malaria mosquito and the adult housefly and body louse. Although o,p′-DDT was ineffective against adult mosquitoes, houseflies, and body lice, it was found to be a fairly effective anopheline larvicide.

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## Blood Sugar Level Following Intravenous Glucose in Rheumatoid Arthritis


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It has been observed (*3*) and many times confirmed that patients with rheumatoid arthritis show a slower return of the blood sugar level to the fasting figure following the oral administration of glucose than do normal subjects. This has been variously considered as the result of (a) faulty intestinal absorption; (b) disturbances of pancreatic function (*2*); (c) circulatory abnormalities (*4*); and (d) dysfunction (*1, 6*).

To evaluate the role of gastrointestinal dysfunction and/or intestinal circulatory alterations, Soskin's intravenous glucose tolerance test (*5*)[2] was done on 64 patients with rheumatoid arthritis and 60 subjects with no evidence of organic disease. All patients with rheumatoid arthritis had multiple peripheral joint involvement and sedimentation rates (Wintrobe method) above 25 mm./hour.

In rheumatoid arthritis the blood sugar levels of 8 of the patients (12.5 per cent) had returned to the preinjection or fasting level within 60 minutes; in 42 patients (65.6 per cent) the blood sugar values fell to the preinjection level in between 60 and 120 minutes; and in 14 patients (21.9 per cent) the blood sugar levels at the end of 120 minutes were still higher than the preinjection figures. In the normal cases the blood sugar levels of 43 subjects (71.7 per cent) had returned to the preinjection level within 60 minutes; in 16 subjects (26.7 per cent) the blood sugar levels returned to the preinjection levels in between 60 and 120 minutes; and in 1 subject (1.6 per cent) the blood sugar was still elevated at the end of 120 minutes.

In Soskin's report (*5*) the blood sugar level of all of the normal controls (30 in number) returned to the preinjection figure within 60 minutes after the intravenous administration of the glucose. The fact that somewhat more than 25 per cent of the authors' normal controls failed to return within 60 minutes is not explainable on the basis of the numerical difference between the two groups. Soskin also found that in 25 cases of hepatic disease the blood sugar invariably

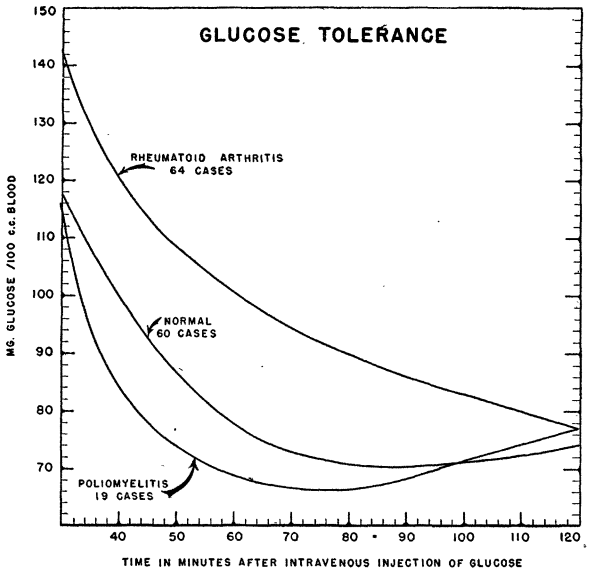


Fig. 1. Curves showing fall of the blood sugar level in the rheumatoid, normal control, and poliomyelitis groups. The curves of the three groups begin at the 30-minute postinjection level rather than the fasting level, since in all determinations the latter was arbitrarily adjusted to a level of 74 mg./100 cc.

returned to the preinjection level in between 60 and 120 minutes following the intravenous administration of the glucose. All but one of the authors' controls that failed to return in 60 minutes did so in 120 minutes. According to Soskin's data this would indicate that these subjects had hepatic disease. It is unlikely that such an assumption is correct, since approximately 50 per cent of the authors' normal controls showing an "hepatic curve" were officers and enlisted men on full military duty. The lack of agreement between the figures obtained by Soskin and those found by the authors in no way detracts from the present study, however, since the intravenous glucose tolerance was used primarily to evaluate the role of intestinal dysfunction. The striking difference between the results obtained by the intravenous glucose tolerance test in rheumatoid arthritis and those obtained in the normal controls is demonstrated in Fig. 1, which shows the

[1] Presently located at Columbia University, New York City, and Veterans Administration, Washington, D. C., respectively.

