

Further observations on the skim-milk treatment of diabetes mellitus / by Arthur Scott Donkin.

Contributors

Donkin, Arthur Scott.

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FURTHER OBSERVATIONS
ON THE
SKIM-MILK TREATMENT
OF
DIABETES MELLITUS.

BY
ARTHUR SCOTT DONKIN, M.D.

LATE LECTURER ON MEDICAL JURISPRUDENCE AND TOXICOLOGY AND
EXAMINER IN MEDICINE IN THE UNIVERSITY
OF DURHAM, LATE PHYSICIAN TO THE SUNDERLAND INFIRMARY, ETC.

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IN concluding the series of papers I have contributed on the skim-milk treatment of diabetes, I desire to be clearly understood as to what I mean by this term. To order the patient to drink as much skim-milk as he can, and whenever he chooses, regardless of measure or the time of administration, or to permit him to partake of other kinds of food in addition, even in small quantities, is certainly *not* prescribing the skim-milk treatment. I have known as much as from sixteen to twenty-six pints swallowed daily by the patient, who was thus converted into a species of funnel, through the permission of his medical adviser. Of course it was not at all astonishing that this unmethodical, but heroic, administration of the remedy was *not* crowned with success.

By the skim-milk treatment, I mean the administration of skim-milk properly prepared, in quantities measured and limited to the requirements of individual cases, given at regular intervals in definite doses, and to the exclusion

of all other food, for a longer or shorter period. This system of treatment, in short, must be pursued in a strictly methodical manner, and according to the rules I have already laid down on this subject; and, I must add emphatically, *if this is not done success must not be expected.*

On account of the scrupulous method, perseverance, and self-denial required, this treatment will never be attended with more than partial success in hospital practice, unless the patients are placed in isolated special wards, and under the care of strictly trustworthy nurses. Of this I am convinced by my own personal experience in the cases of diabetes I treated in the Sunderland Infirmary. In all of these, without exception, no sooner was the sugar nearly or entirely removed from the urine, than the patients began to indulge clandestinely in the most injurious of the prohibited articles of food, and thus caused a return of the disease. The same observation applies with equal force to the more ignorant and unintelligent of the lower classes treated at their own homes, and to young subjects below the age of maturity. I fully concur with Bouchardat, that this cause exercises an important influence over the great mortality occurring amongst the latter class of patients.

The space at my command will only permit me, on the present occasion, to introduce to notice two additional cases, which may be regarded as typical illustrations of what can be achieved by the skim-milk treatment in a large majority of instances. In the first case the disease had not proceeded beyond the stage in which it is curable. The second, however, was too far advanced, and the vital powers too much impaired by the long continuance of the disease in a severe form, to permit of much hope of complete recovery, yet not so near the final period as to preclude the possibility of much improvement. I may mention that similarly beneficial results are not to be expected in cases complicated with tuberculosis or other necessarily fatal diseases; although even in these a great amelioration of the symptoms can generally be obtained.

Case of confirmed Diabetes ; removal of the sugar from the urine in fifteen days ; complete and permanent recovery.—This is the case of a gentleman, aged forty-seven years, suffering from diabetes, sent to consult me by his medical attendant, Mr. G. T. Keele, of St. Paul's Road, Highbury, London. The patient consulted me on the 16th of May, 1871, when I ascertained that the disease, then fully developed, had lasted at least two years, and probably longer, and was first detected about eighteen months previously, when he was slowly recovering from an attack of pleurisy. Shortly after this event, in consequence of over-work in commercial pursuits, and a severe attack of cold, which aggravated the diabetes, his general health became seriously impaired, and he began to suffer so much from debility that entire rest and change of air were recommended as essential for his recovery. Consequently he went to Torquay and Hastings, whence he returned improved in health and spirits ; but, unfortunately, the urine continued as much loaded with sugar as before, and had a specific gravity of 1036. It is necessary to add that the diet of the patient had been restricted during this period and up to the time I first saw him.

At the date just mentioned, when the patient consulted me, he presented the usual symptoms of diabetes, but rendered less intense by the treatment to which he had been subjected. He had lost much flesh since the commencement of the disease ; his urine had a specific gravity of 1040, and contained no less than 27·374 grains of sugar to the fluid ounce ; the quantity voided daily being about six pints. He presented another symptom frequently observed in cases of confirmed diabetes—namely, a soft, spongy, painful condition of the gums, with looseness of the incisor teeth ; a state indicating a deficient or unhealthy nutrition, produced by a depraved blood, not only contaminated by an injurious foreign substance—sugar—but also deficient in the products derived from the healthy assimilation of the proximate principles of food. This

state of the gums is similar to that met with in scurvy, and apparently due to a similar cause.

