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## **Protein and amino acid pattern in juvenile diabetes**

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With 2 tables

(Received December 29, 1976)

Protein metabolism may be markedly deranged in diabetes mellitus. Such derangement could be due to either insulin insufficiency or insulin antagonists that may accelerate insulin destruction or mobilize extra carbohydrate loads (10). Korner and Manchester (8) reported that diabetes results in loss of body weight, a depletion of body proteins, and a negative nitrogen balance. The nitrogen loss can be prevented by the administration of insulin (2). Also plasma amino acids and their uptake by skeletal muscle are affected by insulin level in blood. Insulin stimulates the incorporation of labeled amino acids into proteins (10). Insulin also stimulates glucose metabolism necessary for energy production that could be used in protein synthesis.

To what extent disturbance in protein and amino acids metabolism is affected by the diabetic condition, this study was done to answer such a question or to throw some more light on such phenomenon in young juvenile diabetics. This may help in providing better conditions for protein utilization under such conditions.

### **Materials and methods**

The material of this study comprised 41 subjects 21 diabetics, 6 females and 15 males with age range of 7-20 years. Diagnosis was based on their history, urine and blood analyses. Patients chosen were free from major infections, parasites, or ketogenic acidosis at the time of study. They were under insulin therapy except the day of experiment. Their nutrition status, anthropometric measures, and medical state was reported. The normal controls comprised 20 healthy individuals of the same age range and similar socioeconomic standard. They comprised 8 females and 12 males.

Fasting blood sugar for the patients and controls was estimated by the method of Haslewood and Strookman (6). Total serum proteins were determined by the biuret method (7). Electrophoretic separation was performed by horizontal technique by King and Wootton (7). Total free amino acids were estimated by the method of Ya Pin Lee and Tanckazu (16), and the individual free amino acids were estimated for the deproteinized serum samples by two-dimensional paper chromatography of Smith (12).

Table 1. Fasting blood glucose (mg/100 ml), total and individual serum proteins (g/100 ml) in controls and diabetic juveniles (range, mean  $\pm$  SE and P).

| Item                   | Normal controls              | Juvenile diabetics           | P >   |
|------------------------|------------------------------|------------------------------|-------|
| Blood glucose          | 69-80<br>72 $\pm$ 0.71       | 140-394<br>283 $\pm$ 20.7    | 0.005 |
| Total serum proteins   | 7.30-9.30<br>8.16 $\pm$ 0.11 | 7.71-8.91<br>8.29 $\pm$ 0.10 | 0.15  |
| Albumin                | 2.96-5.27<br>3.98 $\pm$ 0.13 | 3.23-4.97<br>4.26 $\pm$ 0.10 | 0.05  |
| Alpha-1-globulin       | 0.28-0.78<br>0.55 $\pm$ 0.04 | 0.28-0.86<br>0.54 $\pm$ 0.04 | 0.15  |
| Alpha-2-globulin       | 0.50-1.28<br>0.89 $\pm$ 0.06 | 0.83-1.89<br>1.24 $\pm$ 0.07 | 0.005 |
| Beta-globulin          | 0.83-1.40<br>1.03 $\pm$ 0.03 | 0.81-1.20<br>1.01 $\pm$ 0.04 | 0.15  |
| Gamma-globulin         | 1.35-1.99<br>1.68 $\pm$ 0.05 | 0.46-1.89<br>1.17 $\pm$ 0.09 | 0.005 |
| Albumin/globulin ratio | 0.65-1.64<br>0.99 $\pm$ 0.06 | 0.79-1.70<br>1.11 $\pm$ 0.05 | 0.05  |

### Results and discussion

The hyperglycemia seen among diabetic juveniles has been referred to decreased uptake in diabetic tissues (1) or hepatic over production of glucose (4). Also *Stadie* (13) forwarded the concept concerning the possible locations of metabolic blocks, in insulin deficiency or the presence of an excess centra-insulin principles. It is necessary to point out that the individuals included in this group were considered diabetic not only because they showed high fasting blood sugar level, but also because of the accompanied glycosuria.

In spite of the normal values obtained for serum total proteins, yet its individual fractions showed certain variations. It is of interest to mention that similar variabilities were reported by other authors. *Vitelli* et al (14) and *Dabolina* (3) demonstrated that diabetes presented a regular pattern of disturbed protein metabolism according to the severity of the disease. It has been suggested by *Korner* and *Manchester* (8) that insulin has some effect on the synthesis and/or degradation of proteins (5, 15). On this basis, the finding of minimal changes in our diabetic group may indicate good control of their diabetic state by maintenance of insulin therapy.

