty in diseased kidneys.

Residual kidney power of Indians.	“The marvellous residual kidney power of the natives of India is the key-note of the longevity of cases of diabetes amongst them. They retain their kidney power unimpaired, from their vegetarian diet and non-alcoholic drinks, and also the fact that they keep the pores of their skin open by frequent baths.
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Kidneys should not be unduly taxed.	“Not losing sight of the fact that in diabetics, kidneys are sooner or later diseased, our course of treatment should be such as not to throw undue
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10, 1912, says :—“ When the urine has renal casts in it, the kidneys are gravely and permanently diseased and may not continue to function. *Some who are supposed to die from diabetic coma, may have died with uraemic poisoning.*”

strain on them. In the treatment of diabetes, the regulation of diet plays the most important part. With many practitioners, the administration of animal food is the chief treatment of diabetes. They believe that such food is not converted into sugar and thus the cure of diabetes is to be hoped for. The reckless prescription of animal food has been often followed by serious consequences. The writer has known practitioners giving animal food to diabetics who had never tasted flesh before. The patients, instead of improving, sank rapidly and died. It has not been proved that animal food checks the course of the disease. Such being the fact, its use should not be insisted upon those who are not accustomed to it. Moreover, meat diet is not the proper thing for patients suffering from any renal disease. This diet throws undue strain on kidneys, hence it should be very cautiously given to diabetics.

“From vegetable diet on the other hand, much good is to be expected. It is non-stimulating, and does not throw unnecessary strain on kidneys. Of course, such vegetables as are rich in starch and sugar should be excluded.* In India, where the

Why vegetable diet is beneficial in diabetes.

* We cannot, however, pass over the unique experience of Professor Pietro Lupo of Naples, who has reported, in the *Canadian Practitioner*, for February 1898, cases of diabetes completely cured by exclusively vegetable diet. In the vegetable dietary he excluded nothing—all edible soups, peas, beans, saccharine fruits, including the grape. He says that, after two months of the vegetable diet, the urine showed

people are chiefly vegetarians, diabetic patients should be prescribed vegetarian diet.”*

In diabetes, there are skin affections, as boils and carbuncles, brought about by the blood wanting in proper alkalinity. To make it properly alkaline, vegetable diet is of paramount importance. Vegetable salts keep the blood alkaline.

Residents of Europe and America who are mostly meat-eaters, suffer from constipation and other ailments which are due to it. It is a well-known fact that the thirst of the diabetic is increased by constipation. Vegetarian diet not only keeps the bowels regular and thus relieves constipation, but by its containing a large amount of water does not make one feel so thirsty as a meat diet does. For the relief of the thirst and constipation of the diabetic, vegetarian diet is indicated.

All the above show the necessity and value of vegetables in the dietary of the diabetic. †

a complete absence of sugar. However, it is a safe rule in practice not to allow such vegetables to diabetics as are rich in sugar or sugar-forming elements, because large consumptions of them produce fermentation, thus resulting in alimentary toxæmia.

* As said before, diabetes is a manifestation of alimentary toxæmia. Kidney diseases are set up in the course of the latter. Anything which will relieve toxæmia will prevent renal mischief. Hence the importance of vegetarian diet in the treatment of Diabetes.

† Dr. Arany writes :—

Vegetables should be diabetic's principal article of food, (1) on account of their proteids being better tolerated by the

Formerly all kinds of meat (except sweetbread and liver), fish, poultry, game and eggs were considered good for diabetics. But shell-fish, containing a large amount of carbo-hydrates, were forbidden. Articles of food allowed to diabetics. Animal food, for reasons stated above, should be, as far as possible, withheld from the dietary of diabetics.* However, those who are accustomed to it, may be allowed to partake of it in moderation. For them, fish especially, will be found very useful. Bread made from fish roe may also be given with advantage. This is made from the roe of fresh water fish being dried and ground, and then cooked in the usual fashion. In India, the people do not live such an active life as in cold countries, hence there is less waste of tissues and consequently the demand for proteins should be also less. The demand for fat is also less for there is small loss of bodily heat. The cheapest source of muscular energy is undoubtedly carbo-hydrates.

patient than those of animal food ; (2) because they are very good carriers of fat ; and (3) owing to their filling the patient's stomach up, whereby the diabetic's stomach hunger gets more satisfaction than if an amount of meat, corresponding with the calories of the vegetables, were ingested by him." [*The Lancet* for March 29, 1913, p. 386.]

* Professor Chittenden's experiments have shown the harmfulness of giving, even in health, large quantities of albuminous food-stuffs. In a disease like diabetes where the general tone of the system is below par, the reckless administration of proteids—especially animal foods—cannot prove beneficial.

Carbo-hydrates in Diabetes.

The importance of carbo-hydrates is now recognised, and they are not withdrawn from the dietary of diabetics, as it was customary to do not very many years ago.* Several methods of diabetic cure by means of different carbo-hydrates are now practised. But, before describing these different cures, it is necessary to allude to the fact of there being a larger excretion of sugar in the morning hours than at any other time of the day. There is, at present, no satisfactory explanation of this phenomenon. Dr. Naunyer's explanation is "that in the empty intestines the introduced carbo-hydrates more quickly digest and absorb, and so the diabetic organism is supplied with more sugar at once than it can assimilate." But Dr. Haig contends against this, and says that sugar follows the uric acid, rising when it rises, and falling when it falls,

* Falkenstein (*Wien Med. Pressc*, 1905) draws a parallel between gout and diabetes. According to him, in gout there is deficient secretion of gastric juice, so in diabetes pancreatic secretion is defective or absent. The cell in gout is unable to oxidize completely nitrogenous material; in diabetes carbo-hydrate metabolism is at fault, the intermediate product of oxidation being not uric acid, but sugar. If this is true abstention from the carbo-hydrate food, though it may lower the percentage of sugar in the urine, withdraws from the body a useful food, without influencing the disease. Treatment should be directed in diabetes, not to the withdrawal of all possible forms of sugar in the food, but to sources remedying the deficient pancreatic digestion and stimulating the metabolism of the cell.

and so there is a larger excretion of sugar in the morning hours when the excretion of uric acid is large. Be the explanation what it may, this phenomenon has an important bearing in regulating the diet, in reference to time of day. Carbo-hydrates may be withheld, if possible, or given in very small quantities to diabetics during the morning hours.

In recent years, some articles of food, rich in carbo-hydrates, have been recommended by different medical men as specific cures for diabetes, which seem to be based on the principle enunciated by Von Noorden's school that "the most efficient means for combating acidosis in diabetes is the abundant administration of carbo-hydrates."*

Von Noorden says:—

"Whether it is the rice-cure of Duering, the milk-cure, the oat-cure or the potato-cure, on which we fix our attention, we find that, underlying them all, there is a common principle namely, the limitation of carbo-hydrate to one particular kind, excluding all others, and at the same time the exclusion or the maximal reduction of meat. * * *

* * * It is of tremendous importance to possess, as in the oat-cure, a means of mastering large quantities of acetone-bodies within a few days. Even though we may not be able to permanently maintain this favorable state of affairs, it is still of the greatest advantage to the whole organism to be given a period, of about a week or a fortnight, in which the tissues are practically free from acetone."

For my own part, I do not understand the *rationale* of Von Noorden's recommendation. It may be that the limitation of carbo-hydrates to one parti-

* *The Acid Auto-intoxication*, p. 74.

cular kind will make the diabetic take less quantity of food than usual, thus minimising the evil consequences of over-indulgence. But this is hardly beneficial to the diabetic. His dietary should be as varied as that of a healthy individual. Monotony in diet is not calculated to do him good.

Carbo-hydrates are essential to human life, and therefore these should not be withdrawn from the dietary of the diabetic. Truly has Dr. M. C. Ridwill of Melbourne University, in his paper on "Rye bread in Diabetes," observed:—

"I would like to say here that we must not be carried away by the analysis of food stuffs given in books. The chemical means of analysis are not the digestive means, so that when we see a food marked as containing 70 per cent. of starch, we must not consider that the body ferments can extract the equivalent in glucose of 70 per cent. of starch."

According to Schultzen and other recent investigators, sugar is eliminated unchanged in diabetes, because the ferment is lacking which normally splits sugar into lactic acid and glyceric aldehyde. The withdrawal of carbo-hydrates and the administration of flesh-foods will not generate the sugar-splitting ferment in the system.

It is said by many physicians that wheat starch is not well borne in Diabetes and hence they recommend such carbo-hydrate food stuffs as mentioned below.

- (1) It is desirable to administer in diabetes, such carbo-hydrates as lead to their perfect utilisation. No carbo-hydrate
- Banana cure.

is better calculated to serve this end than the Banana starch.*

In its issue of October 17th, 1903, the *Lancet* wrote:—

“There can be no doubt of the nutritious character of banana flour, and the Starch in it is peculiarly easy of solution and digestion in the alkaline digestive juices of the body. Banana flour is readily dissolved, for example, by the saliva *
* * The flour proves to make a very acceptable loaf, uniform in texture and permanently moist, and of a golden colour.”

* Average composition—Percentages.

Dried fruits.	Water.	Protein.	Fat.	CARBO-HYDRATES.		Ash.	Fuel values: calories per pound.
				Nitrogen free ex- tract.	Crude fibre.		
Banana ...	29·2	5·3	2·3	55·8	2·1	5·3	1240
Figs ...	18·8	4·3	·3	68·0	6·2	2·4	1475
Dates (refuse 10·0)	15·4	2·1	2·8	74·6	3·8	1·3	1615

From Dr. Tibbles' 'Food'; their origin, composition, &c.
Nutritive value of Banana and other foods compared:—

	Banana.	Banana flour.	Wheat flour.	Oatmeal.	Potatoes.
Moisture .	75·50	11·10	14·0	8·9	78·3
Protein ...	1·26	3·55	11·4	15·5	2·2
Fat ...	·50	·83	1·0	10·1	·1
Carbo-hydrate ...	21·70	81·70	75·0	54·8	18·4
Mineral matters.	·76	2·23	1·7	4·0	1·0

The plantain meal is better than other starches, on account of the protein compounds it contains. Moreover, as stated in the *Lancet* of February, 1900:—

“For some reasons, not yet explained, the starch of the banana is much more digestible than are the cereal starches.”