On the 19th of May the patient was placed under the skim-milk treatment, *systematically* applied; and he, being a gentleman of superior intelligence, adhered most rigidly to the instructions received, and scrupulously followed the rules to be observed in applying this treatment.

The daily allowance of skim-milk, having a specific gravity of 1038, was at first seven and then eight pints, divided into meals, taken at regular intervals. No other food whatever was taken during the next six weeks, and during the whole treatment of this case not a single dose of medicine of any description was administered.

The progress of the case was watched from day to day by Mr. Keele, and the patient kept a table with the utmost precision, showing the state of the urine, which was daily examined for sugar by Moore's and Trommer's tests. The effect of the treatment on the urine during the first four weeks is shown in the following table:—

May 16. *Urine contained 27·374 grains of sugar per ounce, specific gravity 1040.*

	Pints of urine daily	Specific gravity		Pints of urine daily	Specific gravity
May 19	4½	1037	June 3	3¾	1009
" 20	4½	1040		(No sugar)	
" 21	5	1038	" 4	2½	1022
" 22	4	1030	" 5	3¼	1006
" 23	4	1036	" 6	3¼	1015
" 24	4	1035	" 7	3½	1012
" 25	3½	1033	" 8	4½	1006
" 26	2½	1035	" 9	5	1006
" 27	2½	1026	" 10	4	1006
" 28	3¼	1015	" 11	4½	1006
" 29	3¼	1010	" 12	5¼	1012
" 30	2	1022	" 13	3¼	1015
" 31	3	1015	" 14	4	1014
June 1	3	1012	" 15	4½	1013
" 2	2¾	1015			

During the following (last two) weeks of the purely skim-milk regimen the daily quantity of urine ranged from

four to five pints, and its specific gravity varied from 1008 to 1015.

During the first three weeks of the treatment the patient went only for an hour daily to his office, spending the rest of the day in working in his garden. This occupation caused him to perspire more or less freely, and on some occasions most profusely. It thus produced the considerable variation in the daily quantity and specific gravity of the urine especially observable in the second and third weeks, and the smallness of its quantity compared with that of the skim-milk taken during that period. This was particularly observable on the 30th of May and 4th of June.

There was not much diminution in the quantity of urine or sugar, nor other improvement, during the first week, but from the beginning of the second it commenced to subside rapidly, until, on *the fifteenth day of the treatment, June the 3rd, it had entirely disappeared.* On this day the quantity of urine was three pints and three-quarters, and its specific gravity 1009.

It is necessary here to record that from the first day of the treatment, on the 19th of May, to the 15th of June the patient lost weight, at first rapidly and afterwards slowly; so that in the space of twenty-eight days he lost fourteen pounds, notwithstanding the fact that at the end of this period he felt very much stronger and better. There can be no doubt that this loss of weight can, to the extent of a few pounds, during the first fortnight at least, be accounted for by the much smaller quantity of fæcal matter contained in the intestines under a skim-milk regimen than under an ordinary solid diet, and by the removal of the sugar from the blood, fluids, and tissues previously saturated with this heavy substance, which thus adds considerably to the weight of the entire body. But it would appear also that, independently of these causes, the body had lost weight.

During the whole period of the treatment the pulse was natural, and ranged from 66 to 70.

At the end of the third week, June 8th—a week after the disappearance of the sugar from the urine—the state of the gums had very much improved, and the teeth had become firmer. At the end of the fourth week (June 15) the patient began to take an additional two or three pints of skim-milk, made into curd, daily, by the essence of rennet—a pint for each meal.

At the end of the sixth week (28th June) he was allowed a small steak for dinner, and on the following day took fish and butcher-meat in addition to the skim-milk and curd. This change in the diet did not cause the slightest return of sugar in the urine, and the patient now, to use his own expression, felt ‘well and hearty.’

On the 1st of July he began to indulge in forbidden articles of food, containing large quantities of starch and sugar, and some sugar again appeared in the urine, but rapidly disappeared again on his resuming the skim-milk diet for three or four days.

