

A New Technic for the Detection of Hidden Diabetes

Induction of Hyperglycemia

by Feeding Glucose after Dietary Preparation

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The recent mass surveys of the population for diabetes mellitus have caused widespread interest. In many instances the surveys have been conducted by examination of the urine for glycosuria. In others the preliminary screening survey has been based upon the presence of glycosuria, followed by blood sugar estimation one to 1½ hours postprandial without previous dietary preparation. As an example, Blotner¹ studied the results of the urine examination of 69,088 men examined for military service, finding two per cent exhibiting glycosuria. In glucose tolerance tests on 479 selectees without previous dietary preparation, he found diabetic tolerance curves in 251 cases or 52 per cent of those tested. Of the 1,383 with glycosuria, 340 or 24.1 per cent knew they had diabetes or glycosuria previously. Fitcher and Sauve² attempted to detect diabetes by giving 75 grams of glucose to ambulatory patients and looking for glycosuria. None of these patients, however, were given previous dietary preparation for the test.

It is generally accepted that the presence of glycosuria alone does not warrant diagnosis of diabetes mellitus. On the other hand, persons with diabetes do not necessarily show glycosuria. That an individual with mild diabetes mellitus may be overlooked in a preliminary screening by testing the urine, is therefore, a good possibility. It was for this reason that

employees of a large industrial concern who had previously had from two to twelve periodic physical and laboratory surveys by the staff of the medical division of the company were studied for the presence of diabetes mellitus.

SCREENING METHOD

Tests were made on 500 employees with an average age of 39.8 years. Each subject was given a diet of 2550 calories, containing 300 gm. of carbohydrates, 90 gm. protein, and 110 fat, for a minimum of three days. On the morning of the test the subject ate the breakfast of the diet which contained 118 gm. of potential glucose. He then ingested 50 gm. of glucose in solution. He presented himself at the laboratory one hour later. Venous blood was taken for sugar estimation by the Folin-Wu technic; a specimen of urine was collected and examined for glucose.

All individuals showing a screening blood sugar of 150 mgm. per 100 cc. or higher were subjected to a three-hour glucose tolerance test (1.75 gm. of glucose per kgm. of body weight, given in one dose). Prior to the glucose tolerance test, the subjects were instructed to follow the same diet as that prior to the screening test.

RESULTS

In the screening test, 62 individuals or 12.4 per cent exhibited glycosuria from a very slight trace to

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3 plus. Of these, forty or 8 per cent had a low renal threshold. The remainder had elevation of the blood sugar.

Blood sugar values of 170 mgm. per 100 cc. or higher were noted in 25 subjects (0.5 per cent). Of the 111 individuals subjected to the glucose tolerance test, eighteen exhibited abnormal curves or 3.6 per cent of the total. Of the eighteen with abnormal curves, ten (2 per cent) definitely had diabetes. The remaining eight (1.4 per cent) were classified as potential diabetics. Of the eighteen with abnormal glucose tolerance curves, six exhibited no glycosuria in the screening test.

The average age of those examined was 39.8 years. The youngest was nineteen and the oldest was 65 years. Of the ten subjects having diabetes mellitus, the ages varied from forty to 65 years. Seven were in the fifth decade of life and the remaining were 55, 60, and 65 years of age. In the group of eight with potential diabetes, the ages were 33, 37, 43, 45, 47, 50, 51, and 62 years, respectively.

DISCUSSION

In the Diabetes Detection Drives the number of new cases discovered varied from 0.0 to 14.0 per cent of the cases examined. It is apparent that the criteria have varied. Had our cases been included in many, if not all, of the surveys they would have been overlooked or considered not to have diabetes. If our group of subjects is an indication of the number of cases of diabetes mellitus which will be overlooked in the routine surveys, then the incidence of diabetes will be approximately 2 per cent greater than those discovered by the usual methods of large surveys. In addition, all of our subjects had had from two to twelve thorough examinations of the usual general annual check-up of carbohydrate metabolism. These examinations satisfied the medical examiners of this company that all of these subjects were healthy individuals and the examinations were more carefully conducted than those required by insurance companies for issuance of large policies. In spite of such examinations, 2 per cent of the people were discovered to have diabetes mellitus and another 1.4 per cent had potential diabetes, thus giving a total of 3.4 per cent.

The criteria for the diagnosis of diabetes mellitus have been a much disputed point. If the criteria accepted by Wilkerson and Krall³ had been employed in our study, 25, or 5.0 per cent of our subjects would have been classified as having diabetes. We, however, are

unable to agree that the height of the blood sugar is diagnostic of diabetes and have accepted the height and prolongation of the curve. It is to be noted in Table 1, which gives the curves of our cases diagnosed as diabetes, that in each case the blood sugar was elevated, the curve was prolonged, and they would be classified as diabetes mellitus by any of the different criteria for the diagnosis of diabetes. In Table 2, on the other hand, the eight cases were designated as potential diabetes by our criteria. All eight cases would have been classified as diabetes by the criteria of Joslin⁴ and Wilkerson.³ We did not deem their curves to be definitely diagnostic and therefore classified them within the normal range.