Banana flour is made by drying and grinding of the fully grown unripe banana, that is, before the starch is changed into sugar in the ripening * To peel bananas, they are put into scalding water (176° F.), for a few minutes. The peeled fruit is dried in the sun to reduce the percentage of the water which it contains. Steel knives should not be used, as they turn the banana black; nickel blades are better, and very effective knives can be made from bamboo. One day's hot sun is sufficient to dry them, after which they are put into a mortar, pounded, and then sifted.†

* Ripening of Bananas.

1. The tannin present in the fruit plays no part in the ripening process.

2. The starch is converted first into sucrose, and the latter is subsequently partly or wholly inverted by the action of an invertase.

3. No other sugars besides sucrose and invert sugar are present in the fruit.

(J. Ch. I. for May 15, 1911, p. 569.)

† While the ripe fruit contains 70 per cent of sugars and only 1-2 per cent. of starch, the meal from the green fruit contains nearly 80 per cent. of starch and only 3-4 per cent. of sugars.

In Switzerland a special banana “cocoa” is manufactured of high nutritive value and fine aroma. The following numbers

To make Banana bread, it is necessary to mix a considerable quantity of wheat flour with banana flour.

A loaf from the banana flour is prepared by making a paste of it and then submitting it to the action of steam under pressure.

Bananas may be eaten by being split in half and filled with grated cocoanut. This preparation is relished as much on account of the banana as of the rich sauce of cocoanut milk. Stew of unripe bananas prepared with cocoanut gratings is used with advantage in diabetes.

Rice cure.

(2) Rice cure has been recommended by Duering.

The beneficial effects of rice cure are very easily accounted for; of all the cereals, it is the one which taxes the kidney least and because its consumption in moderation does not produce alimentary toxæmia. Some time ago, the *Herald of Health* summarized the facts on which the claims of rice to be the world's greatest food are based, as follows:—

“1. Rice is the staff of life for nearly two-thirds of the world's inhabitants.

represent the mean of 4 analyses of banana meals from Jamaica:—

Water, 12·77 per cent.

Ash, 2·45 per cent.

Nitrogen, 0·75 per cent.

Equal to protein, 4·69 per cent.

Non-nitrogenory substances 78·32 per cent.

Crude fibre, 1·28 per cent.

Fat 0·49 per cent.

(I. Von. Surey, *Chem Zeit.* 1910, abstracted in *J. Ch. I.* for June 15, 1910 p. 713).

"2. Rice is the most easily digestible of all foods ; it digests in less time than any other food.

"3. Rice is the most easily utilized of all foods, taxing the body least, in both digestion and elimination. Food, such as corn and other cereals, contain five to twenty-five times as much as does rice of the irritating potash salts of which rice, of all foods, contains the least. (Bunge.)

"4. Rice is the best food for sore and feeble stomachs. (Bunge.)

"5. Rice should be the chief food of persons suffering from Bright's disease. (Bunge.)

"6. Rice is the most antitoxic of all cereal foods, and hence the proper food for persons suffering from "biliousness" and other forms of intestinal auto-intoxication.

"The sturdy Japanese rice-eater, whether piloting a warship on the Pacific, digging a canal at Panama, fighting the Russians among the snows of Manchuria, or tilling his fields at home, is far better fed than the beef and potato eating Englishman or American. We may well learn a lesson from the Orient in the matter of diet."—*Herald of Health*.

But then rice should not be polished,* and there

* Dr. J. Water Leather, Imperial Agricultural Chemist, writes :—

"The meals and broken rice are, chemically, the best foods, and the polished rice contains less oil, proteids, and phosphorus. Consequently one is apt to condemn the polishing process. But the consumers hold that one cannot cook unpolished rice, which concludes the argument ! It follows that rice should be consumed in conjunction with other grain,

should be proper methods in its cooking. Only so much water is to be put in the rice to be boiled as will suffice to cook it. To strain off the thickened rice water, after cooking, is not the Japanese practice, nor of the sturdy cultivators of Upper India.

Two points should be observed in the prescription of rice cure in Diabetes, *viz.*,

1. Rice should not be polished; and
2. The thickened rice water, after cooking, should not be strained off.

The following preparations of rice, then, are useful in the treatment of Diabetes:—

- | | |
|---------------------|--------------------|
| (a) <i>Khai.</i> | (b) <i>Chinde.</i> |
| (c) <i>Khichdi.</i> | (d) <i>Choru.</i> |

That distinguished scholar Babu Pratap Chandra Ghosha, late of Calcutta now settled in Vindhya-chala, has described the above preparations in the *Statisti-*

particularly pulses, which indeed is very commonly the case.” (Annual Report of the Board of Scientific Advice for India, for the year 1913-14, p. 13.

A Japanese chemist has described the following method for the extraction of the efficaceous constituents of rice bran.

“The active constituents of rice bran, which exert a protecting influence against polyneuritis of birds, are extracted as follows:—

“100 grams of dried rice bran freed from fat by ether, are extracted with very dilute Pb. (OAC)₂ solution. The extract is neutralized with Na. Co₃ filtered, and the filtrate concentrated *in Vacuo*, at 60° to sirupy consistency. The active constituents are precipitated by addition of 7-10 volumes of absolute Et. O. H. They form a brownish yellow, hygroscopic, amorphous powder of disagreeable taste which is very sensitive to heat. Chemical Abstracts for January 20, 1915, p. 459.

cal Reporter for 1874, a journal which was at that time conducted by the late Mr. Robert Knight as follows :—

“(1). *Khai* is parched paddy. Paddy when parched on fire loses its water, and becomes anhydrous, and swells up into about four diameters. It is then very light, and very white in appearance. In parching, the husk is split and separates itself from the dessicated swollen grain. Indeed, the process and product of parching are similar to those of dessicating borax on fire. The Hindus have observed the resemblance, and have named such anhydrous borax, *sohagar khai*, or the *khai* of borax. Paddy is parched on sand placed upon a shallow earthen pot, generally the detached or broken bottom of a *handi* called *khola*. In separating from its husk, *khai* splits up by heat; and a parching pan of *khai* is a beautiful sight to look at, for a moment the dull-looking, quite insignificant, grains of paddy are converted into dancing white little flowers of *khai*. The act of bursting is called in Bengali *photana*, blown like a blossom. Indeed, like flowers *khai* is scattered about on all joyous occasions. The blowing of paddy is so rapid, that the Bengalis liken the tongue of a fast-talking fellow to a *khai khola*, and the fast-blowing words to *khai phota*. Some paddy is well suited for *khai*, while others are not so, for they do not blow quite so full. Paddy suited for *khai* is called *khaiyerdhan*. The drier the paddy, the better is the *khai* produce. *Khai* is thoroughly cleaned of its adhering husk by being sifted through a large hemispherical sieve called *khaichala chandi*. Dry *khai* is not *sagdi*,

but the least drop of water converts it into *sagdi*; and so polluted *khai* cannot be eaten by a Hindu if it is touched by others than people of his own caste. *Khai* is sold by measure; and a *khai* measure is a *dol*.

“(2). *Chinde* is flattened paddy. Paddy is well boiled, and when slightly dry, it is put under the *dhenki*. Soft paddy, so subjected, is flattened by the heavy pestle of the *dhenki*, and is husked at the same time. *Chinde* is sometime made for the more strict Hindus without boiling the paddy; and so prepared *chinde* is called *atapa-chinde*.”

“(3). *Khichdi* is rice boiled with *dâl*. In a *handi*, *dâl* is made to boil with turmeric and salt; when the *dâl* is sufficiently boiled, washed rice is added to it and boiled till the rice gets soft, when the whole is inverted on a *handi* upon *ghee* and several species are frying. This process is called *samvara* or *santlano*. It imparts to the dish a flavour of laurel leaves, capsicum, the five *phodans*, or seasoning culinary spices, which at the same time, if properly conducted, improve the taste of dish, as a great portion of the waters of the dish is removed as steam. In boiling *dâl*, care must be taken to put just so much water as would boil rice and *dâl*, and leave nothing in the *handi*. The usual measure is two inches above rice and *dâl*.”

“(4). *Choru* is rice boiled with milk, sugar and *ghee*, it is rarely used as food. It is cooked for oblations to the gods and manes of the dead.

In the interior, a kind of *choru*, with different

proportions of *ghee*, is made and eaten ; it is then *gheepâyasa*.*

(3) The author of this is Von Oatmeal cure. Noorden. It is carried out as follows :—

“ The patient for one or two weeks eats nothing but oatmeal gruel daily, 250 grm. of oat flour, 250 to 300 grm. of butter, 100 grm. of Roborat or of some other vegetable albumen ; this mixture is prepared as a soup and given at intervals of two hours. It is a remarkable fact that on this diet the excretion of sugar, almost without exception, falls below the quantity that was excreted on a mixed diet free from carbo-hydrates.

Dr. S. Strouse has reviewed in *The Interstate Medical Journal* for April, 1912, the literature on the subject of oatmeal cure. According to him, it is not advisable to employ it in mild cases. This treatment diminishes the acidosis, and is thus beneficial in severe cases of diabetes.†

I have not tried the oatmeal cure. In this country, at least in the Upper Provinces, oatmeal is not generally used as a food by the people, but is given to horses for fattening purposes. There is prejudice

* I have known and seen cases of Diabetes benefitted by *choru*.

† But it has been suggested by Drs. O. J. Williams and P. Mildred Powell, in a paper on Diabetes Mellitus which they read before the Liverpool Medical Institution, on 7th March 1912, “ that there may be some part of the potato, of oats, and of rice which has a specific action on metabolism, and which if it can be isolated from the cereals or from the preparations, of diastase, may prove to have specific action in the treatment of diabetes.” [The *Lancet* for March 16, 1912, p. 728].

against using it and living on it for days together—which is the method advised by those who advocate its use. Its author, Dr. Noorden, does not claim that oatmeal treatment will cure diabetes. According to him, it will lessen the dangers of that disease.