From this time onwards the patient took solid animal food at breakfast, dinner, and supper, in addition to the skim-milk, which he drank largely at meals instead of water, and which thus continued, and is still continued, as a staple article of food; he also took a Blatchley’s bran-biscuit at each meal, but this was afterwards superseded by the use of gluten bread. The animal food was of great variety—namely, beef, mutton, veal, lamb, tongue, lean ham, chicken, turkey, game, eggs, lobster, shrimps, and fish in every variety. He was also allowed every description of green vegetables, including even asparagus and French beans. But saccharine and starchy food, and butter, bacon, and fatty substances and cheese, were forbidden. The dietary was thus most varied and generous, and contained all the proximate alimentary principles, and everything else requisite for the healthy nutrition of the body.

Up to this period alcoholic drinks had been strictly prohibited, but in September the patient began, of his own accord, to take dry sherry, claret, Burgundy, Scotch

whiskey, or brandy, in moderate quantity daily, and felt very much better in consequence, and without any return of sugar in the urine.

On the 12th of October I examined the patient at his own house, in consultation with Mr. Keele, when we found him entirely free from the disease. He felt remarkably well, and his urine did not contain the slightest trace of sugar, notwithstanding the fact that for three months previously he had attended closely to his office and to business for several hours daily. His diet at this period was that which I have just described.

In accordance with advice given he started early in the following month—November—to spend the winter in the south of Europe. He remained some time at Mentone, spending the day-time chiefly in taking exercise in the open air, feeling all the while healthy and vigorous, and living on the same generous diet as previously. He then visited Venice, Rome, and Naples, and returned home through Spain and France. I saw him in April last, 1872, after his return; he was wonderfully improved in appearance, and was in excellent health. During the past summer he took a tour into Sweden, and felt benefited thereby. I will only add that, not only does the patient continue free from disease, but he even appears to be better than he was previous to his having become affected by it. Thus, in a letter written on the 16th of October last, nearly sixteen months after his recovery, he wrote to me saying, ‘I am at present better and stronger than I have been for years.’

There can be no doubt whatever that a long holiday, with plenty of exercise, under a genial atmosphere, with change of scenery and complete relaxation from business contributed powerfully to confirm the health of the patient.

I am the more anxious to direct attention to this circumstance, having ascertained by experience in similar cases that hygiene and relaxation from business or professional pursuits for a considerable period are of the utmost importance in the after-treatment of diabetes, when con-

valescence has been fairly established. I can point at least to one melancholy instance in which a return of the disease in a severe form was induced by close attention to business in gloomy premises, and continued residence in an unhealthy atmosphere, nearly a year after every trace of sugar had been removed from the urine, and the health and strength of the patient completely restored.

If space had permitted I would have cited other instances, in addition to the above and the other cases already published in my previous contributions, to show the remarkable efficacy of the skim-milk treatment of diabetes—*properly applied*. But these are certainly sufficient to carry conviction to an unprejudiced mind that the disease is quite amenable to treatment if the remedy is *applied in time*. In time, I repeat, because there is certainly no other serious chronic malady in which the Hippocratic axiom '*occasio princeps*' is more applicable than in this.

In illustration of this observation and of the importance of early treatment, I may here refer incidentally to two cases of diabetes now under my observation. In one the disease was apparently of only seven or eight months' duration; the patient, having during the last four months been kept under a restricted diet, was passing from four to five pints of urine, containing 25·340 grs. of sugar to the ounce. Under the skim-milk treatment the sugar entirely disappeared from the urine in fourteen days. In the other, the patient had not suffered from the severer symptoms of the disease longer than two months; but his diet was unrestricted, and he passed ten pints of urine daily, containing 30·092 grs. of sugar per ounce. The whole of this was removed and the disease completely arrested in eleven days by the skim-milk treatment, a result in a great measure attributable to the early application of the remedy.

During the last few years that I have directed my attention specially to this subject several cases have come under my observation in which the disease was so far ad-

vanced, and had inflicted such irreparable injury on the constitution generally and nutritive process—on the vitality of the organism, if I may so speak—that but little good could be effected beyond subduing the more distressing symptoms. In some of these instances, most unfortunately, the disease had not been recognised until it had advanced in its destructive progress for years; and this reflection urges me to remark that diabetes will still continue too frequently to escape detection, in a similar manner, until its symptomatology is re-written in most of our text-books on medicine, thus enabling the student to become familiar with its features in its initial or earliest phase. As hitherto described, the symptoms enumerated are those characteristic of an advanced stage of the malady—namely, excessive thirst, a parched skin, a very large flow of urine, a voracious appetite, and emaciation. Now I venture to repeat what I have already stated on this important subject, that the invasion and early stage of the disease do not produce this assemblage of symptoms, and must therefore be recognised by a widely different class of phenomena. These are—a general feeling of debility not due to emaciation or loss of flesh, considerable nervous and muscular prostration, lassitude and disinclination for bodily and mental exertion, occasionally a dull pain over the loins, loss of sleep, frequently dimness of vision, a feeling of numbness or loss of sensation over the surfaces of the thighs, a clammy condition of the mouth without much thirst, or preternatural dryness of the skin, which is frequently perspiring. Whenever we meet with this category of symptoms, more or less complete, our suspicions should be aroused and the urine carefully examined for sugar.