Values for serum total and individual amino acids in normals and diabetic groups are shown in table 2. In the diabetic juveniles there was a significant increase in total free amino acids compared to normals. This was accompanied by an increase in the level of most of the serum individual amino acids. The cause for such metabolic derangement in amino acids in diabetes could be due to one or more of the following factors:

1. Insulin stimulates the incorporation of amino acids in proteins (11, 10).
2. Insulin lowers plasma amino acid level and promotes the uptake of amino acids by skeletal muscle (5).

Table 2. Serum total and individual amino acids (mg/100 ml) (range, mean  $\pm$  SE and P).

| Item                   | Normal controls                 | Juvenile diabetics              | P     |
|------------------------|---------------------------------|---------------------------------|-------|
| Total amino acids      | 18.30–24.86<br>20.00 $\pm$ 0.26 | 18.59–40.70<br>29.90 $\pm$ 1.29 | 0.005 |
| Aspartic acid          | 0–0.40<br>0.11 $\pm$ 0.05       | 0.20–1.25<br>0.72 $\pm$ 0.06    | 0.005 |
| Glutamic acid          | 0.25–0.90<br>0.63 $\pm$ 0.05    | 0.50–2.05<br>1.17 $\pm$ 0.16    | 0.005 |
| Serine                 | 0.40–1.20<br>0.73 $\pm$ 0.06    | 0.40–2.40<br>1.33 $\pm$ 0.22    | 0.005 |
| Glycine                | 0.63–1.40<br>0.99 $\pm$ 0.06    | 1.00–2.87<br>1.88 $\pm$ 0.25    | 0.005 |
| Lysine                 | 0.20–0.80<br>0.60 $\pm$ 0.04    | 0.42–1.82<br>1.07 $\pm$ 0.10    | 0.005 |
| Arginine               | 0.90–3.40<br>1.48 $\pm$ 0.14    | 0.40–3.25<br>1.50 $\pm$ 0.18    | 0.15  |
| Alanine                | 0.60–1.50<br>0.77 $\pm$ 0.06    | 0.25–3.43<br>1.02 $\pm$ 0.19    | 0.10  |
| Phenylalanine          | 0–0.68<br>0.32 $\pm$ 0.06       | 0–1.75<br>0.63 $\pm$ 0.17       | 0.01  |
| Valine                 | 0.45–1.40<br>0.77 $\pm$ 0.07    | 0.25–1.65<br>0.80 $\pm$ 0.07    | 0.15  |
| Leucine and isoleucine | 0.25–1.40<br>0.61 $\pm$ 0.06    | 0.50–1.87<br>1.08 $\pm$ 0.13    | 0.005 |
| Threonine              | 0–1.30<br>0.63 $\pm$ 0.11       | 0–1.93<br>1.00 $\pm$ 0.19       | 0.01  |
| Tyrosine               | 0–1.80<br>0.93 $\pm$ 0.11       | 1.00–4.50<br>2.56 $\pm$ 0.23    | 0.005 |
| Tryptophan             | –                               | 0–2.00<br>1.03 $\pm$ 0.12       | –     |

3. Insulin was speculated to facilitate the transport of amino acids into the cells (15).

Hence, the absence of or the decrease in insulin would be suspected to give rise to certain derangements in these summarised processes and in turn there would be a rise in the level of serum-free amino acids. However, this appears to be contradictory to the finding of non-significant increase in serum total proteins and a number of its fractions. Yet, this may denote that other factors apart from insulin deficiency may have a role in the hyperaminoacidemia. Again, the latter cannot be a result of increased renal threshold as this hyperaminoacidemia was accompanied with amino-acidurea in juvenile diabetes. Furthermore, Lohman (9) stated that diabetics with vascular disorder are unable to adequately utilize free amino acids for protein synthesis.

4. One has to mention the interference of duration of the disease, age of the patient, dietary regimen as well as the line of treatment which cannot be completely ruled out.

### Summary

A number of 21 diabetic juveniles and 20 controls comprised the material of this study. Serum total proteins and their electrophoretic separated fractions were estimated. Serum free amino acids were also investigated.

Results showed that serum proteins were within normal range. An average increase of 49.5 % in total free amino acids was reported. In general, the data for all the detected amino acids showed an average increase when compared with normal values. The significance of these findings in relation to the normal values were discussed.

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