(4) Potatoes were, and still are, forbidden by many to the diabetic. Yet it is a remarkable fact that its use has been recommended by many in diabetes.*

* Sir Thomas Brounton writes :—

“ In my opinion it is not advisable to remove carbo-hydrates entirely from the diet. If you do this, you find the patients, as a rule, suffer very much, and that they practically get such a craving for carbo-hydrates that they will have them in spite of your prohibitions, whereas, if you allow them in a limited form you may get your patients to stick to the diet as you restrict it, and it is much better that they should take the diet which you have laid down for themselves. Diabetics, as a rule, complain very bitterly of their diet, and say that it becomes so distasteful to them. You may allow a little potato, if it be given in the form of potato chips. A single potato cooked in this form may be made to fill almost a whole dish. It must be cooked, however, in one particular way, and this is the way. You must have a large deep pan, not a frying pan, but a pan six inches deep and this should be nearly full of oil or grease ; dripping is as good as any other kind of fat. You put this on the fire, and it comes as you think to the boil, but this boiling is quite delusive. You let it go on boiling, and all the water that is mixed with the dripping boils away, and, finally, in place of the apparently boiling liquid, you get liquid with a perfectly smooth still surface, which is not boiling at all, and then is the time you are able to cook your potatoes. They should be cut in very thin shavings indeed, and should be then thrown into this practically boiling fat. When I say boiling, I mean this

An editorial in the *British Medical Journal* for January 18, 1902, p. 160, states that the value of potatoes, as a substitute for bread, was recommended in small quantities by several authors such as Dujardin, Beaumetz, Kuelz, Saundby, and others. But M. Mosse, in his communications to the French Academy of Medicine, goes still further in the use of potatoes in considerable quantity, as much as three pounds being allowed daily. He describes a number of cases which were placed on this diet to show that, as compared with the equivalent quantity of bread, their use was followed by a decrease in the amount of the glycosuria, polyuria, and thirst; also marked improvement in general health. In only one case were the results unfavourable. It has been shown that diabetics can take 3,000 grains daily in the form of potatoes, without eliminating more than 500 or 600 grains of glucose in the urine. Mosse ascribes the benefit of the potato diet to the alkaline salts, especially potassium, contained in the potato.

very hot fat which does not appear to boil. They are then quickly taken out, and under the influence of the great heat then become firm and crisp upon the surface, and the fud that they contain is boiled within these crisp surfaces by the heat, so that they are blown out, and each little shaving of potato, which was originally as thick as a bit of cardboard, is now about three-quarters of an inch thick. These potato chips may be used in cases of diabetes, and you will find that the patients are very fond of them as a rule, and they are enabled to get down a quantity of food that they could not otherwise take.—"

[Brounton's *Disorders of Assimilation*, &c, pp. 54-55.]

Sir James Sawyer, in his article on "Improvements in dietetics of diabetics" in the *British Medical Journal* for March 5, 1904, p. 537, states that the permission of potatoes in the food of diabetics is one of the greatest dietetic advances of our times. Cooked in any of the ordinary ways, they are a grateful food, but they should be cooked by steaming with the skin on. He proposes that the bread difficulty in diabetics be met by using the "flour" of properly cooked potatoes, instead of the flour of grain.

He writes :—" I find that excellent and delicious baked cakes can be made from paste composed of a kind of flour prepared by rubbing down potatoes cooked with their coats on by steaming, blended with cream and butter." Then he gives the following details for the making of these new biscuits and bread for diabetics :—

" *Bran and Potato Bread.*—Take half a pound of flour of steamed potatoes, quarter of a pound of bran, half an ounce of German yeast, half an ounce of butter, one egg. Twenty-four hours before making the dough, cook the potatoes by steaming them in their "jackets," then peel and break up into flour with the fingers. Mix all ingredients together, and let the paste stand near the fire for an hour to "rise." Bake in greased tins for an hour and a half."

According to Fletcher (*Maryland Med. Journal* for October 1904) potato starch improves such other symptoms of diabetes as thirst, neuralgia, etc., and that it not uncommonly produces tolerance for carbohydrates. He recommends that potatoes should be given baked.

I have tried the potato cure in some cases of diabetes. But if it did not do any harm, it did not appear to do much good to those who were subjected to this treatment. As stated before, there are many people who attribute the prevalence of diabetes to the introduction of potatoes in this country. For reasons mentioned there, potatoes should be withdrawn from the dietary of the diabetic.*

As substitutes for rice and wheat, different kinds of millets have been used in the dietary of diabetics. These are used in the form of porridge and of *chapatis*. There is a larger percentage of oil in millet than in wheat or rice. This perhaps accounts for its usefulness in diabetes.

* It is necessary to mention here that oatmeal and potato cures have not found favour with the majority of English physicians. Thus Dr J. Rose Bradford, writing on Diet in Diabetes in "*A system of Diet and Diatetics*," edited by Dr. G A. Sutherland, says:—"Potatoes and oatmeal are very suitable kinds of carbo-hydrates to give in certain forms of diabetes, inasmuch as it is so usual to take them with large quantities of fat, either in the form of butter with potatoes, or cream with porridge. * * there is no reason for thinking that either potatoes or oatmeal contain carbo-hydrates that are less prejudicial to the diabetic than bread and other carbo-hydrate foods." (p. 450).

For my own part, I strongly urge the exclusion of the potato from the dietary of the diabetic in India, because the precaution of *non-exposure to light* is not taken by potato cultivators in this country.

Bread being also a carbo-hydrate was (and is) under the ban of many medical men; and so, many substitutes for ordinary bread were recommended for diabetic patients. Dr. R. T. Williamson has classified the most useful of these bread substitutes as follows:—

“ 1. Prepared from vegetable albumens ;

Roborat bread. Aleuronat cakes. Gluten bread.

2. Prepared from nuts :

Almond cakes. Cocoanut cakes.

3. Prepared from milk albumens :

Plasmon powder and biscuits. Protein bread and biscuits. Casoid bread and biscuits. (Kalari and pro-lacto biscuits.)”

Gluten bread was formerly very extensively used in the dietary of the diabetic. But it has fallen into disuse, because it is unpalatable, expensive, and by no means free from starch. Bread made of almond flour, cocoanut flour, *besan* or flour of several varieties of *dâls*, which are not only palatable and inexpensive, but contain less amount of carbo-hydrate than gluten could be very advantageously used as substitutes for ordinary wheaten bread, if so desired.

Speaking of bread, it is necessary to remember what Dr. William Prout said in his work on ‘The Nature and Treatment of Stomach and Renal Diseases,’ regarding the use of bread in diabetes. The present classification of food-stuffs originated with Dr. Prout, and in his time he was considered

a great authority on all questions relating to Food and Diet in health and disease. He wrote:—

“Bread, therefore, made with undressed flour, or even with an extra quantity of bran, is the best form in which farinaceous and excremental matters can be usually taken in most of the varieties of dyspepsia, accompanied by obstinate constipation. This is remedy ; the efficacy of which has been long known and admitted ; yet, strange to say, the generality of mankind choose to consult their taste rather than their reason ; and by officiously separating what nature has beneficently combined, entail upon themselves much discomfort and misery.”*

*“For some time past, I have recommended as a substitute for bread in diabetes, a compound of bran, eggs and milk, which, if properly prepared, is not unpalatable. The late Rev. J. Rigg, to whom this *bran-bread* was recommended, took much pains to perfect the process and the following, with some slight variations, is the method he finally adopted :—

“The bran in the first place is to be re-ground, or the coarser portions separated by sifting. It is then to be diffused through cold water, and permitted to stand for a short time, so as to allow all the heavier portions, and particularly the silicious matter derived from the mill stones, to subside to the bottom. The bran suspended and diffused through the water, is now to be poured into a bag made of cloth, of such a texture as to allow the farinaceous matter, but not the bran, to escape through it ; and the bag with its contents are to be repeatedly washed in cold water till the water is no longer rendered milky ; in other words, till the whole of the farinaceous matter is removed. The bran is then to be removed from the bag, dried before the fire or in the sun, and after being well beaten and separated, again sifted ; when it will be fit for use.

“Seven eggs, one-sixth of a pound of butter, the same quantity of suet (previously melted together,) and a pint of

But it is not always necessary to make use of bread substitutes for diabetics. Most of them can and do tolerate ordinary wheaten bread better than its substitutes.*

milk are then to be well incorporated and mixed with as much of the prepared bran as will make a soft dough, which is to be well kneaded in the ordinary way. The quantity of dough thus prepared will make four or five small loaves or cakes, which may be baked in saucers in a quick oven.

"According to Mr. R., "This bread kept well and remained very palatable for a few days, and having it," he observed, "I really did not feel the want of any other kind of bread." He sent me a specimen, which arrived in good condition, and corresponded with his account. The addition of a few carraway seeds may, by some, be deemed an improvement. I regard this bran-bread as much superior to the *gluten*-bread recommended in Diabetes; all the specimens of which I have seen have been difficult of mastication, in short, almost as much so as caoutchouc. It is probable that a superior bread may be made by a due admixture of bran, prepared as above, with gluten; and that the lightness may be increased by employing the carbonate of soda and muriatic acid, as in the preparation of unfermented bread. In this case, the milk may be omitted, and the bread made to resemble more nearly common bread."—Dr. Prout's *Nature and Treatment of Stomach and Renal Diseases*, 5th Edition, 1847, pp. 43-44.

* Although bran contains a large percentage of nutritive ingredients, it is for the most part indigestible and irritating to the alimentary canal. So attempts have been made to produce a digestible flour from it. In the *Journal of the Society of Chemical Industry* for Oct. 15, 1908, p. 994, there is a description of a process of which the author is T. Schluter, Jun., Foerderstedt, Germany. It has been patented in the United States, America; the patent bearing No. 897, 854 and being dated September 1st, 1908.

Since diabetics can assimilate inuline—a form of starch found in tubers for several species of *Inula*, such as that of *Inula racemosa*, which grows in the Western Himalayas, on the borders of fields, &c., Kashmir, and Piti—it has been recommended to be given in the form of biscuits.*

“Bran is mixed with boiling water to a thin pulp, then heated quickly to a temperature of 100°C, dried at a temperature of about 70°C., and the solid mass obtained ground to a flour.”

Bread made of bran-flour prepared as above, is very nutritious, and may be given to diabetics with advantage.

To recover the mineral constituents from bran for admixture with ordinary flour, &c., the bran is treated with water to extract soluble salts, and the residue then treated with an acid solvent (*e.g.*, hydrochloric acid) and water, and subsequently with an alkaline (sodium hydroxide) solution of sufficient strength to extract gluten, &c., but not to dissolve cellulose. The acid and alkali in the second and third extracts are neutralised, and the whole of the extracts are united and evaporated to dryness, preferably *in vacuo*, and the residue reduced to a powder. [*J. Ch.* I Aug. 31, 1909. Eng. Pat. 15, 474, July 21, 1908, by J. H. Quine, Rochester, New York.]

* The root of *Kasni* (*Cichorium intybus*) contains 36 per cent. inulin, and may be made into biscuits.

