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Frequency of Chemical Diabetes in the Parents of Diabetic Children

By

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Out of 106 parents of 58 diabetic children 5 had manifest diabetes, 19 chemical diabetes, and 28 were suspected of chemical diabetes. In addition, 17 parents displayed reactive hypoglycaemia. This means that apart from the manifest diabetics, 2/3 of the parents displayed a non-physiological oral glucose tolerance test.

Inheritance of diabetes is still an unsolved problem; dominant and recessive inheritance are both possible. According to certain data, maturity onset diabetes is inherited dominantly, and juvenile diabetes recessively [13]. Recent observations all speak for a polygenic inheritance of the disease [4].

In childhood the question is further complicated by the role of exogenous factors. The damage of beta cells is presumably the consequence of an autoimmune process. Inheritance in these cases is still significant, since autoimmune process provokes the metabolic disturbance primarily in genetically susceptible children [3]. The frequency of diabetes in the ascending line of the families of diabetic children ranges between 15.4 and 52% [2]. The frequency of diagnosed diabetes among family members depends primarily on the duration of the observation. If the family is controlled over several decades, the number of diagnosed diabetics rises significantly. At the time of its first manifestation, the prevalence of the disease in the other members of the family amounts to 20%, while 20 years later to 60% and 40 years later to 75%. Diabetes is more frequent among siblings than in the parents [14].

These data concern relatives with manifest diabetes; the prevalence in the relatives of chemical diabetes is higher [16].

The aim of our examinations was to establish the frequency of chemical diabetes in the parents of diabetic children. If there is a relationship between chemical and manifest diabetes, and if juvenile diabetes is inherited recessively, chemical diabetes must occur more frequently in the parents.

Material and Methods

The material consisted of 106 parents of 58 diabetic children. Oral glucose tolerance test (OGTT) was carried out in 43 cases in both parents, in 15 cases in one of the parents. In 5 cases one of the parents had manifest diabetes; these were not tested. To the tested subjects a carbohydrate-rich diet was prescribed for 3 days before the examination. The blood sugar level was determined after a night's fast, then oral loading was done with 50 g of glucose every 30 minutes for 3 hours. Blood glucose was determined from the capillary blood by the orthotoluidine method. Scoring of the OGTT was performed according to the system proposed by Schliack et al. [17, 18], with regard to age. Values of the transitory zones scored one point each at 30 and 60 minutes, and two at 120 minutes. Values over the transitory zones scored two each at 30 and 60 minutes and four at 120 minutes. Thus:

1) 0—2 scores = negative.
2) 3—6 scores = suspect of diabetes.
3) 7—8 scores = chemical diabetes.

Reactive hypoglycaemia was also evaluated. Those cases where a reactive decrease under 70 mg per 100 ml was found, were grouped separately.

Results

Table I shows that out of 48 parent-pairs 18 scored 0—2, in 14 cases only one of the parents received 3 or more points, in 16 cases both parents scored above 3. So the ratios were 1 : 3 for each. Extending our observations to the whole material, chemical diabetes could be proved in 19 parents. Thus, a diabetic disturbance of carbohydrate metabolism could be demonstrated in 24 of the parents including the 5 diabetics. In 28 cases the score was between 3 and 6 (Table II). The type of the curve deviated from the normal in half of the examined cases.

Tables III and IV show the blood-sugar values after OGTT.

In the 0—2 score group, blood sugar decreased below 70 mg per 100 ml in 17 cases. If these 17 cases are added to the 47 pathological ones with scores of 3 or more, the frequency of non-physiological curves amounts to 64/101 (see Table III). Age did not

Table I

OGTT score in both parents

♀ \ ♂	0	1—2	3—6	7—8	Manifest diabetes	Total
0	3	3	0	1	0	7
1—2	6	6	2	0	0	14
3—6	2	3	6	4	1	16
7—8	2	2	2	1	2	9
Manifest diabetes	1	1	0	0	0	2
Total	14	15	10	6	3	48

seem to influence the occurrence of chemical diabetes (Table V).

Table VI shows the relation of age and body weight, and Table VII that between OGTT and body weight. The occurrence of diabetoid blood-sugar curves increased with the increase in body weight.

TABLE II

Distribution of cases according to OGTT score

0	22
1–2	32
3–6	28
7–8	19
Manifest diabetes	5
Total	106

TABLE III

OGTT score with reactive hypoglycaemia

Score	Number of cases	Blood-sugar values in mg/100 ml after OGTT						
		0′	30′	60′	90′	120′	150′	180′
0	9	88±4	133±10	131±5	99±11	77±5	69±4	59±4
1–2	8	92±3	162± 8	148±9	96±12	82±9	66±5	54±3
3–6	2	102	183	193	166	130	79	55
7–8	0							

TABLE IV

OGTT score without reactive hypoglycaemia

Score	Number of cases	Blood-sugar values in mg/100 ml after OGTT						
		0′	30′	60′	90′	120′	150′	180′
0	13	94±3	152±5	13 ± 8	106± 5	90± 2	89± 4	85±3
1–2	24	107±3	168±2	156± 6	115± 4	102± 3	89± 3	83±3
3–6	26	108±3	182±6	182± 9	154± 6	125± 5	106± 4	96±4
7–8	19	127±7	226±6	222±12	179±10	150±11	142±10	103±5