In cases of diabetes too far advanced to admit of cure and the consequent removal of the sugar completely from the urine, the skim-milk treatment will reduce the quantity of sugar to a very much greater degree, and hold the disease in check far more powerfully than any other remedy yet discovered, to say nothing of the subjugation

of the more distressing symptoms, as already described in my previous contributions. In illustration of this effect in such instances, I will cite the following case, in which a diet restricted (except the lactine of milk) to purely nitrogenous substances, was subjected to a lengthened trial in the first instance, and then an exclusive regimen of skim-milk.

W. B——, aged sixty years, lost his health two years ago, when he was obliged to give up work, and began to lose flesh and weight rapidly (his weight at that period having been 15 st., but now reduced to 8 st. 13 lb., showing a loss of 5 st. 13 lb. up to the present time). At the commencement of his illness his appetite greatly increased, and he began to suffer from excessive thirst, great debility, and loss of muscular power, a greatly increased flow of urine, and a dry skin. These symptoms have since gone on gradually increasing. The large flow of urine induced him to remark to his medical attendants that his blood was going to water, but still the disease remained undetected until it was recognised by another practitioner in April 1872, or eighteen months after the health of the patient broke down. When closely questioned on the subject, the patient stated distinctly that long prior to the period he fixed as the beginning of his illness (when he could no longer work) he suffered much from debility, weakness of the limbs, and general indisposition. The disease, therefore, as usual, appears to have come on insidiously, and to have had its origin at a date long anterior to the period when it became so fully developed as to cause a complete breakdown of the patient's health, and the accompanying great emaciation and other distressing symptoms indicative of an advanced stage of the malady.

When I first saw the patient on the 10th of August, 1872, he suffered from the symptoms just enumerated, and complained much of weakness and diminished sensibility of the limbs and loss of sensation in the feet, almost complete in the soles, so that his gait, with the assistance of a stick, was very unsteady. For months previously he

had confined himself to a diet consisting of $1\frac{1}{2}$ lb. of beef or mutton, green vegetables, a moderate quantity of ship-biscuit, and a quart of milk daily; he also drank water. He was passing from 8 to 9 pints of urine having a density of 1040, and (on the 10th of August) containing 31.247 grs. of sugar to the fluid ounce.

He was now placed on a restricted diet, consisting of 1 lb. of lean chop or steak, taken at breakfast and dinner, three or four pieces of gluten bread, and from 7 to 8 pints of skim-milk daily. All saccharine and starch matter (except the lactine of skim-milk) and fat in a great measure were thus strictly excluded. This regimen was strictly adhered to for a period of nine weeks, but with only slight improvement in the condition of the patient, so that on the 12th of October he was voiding $7\frac{1}{2}$ pints of urine, specific gravity 1038, and containing 25.340 grs. of sugar to the fluid ounce.

He was now subjected to an exclusive skim-milk diet (9 to 10 pints daily, 3 pints being made into curd, and taken at three meals). The following table shows the result on the disease as revealed by the rapid and remarkable diminution in the quantity of urine-sugar. I must add that the quantitative estimation of sugar was made by the beautiful polarising saccharimeter of Soleil, perfected by the manufacturer, Duboscq, of Paris, by which the most exact results are easily obtained.

Diet restricted to meat, gluten, bread, and skim-milk, end of ninth week				Pints of urine daily	Specific gravity	Grains of sugar per fluid oz.
October 12				$7\frac{1}{2}$	1038	25.340
Exclusive skim-milk diet, begun 12th October						
October 16				6	1030	19.797
" 22				6	1021	12.670
" 26				$6\frac{1}{2}$	1015	7.419
" 30				$6\frac{1}{2}$	1020	9.502
November 1				$5\frac{1}{2}$	1020	10.294
" 4				6	1015	7.127
" 8				5	1012	2.771
" 12				$5\frac{1}{4}$	1007	1.583
" 18				$4\frac{3}{4}$	1010	2.375

It will thus be observed that in the space of thirty-six days the skim-milk treatment gradually reduced the quantity of urine-sugar from 25·340 gr. to 2·375 gr. per fluid ounce of urine—a diminution equivalent to 22·965 gr. per ounce—and at the same time decreased the daily quantity of urine to the extent of $2\frac{3}{4}$ pints.