“Inulin administered to phlorhidzinized dogs does not give rise to glucose. The feeding of levulose to the same animals results in the elimination of large amounts of glucose. It is concluded that inulin is not, to any appreciable extent, converted into levulose or any other substance capable of forming glucose in the diabetic organism.”—*Chemical Abstracts*, for June 10, 1914 p. 1979.

Kulz gives the following recipe for making these :—

“Fifty grammes of inulin are to be put in a large porcelain basin, and while standing over a water bath to be rubbed up with 30 cubic centimeters of milk, and as much hot water as may be necessary, into a uniform dough, with which the yolks of four eggs and a little salt are to be mixed. To this the whites of the four eggs are to be added, having first been beaten to a foam and carefully worked in. The dough is finally to be baked in tin moulds, previously smeared with butter. The taste of the biscuits may be improved by the addition of vanilla or other spices.”—(“Dietary of the Sick ; Von Ziemssen's Handbook of General Therapeutics.”)

Dr. Hale White suggests that the tubers may be cooked and eaten as a vegetable.

The importance of carbo-hydrates being recognised, the question has arisen, which other carbo-hydrates, besides the above, could be given to the diabetic? Gautier answers this as follows :—

“We say: Suppression of the saccharose or cane sugar and of glucose, but not of levulose, a special sugar which is not sensibly eliminated; reduction of starchy foods, but not of those which Kulz has pronounced harmless and which are rich in ordinary starch, but in inulin and inosit, special starchy saccharine substances which are unfitted to be changed directly into glucose. Such are Jerusalem artichokes, viper's grass, scorzonera, salsify, french beans, chicory, lettuce, cardoons, onions, leeks, many mushrooms, etc.

“As to asparagus, radish, cress, long radishes, turnips, horse-radish and especially the vegetables properly so called: spinach, sorrel, cucumber, cole, cabbage, cauliflower, sauerkraut, salads of every kind; these may be also taken, as they contain *but very few carbo-hydrates*. Moreover, cooking carries off from these vegetables a large proportion of their

sugar and partly dissolves their starches, which disappear with the water."

"Fruits,* properly so-called, particularly those of the Rosaceæ (peaches, apples, apricots, pears, straw-berries, raspberries) containing as a rule only 5 to 6 parts of sugar and 1 to 7 of starch per 100, may in case of necessity be tolerated, provided they are not taken in excess, as 100 to 150 grms. per day do not introduce more sugar than 10 to 15 grms. of bread do. Moreover, half of this sugar is in the form of levulose, which rapidly disappears from the blood. The same may be said of the orange, lemon, pomegranate, etc."

"With still more reason, may those fruits, which contain scarcely any sugar or starch, be sanctioned: almonds, nuts, olives. On the other hand, it is necessary to avoid those which are rich in sugar or starch: bananas, chestnuts, cherries, grapes, etc."

In India, besides the above, such fruits as *jambul*, *khirni*, *phâlsa*, *lasora*, *papaya*, *Bael* (*Ægle marmelos*); *Kath bael* (*Feronia Elephantum*); *Zizuphus vulgaris* and *jujuba*; *Averrhoa Carambola*; *Anacardium Occidentale*; and *Semecarpus anacardium* may be given

* Fruits and acidosis.—

According to N. R. Blatherwick of Yale University (*Arch. Intern. Med.* for 1914), oranges, raisins, apples, bananas, cantaloupes and potatoes, particularly the last two, are very effective in reducing the formation and excretion of acid. Tomatoes are less valuable. The cereals increase the formation of acids. Plums, prunes and cranberries, in spite of their alkaline ash, increase the excretion of acid, owing to the BZOH they contain. Meat produces a large increase in the acidity of the Urine. All acid urines are super-saturated with uric acid; all alkaline urines may dissolve more.—*Chemical Abstracts* for Novr. 20, 1914, p. 3672.

to the diabetic with advantage. The prune also is very beneficial to the diabetic, for it not only acts as a thirst-quencher, but, when properly dried and treated, contains more nourishment, volume for volume, than any other food.

While there is difference of opinion regarding the prescription of starches to diabetics, most of the authorities agree that sugars—saccharose and glucose especially—should not be given to them. Diabetics crave for something to sweeten their foods and drinks with. Saccharin has been proposed to satisfy their craving. This is a coal-tar product and said to be 300 times sweeter than cane sugar. But at the same time it is a poison. It may be used as a medicine, but not as a food.

Sucrol, a paraphenctol-carbamide, has been also proposed as a substitute for sugar, but this also cannot be given in large quantities, as it gives rise to unpleasant symptoms.

Glycerine has been proposed as a substitute for sugar. But its administration also is known to increase glycosuria.

Levulose, erythrite and inosit may be used as substitutes for sugar. But these are very expensive stuffs.

In India, many diabetics take cane-sugar, and they do not seem any the worse for it. As I look upon diabetes as a manifestation of alimentary toxæmia, I do not see any harm in the administration

Sugar in Diabetes.

of cane-sugar, but it should not be given in such a quantity as to increase toxæmia. Practitioners of Hindu and Græco-Arabic Schools of medicine give honey to diabetics with many of their medicinal preparations. Since honey consists of levulose, it is not harmful in diabetes.*

Cane-sugar strengthens cardiac muscles and therefore acts beneficially in diabetes.

Some of the edible gums may be given with advantage to diabetics. Acacia Gums in Diabetes. gum, known in Hindi as *Katirâ gond*, fried in *ghee*, has proved of use to sufferers from diabetes. It is very palatable and is useful, for it is not converted into sugar.†

*"From a study of 7 cases Davidoo claims that honey is a good substitute for other sweet foodstuffs in diabetes. It prevents acetonemia and diminishes the amount of sugar in the urine in spite of the fact that honey contains 75% sugar."—*Chemical Abstracts* for December 10, 1915, p. 3278.

† *The Housewives' League Magazine* of New York for 1914 published an article entitled "The Story of Chewing Gum."

It is stated there that—"Gum-chewing is admitted to be a habit of American origin, and is attributed generally to American nervousness; but there is another and quite rational reason for its use. Spanish explorers reported that they found the Indians five hundred years ago using the gum of the Sapodillo to relieve exhaustion and quench thirst. The Indians probably did not chew the gum, as their descendants to-day do not chew it. They only hold it in the mouth, which has the effect of provoking a flow of saliva and thus keeping the throat moist in the absence of water. * * * * In Greece it is said to be dispensed as a regular ration to the army. * * * Who shall say how much this humble confection had to do

Fats and oils in diabetes.

Diabetics, as a rule, suffer from sub-normal temperature, and when they have fever, then their urine is generally free from, or contains a very small amount of, sugar.

The food which a healthy person takes in the course of 24 hours represents between 2,500 and 3,000 calories: but the diabetic requires more, since he voids large quantities of urine containing sugar. One gramme of sugar representing about 4 calories, a loss of 300 grammes a day means that 1,200 calories have to be replaced. It is calculated that one gramme of proteid represents about 4 calories, whereas the same amount of fat about 9. So the diabetic losing 300 grammes of sugar a day by his urine has to take extra 300 grammes of proteid or 135 grammes of fat to cover his loss. Fatty foods should, therefore, be given by preference.

with the fall of the Turks." (*Literary Digest* for October 17, 1916, p. 797.)

The beneficial effects of gums in diabetes are probably due to the enzymes they contain. According to F. Reinitzer (*J. Ch.* 1. 15th October, 1909), there are at least three enzymes, *viz.*, an oxydase, a peroxydase, and a diastase present in gum, though, in some gums, all three enzymes may not be present.

Again, a gum solution is very rich in colloids, and it has been shown by the above-named author that, on passing such a solution through the filter, a large proportion of the colloids is retained, and that the saccharifying part of the amylase may either be completely or almost completely retained, whilst the liquefying part passes through.

Fats and oils have been proposed as substitutes for carbo-hydrates in feeding the diabetic.

It should be remembered that carbohydrates and fats cannot substitute each other indiscriminately as each has its specific action on the whole metabolism of force and matter, which is a factor of great importance for their rôle as food.

When the liver is affected, that is, when diabetes is due to liver disorder, food which does not undergo secondary digestion in that organ should be given. Fats, therefore, are very useful in diabetes, since the liver is not unduly taxed for their digestion.

Fats, as said before, are our sheet-anchor in the dietetic management of diabetes. These may be derived from the animal or the vegetable kingdom. Butter, cream, cheese, yolk of eggs, bone-marrow, vegetable oils, nuts and other oleaginous seeds may be very usefully given to diabetics. But it is necessary to remember that fats without the addition of carbo-hydrates may produce acetonuria. Regarding butter, the authors of the monograph on "The Acid Auto-intoxication" say :—

Butter gives the highest values for acetone excretion of all the fats that we eat. Von Noorden has called attention to the fact that this deleterious influence that large quantities of butter exercise can be reduced if the butter is first thoroughly washed with cold water; for in this way the lower fatty acids are removed and they exercise the greatest influence on the acetonuria. If the butter is thoroughly washed, quantities as large as 180 or even 200 grm. can be given without causing any appreciable increase in the acetone excretion, and we will hardly ever be tempted to give more fat than this." *

* L. C. pp. 73-74.

Clarified butter, known as *ghee*, can be given with more safety than butter.

In his monograph on Diabetes Mellitus, Noorden says :—

“The question as to whether fats also play a part in the formation of the sugar is a much more difficult one to answer. For the one component of fat—the *glycerin*—the question may be at once answered in the affirmative. * * * Glycerin increases glycosuria, both in severe cases of diabetes in man and in dogs after extirpation of the pancreas. *Lecithin*, which contains a fair amount of glycerin, behaves in the same way.” p. 75).

Fats are, no doubt, our “sheet-anchor” in the dietetic treatment of diabetes, for the production of sugar from fat has not yet been demonstrated. But fats cannot be given in very large quantities, or rather in isodynamic quantities as substitutes for carbohydrates.* Moreover, it has been found that ingestion of certain kinds of fats often leads to acetonuria.

* Dr. E. P. Cathcart of Glasgow University, in a paper on “The rôle of carbo-hydrate in nutrition,” in the *British Medical Journal* for September 19, 1914, writes :—

“When we consider carbo-hydrate we find, in man at least, that still less of the carbo-hydrate in a diet can be replaced by fat. The organism demands that there be a constant supply of carbo-hydrate circulating in the body fluids ; even in advanced starvation, the glucose content of the blood varies but little from the normal.”