TABLE V

Frequency of hypoglycaemia in parents according to age and OGTT score

Score \ Age	20—29	30—39	40—49	50—60	Total
0	0/2	5/9	3/7	1/4	9/22
1—2	1/7	3/5	3/18	1/2	8/32
3—6	0/4	0/7	2/16	0/1	2/28
7—8	0/3	0/6	0/8	0/2	0/19
Total	1/16	8/27	8/49	2/9	19/101

The denominator shows the number of cases tested

TABLE VI

Correlation of excess weight and parental age

Ecess weight \ Age	20—29	30—39	40—49	50—60	Total
I	11	14	22	5	52
II	4	8	18	2	32
III	0	4	3	1	8
Total	15	26	43	8	92

Excess weight according to Brocca: I=under 10%
II=10—30%
III=above 30%

TABLE VII

OGTT score and body weight

Excess weight \ Score	0	1—2	3—6	7—8	Total
I	17	18	14	3	52
II	4	10	10	8	32
III	0	2	2	4	8
Total	21	30	26	15	92

Discussion

Chemical diabetes has been classified by Jackson et al. [10] into 3 groups:

1. Definite chemical diabetes; this corresponds our scores ranging from 7 to 8.

2. Probable chemical diabetes; this corresponds to our scores ranging from 3 to 6.

3. Possible chemical diabetes, with a score between 0 and 2, plus significant reactive hypoglycaemia (Table III).

A disposition for reactive hypoglycaemia is characteristic of chemical diabetes [1], probably due to the irregular insulin secretion, which is an early symptom of chemical diabetes [5, 8, 9, 10, 11, 12, 15]. Silwet and Oscarsson [19] observed an identical incidence of chemical and manifest diabetes in different age groups. In the present, in the parents of diabetic children, chemical diabetes was four times more frequent than manifest diabetes: 5 had manifest and 19 chemical diabetes. Cerasi and Luft [6, 7] on the basis of low insulin secretion assumed a 20% frequency of the prediabetic condition in the normal population. According to our observations, 2/3 of the parents of diabetic children have some disturbance of carbohydrate metabolism. Thus, the OGTT revealed a diabetic predisposition with an increased frequency in both parents.

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References

1. Balsam, M. J., Kaye, R., Baker, L.: Chemical diabetes in children: Glucose tolerance tests. Metabolism **22,** 283 (1973).
2. Barta, L.: Über die Frage der Vererbung des Diabetes mellitus. Dtsch. med. Wschr. **85,** 558 (1960).
3. Bastenie, P. A.: Diabetes immunity and autoimmunity. Proc. 8th Diabetes Congress, Brussels 1973.
4. Butler, L.: The inheritance of diabetes in the Chinese hamster. Diabetologia **3,** 124 (1967).
5. Camerini-Davalos, R. A., Oppermann W., Velasco, C., Cole, H. C.: Abnormalities at the stage of chemical asymptomatic diabetes. Metabolism **22,** 219 (1973).
6. Cerasi, E., Luft, R.: The pathogenesis of diabetes mellitus — a proposed concept. Nobel Symposium 13. Almquist and Wiksell, Stockholm. 1970, pp. 17—43.
7. Cerasi, E., Luft, R.: The prediabetic state, its nature and consequences. Diabetes **21,** Suppl. **2,** 685 (1972).
8. Goto, Y., Sate, S.-I., Ohira, S.-I., Maruhama, Y.: Plasma insulin and free fatty acids in young people with postprandial glycosuria: plasma insulin response in the cases with borderline glucose test. Diabetologia **9,** 264 (1973).
9. Guthrie, R. A., Guthrie, D. W., Murthy, D. Y. N., Jackson, R. L., Lang, J.: Standardization of the oral glucose tolerance test and the criteria for diagnosis of chemical diabetes in children. Metabolism, **22,** 275 (1973).
10. Jackson, R. L., Guthrie, R. A., Guthrie, D. W., Waiches, H. M.: The definition of chemical diabetes in children. Metabolism **22,** 229 (1973).
11. Jackson, R. L., Guthrie, R. A., Murthy, D. Y. N.: Oral glucose tolerance tests and their reliability. Metabolism **22,** 237 (1973).
12. Jackson, R. L., Guthrie, R. A., Murthy, D. Y. N., Lang, J.: The intravenous glucose tolerance test in chemical diabetes. Metabolism **22,** 247 (1973).
13. Köberling, J.: Untersuchungen zur Genetik des Diabetes mellitus. Eine geeignete Methode zur Durchführung von Alterskorrekturen. Diabetologia **5,** 392 (1969).
14. Krall, L. P.: Diabetes in the young. Diab. croat. **1,** 235 (1972).

15. Reaven, G. M., Olefsky, J., Farquhar, J. W.: Does hyperglycaemia and hyperinsulinaemia characterise the patient with chemical diabetes? Lancet **1**, 1247 (1972).
16. Rosenbloom, A. L.: Criteria for interpretation of the oral glucose tolerance test in children and insulin responses with normal and abnormal tolerance. Metabolism **22**, 301 (1973).
17. Rost, G., Honigmann, G., Schliack, V.: Diabetes-Frühstadium und die Problematik ihrer Definition. Z. inn. Med. **22**, 709 (1967).
18. Schliack, V., Rost, G., Honigmann, G., Letz, U.: Der orale Glukosetoleranztest für Labordiagnose des Diabetes mellitus. Bewertung und altersabhängiger Verlauf. Z. inn. Med. **23**, 243 (1968).
19. Silwet, H., Oscarsson, P. N.: Incidence and coincidence of diabetes mellitus and pulmonary tuberculosis in a Swedish country. Acta med. scand. **161**, 335 (1958).

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