This case is not only of very great importance in illustrating the remarkable potency of skim-milk in checking the disease and preventing the formation of sugar, but it is extremely valuable in demonstrating, in the clearest possible manner, the fact that skim-milk loses its curative power altogether, and becomes valueless as a remedy, in diabetes, when administered in combination with solid animal or other nitrogenous food. I have repeated the experiment over and over again, with every variety of modification, in similar cases, and always with the same result.

I may add that the improvement in the general health of the patient, and in the more important or distressing symptoms, especially in the loss of sensation in the feet and legs, has been quite commensurate with the decrease of the urine-sugar. He now walks steadily and with a firm step. He is still under treatment; but a complete recovery is scarcely to be expected.

In the treatment of diabetes it must be remembered that the source of the urine-sugar is the food. The most remarkable pathological character of the disease is its power of *misappropriating* the proximate principles of food required for the nutrition of the body and the production of animal heat, converting them into an unassimilable substance incapable of oxidation—namely, diabetic sugar—which is out of the system by the kidneys as a useless and injurious foreign substance.

At first there is only a *partial* malassimilation of starchy and saccharine substances, but this becomes *complete* as the disease advances. Next comes a period when the fatty matter of the food is likewise converted into sugar; and when this stage of the disease is fully developed the whole of the carbonaceous alimentary principles are misapplied,

instead of being assimilated and undergoing their normal metamorphic changes. Consequently they are not oxidised, and the temperature of the body falls below the healthy standard. Unfortunately this is not all; for if the disease runs its course unchecked, it passes into a much more serious phase of its progress, and the albuminous or nitrogenous principles of the food also begin to contribute to the formation of diabetic sugar, and in quantity gradually increasing as the disease advances towards its termination, until a very small proportion is left to nourish the tissues and maintain the heat of the body. Thus, Professor Griesinger* found, by careful experiment on a diabetic patient restricted to a rigorous meat diet, that only *two-fifths* of the whole of the albumen consumed in the food remained available for the purpose of nutrition, the rest being converted into diabetic sugar. But this does not even represent the full extent of the malassimilation of albumen in very advanced cases.

These data supply a ready and intelligible explanation of the gradually increasing and at length extreme emaciation observed in diabetics, accompanied, *not* by pyrexia, but an abnormally low temperature of the body, the latter condition being due to the complete absence from the blood of the oxidisable products of the assimilation of the carbonaceous principles of the food, and the great deficiency of those derived from the albuminous. Hence we can readily understand the fact shown by the recent investigations of Pettenkofer and Voit, that in diabetes there is a diminished consumption of oxygen, and a correspondently decreased production of carbonic acid by the process of respiration.

I have already referred to the necessity on the part of diabetics to refrain from starchy and saccharine articles of food, in order to prevent a return of the disease after recovery. The prohibition of bread from the regimen thus prescribed is generally complained of as the greatest hardship to be endured; consequently, various substitutes have

* Archiv für Physiolog. Heilk., 1859.

from time to time been invented. Thus we have the gluten bread first suggested by Bouchardat, and the bran biscuits made according to different formulæ; the former, however, is insipid and unpalatable, while the latter, when free from starch, are composed entirely of *lignine*, and, therefore, contain no nutriment whatever. To obviate these serious objections, it struck me that a very important end would be gained if a kind of diabetic bread could be manufactured consisting of an admixture of gluten and bran. I therefore communicated with Mr. Van Abbott, of Princes Street, Cavendish Square, on the subject, and he has succeeded in getting manufactured in France, after much difficulty, a bread consisting of 80 per cent. of gluten and 20 per cent. of bran nearly free from starch, and a very small quantity of butter. This bread is a much closer approximation to ordinary brown bread than any other substitute now in use. It is not only agreeable and palatable to the patient, as well as nutritious on account of the large proportion of gluten, but, what is also very important, it excites the peristaltic action of the bowels, and prevents or corrects constipation, in consequence of the *lignine* it contains in the form of bran. I have no hesitation in saying that this bread is much superior to any other form hitherto produced for the use of diabetics.

In closing this series of contributions, I may state that I have conducted some experiments with lactic acid in the treatment of diabetes, but find it possesses no specific action on the disease apart from the strict animal regimen in conjunction with which it is administered. I intend at a future period to publish my experience on this subject.

22 HENRIETTA STREET,
CAVENDISH SQUARE, W.