As a result of certain experiments, he states :

“The definite psychical effect of the taking of carbo-hydrate after the prolonged use of a fat diet was particularly well marked ; the subject, within an hour or two, was bright and

"Gelymuden was the first to call attention to this relation, for he demonstrated that the ingestion of butter led to an increased excretion of acetone. This author assumed that the acetonuria in this instance was due to the effect of free fatty acids, and Waldvogel, Hagenburg, Schwarz, Mohr and Lob and others could also determine that the ingestion of free fatty acids, as for instance, butyric acid, led to an increased elimination of acetone in the urine and in the expired air. The same effect, however, is also exercised by the neutral fats, although not to such a degree."*

How the deprivation of carbo-hydrates produces acetonuria is not as yet fully understood, although the abovenamed authors have attempted the following explanation, when they say :—

"The phenomenon of acetonuria, with its many modifications, becomes quite comprehensible if we assume that acetone is a synthetic product derived from certain bodies that contain few carbon atoms and that may be derived from different sources."

"Normally, the fragments of the proteid and fat molecules that contain few carbon atoms undergo further oxidation, but only, as has been repeatedly emphasized, if a sufficient quantity of carbo-hydrates is present. This is probably due to the fact that the carbo-hydrates contain so much oxygen. A portion of this oxygen is presumably liberated when the carbo-hydrates undergo metabolism and is used for the oxidation processes. That the effect of the oxygen must be of a peculiar kind, is

cheery, whereas previously he was dull and heavy, at the same time the feeling of physical debility and tiredness disappeared."

"Now, carbo-hydrate may be regarded as the currency which is readily available, and fat the security, but a security which cannot apparently be so fully liquidated as to take its place as a universal currency."

*'Acid Auto-intoxication,' by Prof. S. Carl Von Noorden and S. Mohr (1903), pp. 25 and 26.

demonstrated by the fact that there is no lack of respiratory oxygen in diabetes. One might imagine that the influence of the carbo-hydrates is a constant effect, exercised by the oxygen *in statu nascendi* that is liberated within the cell."*

The same authors write:—

"Some authors recommend adding carbo-hydrates or substances that are similar to carbo-hydrates to the diet, for in this way, it is argued, the acetonuria is decreased, while at the same time glycosuria is not greatly increased. A substance answering this purpose would seem to be levulose. Unfortunately however, as Von Noorden has repeatedly shown, this sugar is useful only in mild cases, for, in the more severe cases, levulose seems to increase the glycosuria as much as other carbo-hydrates (amylum, etc.) In severe cases, on the other hand, levulose presumably exercises the same effect on the glycosuria as starch, and the latter substance is more useful, because it offers more variety to the patient and is more agreeable to take than levulose. For these reasons, we employ levulose in those cases in which we desire a very rapid result, and in cases in which—as for instance in incipient coma—only a liquid diet can be given. Under these circumstances, levulose frequently exercises a very excellent effect and aids in warding off impending danger."

Milk in diabetes.

Milk is very useful in diabetes; so much so that there is the system known as milk cure of diabetes. In this system, which was much practised by Dr. Scott Donkin, the food is limited to *skimmed* milk. At first the patient takes four to six pints in 24 hours, gradually increasing it to 12 pints. Part of this milk is converted into curds and whey, and taken as such. According to Dr. Donkin, by placing

* Locum Cit., pp. 71—72.

a patient on milk diet, sugar entirely disappeared from the urine, at the end of a fortnight.*

***THE SKIM-MILK TREATMENT OF DIABETES.**

"The skim-milk treatment of diabetes and Bright's disease was suggested by the late Dr. Arthur Scott Donkin in a book under this title published by Longmans Green & Co., in 1871. He considered it suitable for all but the very worst cases. He administered it in the following manner: On the first day of treatment half a tea-cupful of skim-milk every two or three hours; on the second day, double the quantity at the same intervals; on the third day, half a pint at intervals of three or four hours; on the 4th day, four pints may be given; on the fifth or sixth, five pints and, if borne well, the quantity may be raised to six, seven, or even, in patients of large frame and keen appetites, to nine pints. In some cases he gave curds in addition. The milk may be given cold or warm: every other article of food must be strictly prohibited, although occasionally tea or coffee was allowed. The general experience of other authorities has not been favourable to this plan of treatment. The late Sir William Roberts said: "Three chronic cases I know of, in which the treatment was obstinately persevered in, died from exhaustion." Dr. W. H. Dickinson writes: "Of two diabetic women thus treated in St. George's, one died on the second day, possibly partly from the effects of the journey to the hospital; the other slowly sank under the process, and owed her death in all probability to it; with these experiences I have myself forborne the practice." The late Professor Frerichs condemned it, and Dr. Ralfe spoke of it as only suited to the gouty type. Professor Saundby, in the first edition of his *Lectures on Diabetes*, printed a table to show that this diet is one on which patients may lose weight while the amount of sugar is not reduced. Finally, it is not in accordance with the modern principles upon which the treatment of diabetes is based; these recognise that each diabetic patient has an individual capacity for the assimilation of carbo-hydrate food, and that the problem which the physician has to solve is to determine this quantity for him and to construct a diet containing only as much carbo-hydrate as he can utilize.—*The British Medical Journal* for 12th November, 1904.

But this exclusive milk diet has not found favour with the medical profession generally.*

Milk contains four per cent of sugar and a very large amount of water—which, it is said, makes the condition of the diabetic worse. But, on the other hand, it contains a large quantity of fat and albumen which cannot but benefit diabetics. So cream may be given with great advantage to them. It contains less milk-sugar, and a large amount of fat.†

*“I consider milk to be counter-indicated at all periods of the disease and, like Frerichs have always seen the sugar in the urine greatly augmented under its influence.” (Germain See’s *Du Regime Alimentaire*, p. 522.)

Milk is not easily digested by many. It produces flatulence which is a very common cause of alimentary toxæmia. It is advisable, therefore, not to prescribe it indiscriminately in all cases of diabetes.

†“I reject milk entirely from the dietary of the diabetic. I have always seen in diabetics who have drunk milk the amount of sugar in their urine increased by it.” (Dujardin—Beaumetz’s *L’Hygiene Alimentaire*, p. 178).

On the other hand, Dr. Haig writes of the case of a diabetic patient that “by increasing the milk I appeared to be able to ward off the coma. It has also been pointed out by Maurel (*Bull Gen de Therapeutique*, 1897) that milk diet wards off both “the gangrene and coma of diabetes.” [*Uric Acid*, 6th Edition (1903), p. 678.]

(Ettinger (*Sem. Med.* March 26th, 1897) treated patients with chronic myocardities, albuminuria, generalised gout, dyspepsia, etc., with milk diet, with great success, and concludes that milk is not so injurious as is supposed. It is far from certain that lactose generates glycosuria in all cases of diabetes, though it has been shown to do so in coma. Bouchard has shown that all generators of glycogen do not have

Curds of milk, in which sugar has been partly converted into lactic acid, are useful in diabetes. *Koumiss*, *kefir*, *laben* and those preparations of milk in which the sugar is got rid of by fermentation may be prescribed with advantage to diabetics.*

It is also said that lactic acid ferment destroys sugar. But the true explanation seems to be that the lactic acid ferment brings about the rapid cleavage and solution of proteid foods before their decomposition by intestinal bacteria.

Whey is useful in diabetes, because it relieves ali-

Whey in dia- mentary toxæmia. It is on that
betes. account that Metchnikoff attributes

an equal action. There are carbo-hydrates that seem to have little influence on glycosuria, such as levulose, inuline and mannite, which have often been used without ill-effect. It is, however, certain that the same carbo-hydrates produce different effects in different persons. Certainly the rule is that the groups of sugar which deviate polarised light to the left are less injurious than those that deviate it to the right. Ettinger has shown that milk may be invaluable in some cases of diabetes, and that its prescription should depend, not on a general theory, but entirely on the individual case.

* *Koumiss substitute.*

To prepare a substitute for Koumiss from cows' milk, the *Ap. Zeitung* gives the following directions: Dissolve 15 gram. ($\frac{1}{2}$ oz) of grape sugar in 120 cubic centimeters (3 fl. oz) of water. Mix 12 grain. (18 grain of well-washed and pressed bear yeast with 60 cubic centimeters (2 fl. oz.) of cows' milk. Mix the two liquids in a champagne bottle, fill with milk, stopper securely, and keep for three to four days at a temperature not exceeding 10°C. (50°F.), shaking frequently. The preparation does not keep longer than four or five days.—[*Scientific American Cyclopedia of Receipts.*]

the longevity of Bulgarian peasants who consume large quantities of this food.

In Europe, the importance of whey as an article in sick dietary has been recognised only in recent years; but Hindu physicians knew its usefulness so well, that they compared it to nectar or water of immortality.*

* In one of the medical works of the Hindus, it is stated :

न तक्रसेवी व्यथते कदाचन न तक्रदग्धाः प्रभवन्ति रोगः ।

यथा सुराणाममृतं सुखाय तथा नराणां भुवि तक्रमाहुः ॥

निशान्ते यत् पिबेत्तोयं तत्तोयं नेत्रवर्धनम् ।

भोजनान्ते पिबेत् तक्रं तत् तक्रममृतोपमम् ॥

Utilisation of Whey for Dietetic Purposes.

Whey is allowed to stand in a suitable vessel for from 2 to 6 days at the ordinary temperature, until it has attained the desired degree of acidity, as is ascertained by testing portions of the liquid from time to time; and the clear liquid is then drawn off and heated to a temperature of 170° F. The dissolved proteins are thus coagulated and are separated; after being washed, the coagulum may be dried, powdered, and used as a food. The clarified whey is then bottled, while it is in a hot and sterile condition. If desired, the whey, after bottling, may be inoculated with a quantity of a culture of lactic acid bacilli, in order to increase the acidity; this result is aided by the addition of a small quantity of dextrose, and the bottles may be closed before the fermentation is completed, so that an aerated beverage is produced. An alternative method consists in treating the fresh whey with a sufficient quantity of hydrochloric acid to precipitate the proteins when the mixture is heated to 170° F. The coagulated proteins are then removed, and the solution is inoculated with lactic acid bacilli [*Eng. Pat. 23, 127, October, 11, 1909, J. Ch. 1. 30-11-1910, p. 1327.*]

Artificial milk, from which sugar has been removed, has been suggested for diabetics.*

The acid may be concentrated under atmospheric or reduced pressure, so as to form a syrupy liquid or a solid mass. The solid product may be ground and the powder pressed into the form of tablets. Or, the whey may be sprayed into a current of air having a temperature of about 300°F., and the finely divided dry powder thus obtained pressed into tablets.