[2] Method: One-third gram of dextrose/kg. body weight in a 50-per cent aqueous solution injected intravenously within a period of 3–5 minutes. A preinjection fasting and 30-, 60-, and 120-minute postinjection venous blood samples were assayed by the Somogyi method for the determination of the true blood sugar level.

mean curves of the glucose tolerance tests obtained after arbitrarily adjusting all figures to a preinjection blood sugar level of 74 mg./100 cc. This adjustment is permissible since, as Soskin (*5*) has pointed out, the important factor is the time interval required for the return of the blood sugar level to the preinjection figure, rather than the maximum height of the blood sugar level. This observation is confirmed by analysis of the data presented in Table 1. These figures were obtained by determining the blood sugar levels at 3 and 5 minutes after the intravenous injection of glucose in addition to the usual 30-, 60-, and 120-minute samples.

TABLE 1

| Type of case | No. of cases | Mean postinjection blood sugar levels mg./100 cc. | | | | |
|---|---|---|---|---|---|---|
| | | 3 min. | 5 min. | 30 min. | 60 min. | 120 min. |
| Rheumatoid arthritis ..... | 10 | 247.6 | 210.4 | 142.1 | 100.4 | 75.9 |
| Normal controls | 7 | 245.0 | 202.5 | 121.5 | 84.7 | 75.1 |

For these determinations an additional 10 patients with rheumatoid arthritis and 7 normal subjects were used. All fasting levels were again arbitrarily adjusted to 74 mg./100 cc. Three minutes after the injection of glucose was completed the blood sugar level was approximately the same for both types of cases. After 5 minutes the curves of the rheumatoid arthritic patients and the normal subjects became divergent, the normals falling faster than the rheumatoids. These deceleration studies indicate that the abnormal glucose tolerance in rheumatoid arthritis is not a simple function of the maximum height of the blood sugar level at the end of the glucose administration.

In view of the fact that the intravenous glucose tolerance test shows a slower deceleration of the blood level in 87.5 per cent of patients with rheumatoid arthritis than in 71.7 per cent of normal controls, it can be concluded that intestinal dysfunction plays no role in the altered glucose tolerance found in the former.

In a further effort to ascertain the factor or factors responsible for the difference in glucose tolerance between patients with rheumatoid arthritis and subjects with no evidence of organic disease, the aforementioned data were reconsidered in the light of the possible fate of intravenously injected glucose. This may presumably be disposed of via the following channels: (a) utilization in the tissues for immediate energy requirements, (b) conversion into hepatic glycogen or (c) into muscle glycogen, and (d) excretion in the urine.

To evaluate the possibility of the altered glucose tolerance resulting from a difference in the amount of glucose lost in the urine, quantitative urinary glucose determinations were made on the 64 rheumatoid arthritic cases and on the 60 normal controls. The urine samples were collected at approximately the time the blood samples were drawn for the glucose tolerance test. Most of the glucose lost in the two groups was present in the sample obtained 30 minutes after the glucose was administered, and samples obtained 2 hours after the injection of glucose were invariably free of sugar. The total output of urine for both groups was approximately the same for the interval during which the determinations were done. The difference in the 2-hour mean total urinary output of glucose of the rheumatoid (.516) and normal control (.600) groups amounted to only .084 grams/100 cc. of urine—obviously an amount too small to be of any significance.

To evaluate the possibility that the altered glucose tolerance in rheumatoid arthritis results from a diminution of peripheral glycogen depots consequent to muscle atrophy, the intravenous glucose tolerance test was also done on 19 patients with severe poliomyelitis, all of whom were convalescent. Only patients having severe atrophy of at least three extremities were used. Certain of the patients had a quadriplegia. Fig. 1 shows that the glucose tolerance curve for the poliomyelitis cases falls below both the normal and rheumatoid groups. The reason for the difference between the normal controls and poliomyelitis cases is not apparent. It is obvious, however, that diminution of peripheral glycogen depots does not explain the alteration of the glucose tolerance found in rheumatoid arthritis, since the poliomyelitis patients had as much and often more atrophy than the former group.