TABLE 1. Sugar tolerance tests showing diabetes in cases in which hyperglycemia was noted in the screening test.

Case number	Blood Sugar mgm. per 100 cc.			
	Fasting	1 hr. after glucose	2 hrs.	3 hrs.
10	118	275	225	182
41	140	280	190	155
114	128	263	272	216
119	186	276	—	227
178	103	212	205	163
255	117	195	216	180
386	130	190	193	133
409	140	240	270	198
441	113	222	224	147
418	153	184	240	370

TABLE 2. Sugar tolerance tests showing potential diabetes in cases where hyperglycemia was noted in screening test.

Case number	Blood Sugar mgm. per 100 cc.			
	Fasting	1 hr. after glucose	2 hrs.	3 hrs.
8	122	232	173	93
68	113	195	148	132
71	110	174	155	98
73	136	212	120	119
197	104	182	130	127
251	112	220	146	69
476	137	202	132	131
343	105	222	155	124

It is of interest that six subjects with abnormal glucose tolerance curves exhibited no glycosuria in the preliminary screening test. Yet, two of these cases, 386 and 441 (Table 1), had definite diabetes and cases 8, 68, 343, and 476 (Table 2), had potential diabetes. If the urine test alone had been employed for screening, two cases or 0.4 per cent would have been missed. In addition, four other cases of potential diabetes or 0.8 per cent would have been overlooked. The total not detected would have been 1.2 per cent, which is greater than those detected in a large number of surveys.

SUMMARY

Five hundred apparently healthy individuals who previously had been examined in detail two to twelve times, were subjected to a screening test for diabetes mellitus.

In this test, the subject followed a known diet for three days, and then ingested 50 gm. of glucose after the standard breakfast. Those individuals who had hyperglycemia (with the blood sugar over 150 mgm. of glucose per 100 cc.) one hour later were subjected to a standard one-dose-three-hour glucose tolerance test. In this manner, the diagnosis of diabetes mellitus

could be made in 2 per cent of the cases, and an additional 1.4 per cent satisfied the criteria for potential diabetes.

REFERENCES

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- ³ Wilkerson, H. L. C. and Krall, L. P.: Diabetes in a New England town. *J.A.M.A.* 135, 209-216, 1947.
- ⁴ Joslin, E. P. and others: *Treatment of Diabetes Mellitus*. Lea and Febiger, Philadelphia 1946, p. 159.

Major Needs in Nutrition

By many indications, this country's major needs in nutrition today are as follows: (1) control of obesity, (2) elucidation of the role of nutrition in the chronic diseases, (3) assessment of nutritional status as a step toward control of borderline deficiencies, (4) means for complete intravenous alimentation and (5) additional knowledge regarding nutrition in the aged, under stress, and in convalescence. Nutritionists in their efforts to meet these needs should emphasize biochemical and clinical studies of nutrition and metabolism.

OBESITY

Obesity is prevalent throughout the world, occurring even in countries where food is scarce and nutritional status low. In America today it is the gravest known effect of malnutrition. Insurance records indicate that a quarter of the adult population is obese—that is, sufficiently overweight to impair health. Mortality for this group, according to estimates by the Metropolitan Life Insurance Company, is well above normal at every age and rises with increasing weight. Obesity is associated with a high mortality from cardiovascular-renal disease, diabetes, childbirth and diseases of the liver and gall bladder.

Deaths from diabetes are more than three times as common in the obese as in persons of average weight, and deaths from cirrhosis of the liver, among men, more than twice as common. The overweight also have an excessive incidence of hernia, urinary impairments, cancer of the endometrium and some forms of arthritis. Among the nation's major nutrition problems, obesity is in one respect unique. Like pellagra, it can be controlled

in the absence of further knowledge of the underlying mechanism. . . .

DIETARY DEFICIENCY DISEASES

Medical science in general, and certainly nutritional science, would be greatly advanced by further knowledge of how the various dietary deficiencies produce their effects. Pellagra, for example, raises many questions that only intensive metabolic studies may be hoped to resolve . . .

Nutrition science, often through use of biochemical technics, has made notable progress against the major chronic diseases. Here, clinical investigation has been particularly fruitful and should be much extended. . . .

BORDERLINE DEFICIENCIES

Further clinical research is strongly indicated in the problem of borderline deficiencies—that is, conditions presenting an indefinite clinical picture, but nevertheless one of suboptimal health. Such deficiencies are suspected to result in loss of vigor, retarded growth, low resistance to infection, tooth decay, abnormal births and other forms of illness and debility. That these conditions are prevalent is unquestionable, but the extent to which malnutrition is responsible is a matter of few facts and much debate. Those facts require supplementation and possibly intensive action.

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