A New Method of Preparing Whey.

Treat 300 CC., cold milk with 6 CC. 50% tartaric acid. Stir well. Coagulation is instant. Let stand 2 minutes and filter in graduated cylinder, pouring back the first portions until a clear filtrate is obtained. Determine sp. gr. at 15° of the first 60 CC., filtrate by means of a Quevenue lactometer. Tables for correction to be made when sp. gr. is taken at other Temperature are given. 20-25 minutes only are required for making this test. 90 % of adulteration with 5 % water can be easily detected. The sp. gr. of the whey lies between 1028 and 1030. —*Chemical Abstracts*, for May 10, 1914; p. 1625.

* There are several methods of preparing artificial milk. According Dr. R. T. Williamson:—

“Four table-spoonfuls of cream are added to a pint of water and well-mixed. The mixture is allowed to stand in a cool place. At the end of 12 hours the fat of the cream which will have floated to the surface, can be skimmed off with a teaspoon. On examination, this will be found to be practically free from milk-sugar which will remain dissolved in the pint of water. The cream fat is skimmed off the surface of the water in the first vessel and then placed in another vessel, and to it are added water, the white of an egg, a little salt, and a trace of saccharin (if desired). A palatable artificial milk can thus be prepared. This milk may be allowed freely in all forms of diabetes. (The egg albumen may be omitted, according to the patients' taste.) —*The Practitioner*, for April, 1906 pp. 494-495.

Green vegetables in Diabetes.

It is because green vegetables contain a large quantity of salts that their use is recommended in diabetes. These not only ward off scurvy, but relieve constipation, which is one of the most distressing symptoms in this disorder.* Green vegetables

The Journal of the Society of Chemical Industry for 15th September, 1905, gives an account of English Patent 17,318 of August 16, 1904, for the production of *Milk free from sugar*. The cream is separated from the milk by centrifugal action and washed, the casein is precipitated by acetic acid, filtered off, washed and redissolved in a dilute alkaline solution; this casein solution is recombined with the separated cream and the necessary salts are added. These salts consist of a soluble calcium salt, such as calcium chloride, sodium chloride, and a soluble phosphate, such as sodium phosphate; the desired sweetness is imparted by the addition of "crystallose," the sodium salt of methyl-saccharin. This sugar-free milk can be sterilised at 100°C. without coagulation.

* Dr. Prout in his work on *The Nature and Treatment of Stomach and Renal Diseases* (5th Edition, 1848) wrote:—"The green matter of plants is in general little acted on by the stomach of the higher animals; and hence may, in most cases, safely form a portion of the food of diabetic individuals, as first, I believe, recommended by Dr. B. G. Babington; though on very different principles."

Then in a footnote Dr. Prout added:—"From a careful attention to these points for sometime past, I am persuaded that green vegetables, not only exert a beneficial action in diabetes and other forms of dyspepsia; but that they can be taken with impunity in almost all cases, provided the patient abstains from drinking while taking them. It is the fluid that is taken with them that, more than anything else, causes acidity and flatulence."

are useful, because their starch is converted into levulose.

Vegetable and mineral salts in diabetes.

Vegetable and mineral salts are necessary for diabetics. Decocotions of cereals, namely, wheat, barley, gram and bran, are very useful to them.

Calcium salts have benefited diabetics. This may be given in the form of powdered egg-shells, which I have often tried with advantage.

Citric acid in Diabetes.

Fresh lime or lemon juice is very useful in diabetes—not only by its relieving thirst, but also because it diminishes the break-down of the fats of the body. Acetonuria is said to be due to the break-down of the body fats. Hence the administration of fresh lime juice prevents the occurrence of acetonuria.

Pickles in diabetes.

Pickles prepared in European method with vinegar, harden vegetable tissues, and thus render them difficult of digestion and therefore harmful in diabetes. On the other hand, the Indian method of preparing pickles with oil, by softening vegetable tissues, is not injurious to digestion. But then there is one drawback in the extensive use of Indian pickles. These contain large quantities of spices, and so cannot be good for digestion. Indian pickles, without spices, may be given with great advantage to diabetics. I have found lime and lemon pickles very useful in diabetes.

Not long ago, not a little sensation was caused by Pân-chewing in a certain Docter—not of Medicine diabetes. —but of Science—giving out as his opinion—not founded on fact or actual observation, but on mere theoretical consideration—that diabetes in Indians was caused by their habit of chewing the *pan* (*Piper Betle*, Lin). When we take into consideration the millions of men and women in India, who are addicted to *pân* chewing—a habit which is prevalent in this country from time immemorial—and the number of diabetics bearing no appreciable ratio to the population, we do not find adequate reason to accept the view that the habit of chewing the *pân* plays any part in the causation of this disease. From the *pân* acting as a stimulus to the flow of saliva and thus helping in the digestion of carbo-hydrate food-stuffs, the habit of chewing it is decidedly beneficial in diabetes.

Beverages for the diabetic.

The diabetic is very thirsty, and so no restriction should be placed in letting him have his drink of pure water. Tea, coffee, cocoa, may be allowed in moderation, although it would be better if he could do without them, for these substances not only contain purin bodies, but often give rise to dyspepsia, nervousness, &c., and thus do harm to diabetics.*

** Lemonade for diabetics.*

The following is said to be useful for assuaging the thirst of diabetics :—

Citric acid	...	...	1 gramme.
Glycerine	...	...	50 grammes.

Some are in favour of alcoholic beverages in moderation, while others condemn them *in toto*. Gautier writes:—

“Generous wines and even cognac bring a valuable element of calorification. Alcohol facilitates the digestion of the fats, and in certain cases diminishes the glycosuria and azoturia. But beer ought only to be allowed very occasionally to diabetics by reason of its dextrin.”

Recently, alcohol has been recommended in minute amounts as a food to diabetics *

Cognac	...	...	40 grammes.
Distilled water	...	...	500 grammes.

(*Medical Times*, quoted in the *Scientific American Supplement*, No. 1376 of 17th May, 1902.)

* “*American Medicine*” (1906) believes that alcohol in diabetes is intimately bound up with the food question. Plant physiologists have about concluded that vegetable cells cannot utilize sugar delivered to them in the sap until they have first changed it into alcohol, and there is some evidence that this is also the first step in the oxidation of sugar by animal cells. Should this be true, it would be rational to feed alcohol to diabetics during the period that starches and sugars are withheld, indeed some therapeutists advise it on empiric grounds, or for the symptomatic treatment of the exhaustion. It is unfortunately given in large doses which have narcotic effects, whereas it should be given in minute doses, highly diluted, and very frequently to imitate nature’s method of delivering it to the cells in minute amounts all the time. This method has been tried with apparent benefit, and might tide the organism over the period during which it is building up its nervous control over the metabolism of the sugar. It is possibly the only disease in which alcohol can rationally be given as food, now that there is such a reaction against giving it in conditions formerly considered essentially in need of alcohol. It is one way at least of saving the oxidation of proteids at a time when they are needed so badly and likely to be burned up.”

Alcohol is said to aid the digestion of fat and, therefore, recommended as a beverage.

In diabetic coma also, according to Dr. Hutchison, "the combustion of alcohol in the tissues appears to lessen the destruction of proteids which are the source of the acid poisons that produce the coma."*

But if alcohol is to be given at all, it should be given with great caution. It should be given rather as a medicine than either as a beverage or a food; and for this purpose it may be prescribed in the form of a medicated wine, such as the one containing cocaine which has been found useful in diabetes.

Diabetic Patent Foods.

There are on the market many proprietary foods meant for diabetics. These are advertised as being free from starch and sugar. Thus Messrs. Callard and Co. of 74, Regent Street, London, say, regarding their preparation of "Casoid Diabetic Flour," as follows:—

This flour consists mostly of vegetable proteids, and is therefore a very highly concentrated nourishing food. It can be made into loaves by following the directions printed on every packet; 3 ozs. only are required to make a good loaf. It is also useful for making puddings, pastry, cakes, etc. according to the directions.

*So also Benedict and Torok (Zeits. f. Kl. Med.) as a result of clinical experiments, conclude that in many severe cases of diabetes, alcohol is of great value, lessening the proteid combustion and diminishing the amounts of "acetone bodies" produced. They recommend its careful prescribing in amounts ranging from one to three ounces daily, noting carefully the effects and controlling the amount used. As contra-indications, they mention albuminuria, neuritis, arterioscleroses, also the diabetes of children. (J. T. H.)

Analysis of Casoid Flour.

Water 10·80 ; Fat 1·40 ; Mineral Matter 2·50 ; Proteids 84·56 ; Cellular Fibre, etc., 0·74 ; Total 100·00.

Diabetics require more fat than proteids. So most of these preparations are not suited to them. Besides, they become stale after some time, and, as these are not manufactured in India, they cannot be used when fresh. For my own part, I do not recommend any of the advertised proprietary foods to Indian diabetics. Moreover, both Hindus and Muhammadans have religious scruples against their use.

Casein and cream treatment.

In the *British Medical Journal* for March 13th, 1915, Dr. R. T. Williamson describes his method of treating Diabetes with casein and cream. According to him—

“The patient is kept at rest in bed, or on the sofa, and every two hours, from 8 A.M. to 10 P.M., receives a glass of artificial milk prepared from casein, cream and water. One tablespoonful of casein is well mixed in a tumbler with one tablespoonful of cream until a paste is formed ; then hot water (or cold, if preferred) is added gradually until the tumbler is full, the mixture being well stirred with a teaspoon whilst the water is being added. A white fluid is thus prepared which has the appearance of milk.

Dr. Williamson claims the following advantages for his treatment:—

1. “This method will often remove the sugar from the urine when the ordinary rigid diabetic diet has been unsuccessful, and this is its great value.

2. "The results are often prompt, the urine being free from sugar, after two or three days.

3. "After a period of treatment with casein and cream, the patient is often able to take ordinary diabetic diet, or even a less rigid diet, without the appearance of sugar in the urine, whilst previous to the casein treatment the most rigid diabetic diet did not remove the sugar from the urine.

4. "Though the sugar will return in the urine in course of time in most cases after the patient's diet has been relaxed, still I am inclined to think that the return is much less rapid than when the sugar has been removed from the urine by an ordinary rigid diabetic diet.

5. "The casein method is not expensive, and is easily carried out.