As before stated, pancreatic insufficiency has been suggested to explain the altered glucose tolerance. Soskin (*5*) demonstrated that when a constant and unvarying amount of insulin is supplied intravenously to a depancreatized dog, the administration of a large dose of glucose is still followed by a normal glucose tolerance curve. On the basis of this experiment and others equally ingenious (*5*), he demonstrated the existence of an hepatic homeostatic control which supplies glucose to the blood stream when the blood sugar level drops below a certain point and inhibits its release when it rises above a certain point. The homeostatic equilibrium is affected by certain endocrine glands, notably the pancreas, anterior lobe of the hypophysis, the thyroid, and the adrenal cortex. Hence, hormonal influences affecting the hepatic homeostatic control of the blood sugar level could account for the alteration in the glucose tolerance. The available data do not, however, permit evaluation of the role of these extrahepatic factors.

SUMMARY

Since the majority of patients with rheumatoid arthritis show a slower fall in the blood sugar level after the intravenous injection of glucose than do the normal controls, the alteration cannot be explained on the basis of gastrointestinal dysfunction.

Differences in the renal threshold of glucose do not explain the altered glucose tolerance, since approximately the same amount of glucose is lost in the urine in both groups.

Blood samples taken at 3 and 5 minutes following the injection of the glucose showed the height of the blood sugar level to be approximately the same in the patients with rheumatoid arthritis and in normals. The slower fall in the blood sugar level of the former is therefore not a simple function of a greater rise following the intravenous administration of the glucose.

Although the patients with severe poliomyelitis had as much or more atrophy than the rheumatoid arthritic patients, there was no delay in rate of fall of the blood sugar level after the intravenous administration of glucose.

In view of the fact that the hepatic homeostatic control regulates the blood sugar level, faulty utilization of glucose by extrahepatic tissues cannot be considered the primary factor responsible for the alteration of the glucose tolerance.

The altered glucose tolerance in rheumatoid arthritis is explainable on the basis of an altered threshold of the hepatic homeostatic control of the blood sugar. Additional studies must be done to determine whether this derangement emanates directly from extrahepatic influences.

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# *News and Notes*

## About People

*George A. Ellinger* and *Harold E. Cleaves* have been appointed chiefs of the Optical Metallurgy Section and the Chemical Metallurgy Section, respectively, at the National Bureau of Standards.

*Justin M. Andrews* was recently commissioned as senior scientist (R) with the U. S. Public Health Service. He has assumed the position as deputy officer in charge of the Communicable Disease Center, Atlanta, Georgia. During the war, Dr. Andrews served as a colonel in the Sanitary Corps, AUS.

*Carl A. Kuether,* Western Reserve University, has recently been made professor of biochemistry at the new School of Medicine, University of Washington, Seattle.

*Norman Kharasch,* formerly of Northwestern University, has been appointed assistant professor of chemistry at the University of Southern California.

*E. M. Gilbert,* professor of botany at the University of Wisconsin, has retired after 36 years of service.

*Julius A. Brown,* director of the observatory at the American University at Beirut, Syria, from 1909 to 1945, has been named visiting lecturer in physics and astronomy at Colgate University.

*Russell B. Stevens,* recently on the staff of the Biology Department, University of Louisville, has become associate professor of botany, Alabama Polytechnic Institute, Auburn, Alabama.

*Chalmer L. Cooper,* formerly geologist with the Illinois State Geological Survey, has been appointed senior geologist with the U. S. Geological Survey, Washington, D. C., where he is working in the office of the director, coordinating activities of the various branches in the preparation of Survey reports for publication.

*George M. Reed,* since 1921 curator of plant pathology at the Brooklyn Botanic Garden, became curator emeritus on 1 October.

*Roy O. Greep,* Harvard School of Dental Medicine, Boston, has been appointed associate professor of dental science. The appointment became effective on 15 July.

*Paul B. Beeson* and *Albert Haymen,* Emory University, have received a grant of $12,500 from the U. S. Public Health Service for fundamental research in the mechanics and effects of fever.

*Stanley A. Cain,* professor of botany, University of Tennessee, will join the staff of Cranbrook Institute of Science, Bloomfield Hills, Michigan, on 15 October.