6. "In most cases of the very severe forms of diabetes in which the urine contains much diacetic acid, the casein treatment is of little value, and sometimes may be very unsuitable; still in certain cases it is of much service, and may remove the diacetic acid and even the sugar from the urine for a short time, and on returning to a less rigid diet the sugar excretion may be very small for a long time and the diacetic acid may not return for a long period. Of course, such cases form only a minority of cases of this class."

In the casein treatment just described—

1. The amount of carbo-hydrates in the food is reduced to the minimum;

2. The total quantity of food is reduced to a very small amount;

3. The food is given in small quantities, at frequent intervals—every two hours.

I am inclined to believe that the last two points are of much importance in the success of the treatment."

The beneficial effect of this treatment is probably due more to cream which contains a large amount of fat than to casein. That this is not useful in all cases is admitted by its author. Besides, it cannot be used for any long period, for patients lose weight and feel exhausted and weak, and there are also unpleasant symptoms.

We should remember Von Noorden's experience, for according to him. "Feeding with casein is associated with the most marked degree of glycosuria, then follow that resulting from the proteids of the leguminosae (peas, lentils, beans). Egg albumin and the albumin of cereals (wheat, rye, rice, oats) have the least power of producing glycosuria. In severe cases of diabetes one must bear this experience in mind, and absolutely forbid casein and also limit the quantity of meat that may be eaten." ('Diabetes,' p. 75).

The Cocoanut Cure.

The cocoanut tree is the most useful plant that nature has bestowed upon mankind.* There are

* Regarding Copra margarine and the rise in the price of cocoa-nut oil, the 'Times' for October 20th, 1913, wrote an article, the summary of which is given below:—

The comparative scarcity of copra, in view of the increasing demand for margarine, has caused a great rise in the

at least a hundred uses to which the different products of this tree can be put. But, without referring to its other economic uses, it is necessary to say that the fruit has not attracted that attention in the

price. In every quarter where copra is bought and sold, and even in Japan, despite the popularity of the Soya bean, plant for the manufacture of cocoanut oil is being rapidly erected. To extract the oil the copra is milled, the resultant meal steamed and formed into cakes and the oil squeezed out by hydraulic pressure. This is done, not upon the spot, but by a limited number of refiners in Europe and America.

Cocoanut oil has long been used in the manufacture of freely lathering soaps, called "washers" in the trade, as well as for what is termed "cold process" and "marine soaps." It also plays a part in the manufacture of candles and night lights. On the other hand, it was never used for edible purposes in civilised countries owing to its insinuating cocoanut taste and its capacity for quickly turning rancid. All this has now been eliminated by chemical means, and cocoanut oil finds its way to the table in many forms. Cocoanut lard is now manufactured on a very large scale, and the oil has taken the place of animal fats in the manufacture of margarine.

In its most highly refined form, blended with milk, it appears on the Continent as actual butter. Before the discovery of the above-mentioned methods of purification, £12 was considered a good price for copra, whereas now it costs £48 a ton, without likelihood of any fall. The kernels are the staple food of most of the people where the nuts grow, and their needs must be satisfied before there is any margin for export. Thus there can be never over-production.—*J. Ch. I.*, November 15th, 1913, page 1020.

"The matter which at the moment of writing engages our attention is the copious issue of books on the subject of the

treatment of diabetes which its importance demands. The fruit is a perfect food and drink combined. The objections which can be raised against cures by oatmeal, potato, rice or some other carbo-hydrates cannot be urged against the cocoanut. It contains all the ingredients necessary to maintain man in health and comfort. In diabetes also it can be given with safety. The cocoanut water is a very pleasant beverage, beneficial to the diabetic, as it assuages thirst, since it is about twenty-five degrees cooler

cultivation of the Cocoanut. As happened in the earlier days of the Rubber and other industries which have rapidly assumed exceptional importance, a number of books and pamphlets are being published upon the subject of Cocoanuts, and many articles are now appearing thereon in the public press—all of which are “signs of the times,” and are the usual forerunners and customary indicators of great activity. * * *

“The cocoanut production of the world may be put something in the neighbourhood of 6,500,000,000 nuts per annum.

“Now, if we reckon 5,000 nuts to go to a ton of Copra, this represents 1,300,000 tons of Copra, which at £30 per ton are worth £39,000,000. In addition to the Copra, there are, however, to be reckoned the Cocoanut Fibre—a valuable item—and also Cattle food-cake and other important by-products. If the value of these is added to that of the Copra, the world's Cocoanut production may be reasonably estimated at perhaps £50,000,000 per annum.

“Whilst the world's population continues to increase, and whilst communities continue to advance towards what we have termed a “higher plane of living,” the demand for and consumption of the Cocoanut in the form of edible and industrial fats, fibres, yarns, and many other articles, must continue to increase. There can be no limitation—the Cocoanut is a necessity and not a luxury.”—“Tropical Mail,” (1913).

than the atmosphere. In describing the liquid possibilities of the cocoanut tree, Sir Samuel W. Baker writes:—

“As the stream issued from the rock in the wilderness, so the cocoanut tree yields a pure draught from dry and barren land; cup of water to the temperate and thirsty traveller; cream from the pressed kernel; refreshing and sparkling toddy to the early riser; arrack to the hardened spirit-drinker; and a cup of oil, by the light of which I now extol its merits—five separate and distinct liquids from the same tree.”

Cocoanut water and cocoa-nut oil are very useful in the treatment of diabetes.

The possibilities of cocoanut oil are also great. In these days, when it is becoming very difficult to obtain pure and unadulterated *ghee*, refined cocoanut oil should be largely used in every household. It is so very nourishing that some have even proposed it as a substitute for codliver oil in the treatment of tuberculosis. The importance of cocoanut oil will be recognised if we bear in mind that fats constitute our sheet-anchor in the treatment of diabetes.

Cocoanut oil destroys bugs, lice and other insect pests. Bengalis used to rub their bodies with the oil—a process which acted beneficially by destroying insects. How far the discontinuance of oil rubbing is responsible for some of the diseases to which the young generation of the Bengalis is subject, requires investigation at the hands of the medical profession of that province.

Cocoanut also enters largely into the confectionary of the Bengalis. But I understand the present generation of educated Bengalis is not so fond of

sweets prepared with cocoanut as were their forefathers.

The cocoanut meal may be given in a variety of ways to the diabetic. I have tried *chapatis*, cakes and several other preparations of cocoanut. Cocoanut, finely powdered with the addition of a little *besan* and butter, will make fine *chapatis*, which will keep also for some time.

I urge on the medical profession of this country, where cocoanut can be had in abundance and where unfortunately diabetes causes a large mortality every year, to try the cocoanut cure.

Leguminous Alimentation in Diabetes.

Bovet* has shown the usefulness of leguminous food in many diseases of nutrition, and he considers it also suitable and valuable in diabetes. Leguminous seeds are rich in nitrogen, and hence useful as giving tone to the system.

The modern advocate of leguminous regimen in diabetes, Dr. Marcel Labbe of Paris, attributes the beneficial results of this diet to the peculiar chemical properties of leguminous albumin and starch, assimilation of which seems to take place under conditions different from those obtaining for cereals.

The Japanese use very extensively *Soya hispida* or soya-bean as an article of diet. A meal of this, as it contains a small amount of carbo-hydrates, is

Soya-bean in diabetes.

* *Presse Med.*, May 11th, 1895, and also *B. M. J. Epitome*, for 10th August 1895, p. 24.

used in the form of bread for diabetics. Although soya-bean is also indigenous, it is not largely used as an article of food in India as it is in Japan.*

Ground-nut is extensively cultivated in many parts of India. But it is not so largely used as an article of diet as it deserves to be. This may be put to the same use as the Japanese soya-bean in the dietary of diabetics. Dr. J. Walter Leather

* Soya beans as Food for diabetics—

“Soya beans are treated with boiling water and 0·5 per cent. of sodium bicarbonate, until the carbo-hydrates and other water-soluble substances are removed. The residue, after being dried and pulverised, is a yellow powder containing the nutritive fatty and albuminoid constituents of the beans.”

[U. S. Pat. 980, 292 Jan. 3, 1911, taken by E. Lampe, Frankfurt-on-Main, Assignor to Farbenfabr. Vorm. F. Bayer and Co., Elberfeld, Germany.]

Soya. A patent for [Preparation of albumin from Soya]

The finely ground Soya is lixiviated several times with warm water and the milky extract, after separation by filtration and pressure, is coagulated by addition of suitable acids (lactic acid, &c.) or salts, or spontaneously by the action of enzymes extracted from the Soya. The coagulated precipitate is dried and freed from fat or oil by extraction with a suitable solvent, the albumin being left as a white powder. When the product is to be administered to women to promote lactation, it is important that the enzymes present in the Soya should not be destroyed, and no part of the process is carried out above 65° 70° C. Higher temperatures may be employed when the product is to serve only as a normal food.

J. Ch. I. 30. 6. 1911. p. 764.

gives the following chemical composition of its kernels :—

Moisture...	...	...	4.70	p. c.
Oil ..	...	...	94.25	„
Albuminoids	...	...	29.09	„
Soluble carbo-hydrates	...	...	13.21	„
Woody fibre	...	...	1.65	„
Soluble mineral matter	...	...	2.15	„
Sand and Silica	...	...	.05	„
Total Nitrogen	...	...	4.65	„

From the large percentage of oil that it contains, ground-nut forms an useful article of diet for diabetics. Its meal may be made into cakes or *chapatis* and given to diabetics.*

* “The peanut, although a very useful article of diet, is rather difficult of assimilation by the system, until it has been digested. To aid in this process, the peanut is first cooked, then digested by a chemical process similar to, but slower and more thorough than, that which goes on in the stomach of the human or other animal.

“The next step is to segregate the digestible from the non-digestible portions. The digestive agents employed are peptinzyne, pancreatin, diastase, hydrochloric acid and others. The excess of hydrochloric acid is removed by the use of sodium carbonate, which tends to saponify the indigestible fats and forms, with hydrochloric acid, common salt, which goes to the bottom, while the soapy substance, which is insoluble, rises to the top and easily skimmed, and may be removed by means of a centrifugal machine.

“Now, we have the goober juice ready for incorporation into the elixir. This juice of itself is very sweet, like a syrup, and, in order to be rendered palatable, requires only to be combined with tasty, palatable aromatics.

Peanut butter, made by grinding the nut very fine and reducing the mass to a pasty substance and adding salt for flavouring, is an useful article of diet.

Several varieties of leguminous seeds, known as *dâls*, are used as staple articles of food by Indians.

The use of *dâls*.

The meal of gram and several other kinds of *dâls* may be put with advantage to the same use in the treatment of diabetics as is done with the meal of soya-bean in Japan. The meal, known as *besan* in the bazars of Northern India, may be used in a large variety of ways in the treatment of diabetics. *Chapatis* or bread made of *besan* is well relished by, and is beneficial to, the diabetic patients.

In the Punjab, *chapatis* of *besan* mixed with a certain amount of wheaten flour are prepared and largely used by the people. These are called *missirotis*. These may be used with advantage by diabetics.

Unfortunately, *besan* is not very largely used in Bengal, where more cases of diabetes are to be met with than in any other province of India.

In the cookery of vegetarian Indians, *besan* serves the same purpose as the yolk of an egg does in

"Aside from the juice obtained by the digestive process above described, there is also obtained (in this latter case from the roasted peanut) an extract of high medicinal value. Together with these extracts from the peanut, and the flavours mentioned, is incorporated animal nuclein. This latter agent is a most important addition to the compound, as it assists in digestion, and is an active builder of tissue, the great work of maintaining life."—*Scientific American* Supplement, No. 1431 of 6th June, 1903).

European cookery. It is mixed with water and made into a paste, and is used to form a sort of coating upon many fruits, tubers and green vegetables which protects them from too much singeing or getting overburnt.

Very wholesome and palatable cakes are also made from *besan*. It is well-beaten, and, after being a little fermented, small balls of it are made, of the size of filberts. The more the paste is beaten and allowed to be fermented, the lighter and more porous becomes the ball, which is used after being fried in *ghee* or oil.

Drawbacks to the use of *Dâls*. Dr. Pavy writes:—

“As a drawback to their high nutritive value, the leguminous seeds must be ranked as difficult of digestion. They require prolonged boiling to render them tender and digestible. They are apt, besides being heavy on the stomach, to occasion flatulence and colic, and the flatus is charged with a considerable quantity of sulphuretted hydrogen, arising from the sulphur which the legumine contains.”

Pulses are the staple articles of diet of many races and communities inhabiting India, and so these know how to counteract their drawbacks. They cook *dâls* with *Pâpad-khâr* (an impure carbonate of soda) which greatly aids in the process of digestion. In a paper on “the proper cooking of *dâls*” which I contributed to the *Indian Medical Gazette* for December 1896, I tried to show how the addition of *Pâpad-khâr* proves useful in the cooking of *dâls*.

Sulphur is useful in alimentary toxæmia. Hence the beneficial action of leguminous alimentation.

Flatulence from the use of *dāls* is got rid off by adding assafoetida.

The use of Oleaginous Seeds in Diabetes.

Besides nuts, several oleaginous seeds are useful in diabetes. In this disease, as the skin is often dry and harsh, so the administration of seeds which are rich in oil proves beneficial;—on the same principle on which oil-seed cakes are given to cattle and horses to improve the gloss of their skin. Oleaginous seeds are less expensive and more easily digestible than nuts.

Seeds of *Sesamun Indicum*, known as sesame, or, The use of se- in vernacular *Til*, are very extensive. same. sively used in a variety of ways, by natives of India, as an article of food. Dr. J. W. Leather gives its chemical composition as follows:—

Local description.	Source.	Moisture.	Oil.	Albuminoids.	Soluble Carbo-hydrates.	Woody fibre.	Soluble Mineral matter.	Sand and Silica.	Total Nitrogen.	Albuminoid Nitrogen.
"Red"	Poona ...	4.18	49.12	20.37	14.16	2.93	6.65	2.59	3.34	3.26
"Black"	" ...	4.13	47.60	18.12	18.6	4.14	6.86	.59	3.11	2.90
"White"	" ...	4.21	51.96	18.06	14.62	4.49	6.28	.38	2.99	2.89
" "	Nagar ...	4.87	48.13	22.50	14.05	4.49	5.59	.37	3.60	...
"Black"	Nadiad ...	5.42	46.50	25.81	9.06	6.51	6.03	.66	4.13	...
"Red"	Nagar ...	5.37	46.29	21.03	15.87	4.18	6.00	1.35	3.37	...

The grain is very rich in oil, and may be used in combination with *besan* or pulses of other kinds.

Til, used either baked or parched, is a very wholesome food. Husked *til* is parched and ground and made into cakes with *besan*, cheese, cream, a little camphor and cardamoms. The delicate aroma of *til* pervades the cakes, which are wholesome and nutritious.

Ground *til* may also be used by being mixed with cocoanut water and *dahi* (curd), to which a little *ghee* is added. This makes a pleasant drink.

Linseed may be used as a bread or a porridge, with milk. It makes a lighter bread than pure white flour. The oil may also be applied externally to the skin.

Chironji, the seed of the berry known as *pial* in Bengal, is very palatable and nutritious, and is very rich in oil. It is used as a substitute for almond and is eaten roasted with milk.

Regarding the fruit of *Buchania latifolia*, Dr. G. Watt writes:—

“The fruit is eaten by the hill tribes of Central India. Having first pounded them, along with the contained kernels, they dry them in the sun. As required, this is baked into a sort of bread and eaten.”—(*Dictionary of Economic Products of India*, Vol. I, page 545.)

Chironji bread, as prepared above, is given with advantage to the diabetic, as a substitute for ordinary bread.

Poppy seeds form a valuable article of food of the natives of India. They are largely

Poppy-seeds. employed by confectioners and also in the preparation of curry powders.

Parched poppy seed is very wholesome. The seeds are rich in oil, very nutritious, and hence useful in diabetes.

Some of the practitioners of the Greco-Arabic School of medicine prescribe cotton-

Cotton-seeds as a food for diabetics. seeds as a food to the diabetic. Dr.

J.W. Leather, in his analysis of Food-grains and Fodders (Agriculturer Ledger No., 10 of 1901), gives the following analysis of the seed grain:—

Local description.	Source.	Moisture.	Oil.	Albuminoids.	Soluble Carbo-hydrates.*	Woody Fibre.	Soluble Mineral matter.	Sand and Silica.	Total Nitrogen.	Albuminoid Nitrogen.
...	Poona.	8.52	18.33	11.74	38.78	17.53	3.92	1.22	2.57	1.87
...	„	6.93	14.57	11.34	35.96	25.05	4.47	1.68	2.49	1.81
...	Surat.	6.83	16.51	12.54	32.54	27.11	4.23	.24	2.86	2.00
Egyptian seed.	...	6.75	28.40	22.63	21.06	16.71	4.19	.26	3.78	3.63

* Regarding soluble carbo-hydrates, Dr. Leather writes:—

“This term is applied in England to those component parts of food stuffs which are not separately determined.

“In cereals and pulses it includes principally starch, but in other cases, such as some of the oil seeds, there is but little starch; its place being taken by such substances as pectin or mucilage.”

From the above analysis it will be noticed that the Egyptian seed is the one best suited for the diabetic, since it contains a larger percentage of oil and albuminoids and less amount of soluble carbohydrates than the Indian one.

Cotton-seed is given in a variety of ways, such as fried, parched, roasted, or ground into flour and made into bread. Professor Connell of America considers cotton-seed to be the richest of all food-stuffs and breadstuffs. The cotton-seed meal contains three times as much digestible protein as the highest grade of wheat flour. Being over-rich in protein, pure cotton-seed meal bread would closely resemble cheese; a combination, however, of cotton-seed meal with other recognised breadstuffs will prove useful.*

* The value of cotton-seed flour in diabetes—

“Cotton-seed flour contains more than twice as much protein as meat, but little ‘kneading principle.’ It must be mixed with two parts of wheat flour when intended for baking.”—*Chemical Abstracts*, for May 20, 1914; pp. 1837-1838.

Utilization of the proteins of cotton-seed by man—

Experimental results indicate that the utilization values of the proteins of cotton-seed products are about 78·6% as against 96·6% with meat, on the same men. The cotton-seed proteins are utilized by men equally as well as those of legumes 9/10 as well as those of cereals, and 8/10 as well as those of meat.—*Ibid*, p. 1838.

Cotton-seed meal as human food—

The flour should be from hulls, and have a bright yellow colour, a pleasant odour, and a sweetish taste. It contains protein 48 p. c., fat 12 p. c., sugar (mostly raffinose) 2½ p. c., fibre 4 p. c., ash 5·5 p. c. It is richer in protein than meat and resembles meat more closely in composition than it does

Diabetic Dietary.

A dietary, somewhat on the following lines, will be found useful for diabetics in India :

I. *Breakfast*.—As mentioned before (page 51), there is a larger excretion of sugar in the morning hours than at any other time of the day. So, for breakfast, carbo-hydrates should be given in moderation, if not totally withheld.

Milk, cocoanut cakes and preparations of *besan* may be given for breakfast. Those who live in provinces where cocoanut can be had in abundance, should take for breakfast cocoanut and its preparations without sugar. Thus, for beverage, they should drink cocoanut water, and eat cocoanut meal, either raw, fried, or roasted. Ground-nut meal, made into *chapatis* or cakes, is also very beneficial. So are also almond, pistachio-nut, *akhrot* and oleaginous seeds.

II. The principal meal of the day, which should be at about 2 or 3 P.M., to consist of rice, *chapatis*, *dâl* and vegetable curries. Such fruits as have been mentioned above are to be given to diabetics with their principal meal of the day.

the cereals ; accordingly, it might be tried experimentally as a meat substitute or to reinforce a diet deficient in protein. It is advisable to mix one part of meal with four parts flour. Experiments with animals show that the protein of cotton-seed meal is as digestible as that of cereals. Mouldy or damaged or dark coloured meal should be avoided.

(G. S. Fraps, Texas Agric. Expt. Stations, Bull. No. 128, 1910, 15 pages abstract in *J. Ch. I.*, for Aug. 15, 1910, p. 1972.)

III. For *supper*—milk and cocoanut preparations.

As I look upon diabetes as a manifestation of alimentary toxæmia, I should treat

Conclusion.

every individual case on its own merits. It is not necessary to en-

force a too rigid diet, which, by producing disgust for food, might make a patient worse. Anything which relieves alimentary toxæmia is bound to be beneficial to the diabetic. Hence the importance of vegetarian dietary and fruits in the treatment of the disease and the restriction, if not the total withdrawal, of meat, alcohol, tea, coffee, cocoa, and also the potato.





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