Acta Paediatrica Hungarica, 24 (1), pp 17—22 (1983)

The D-xylose test in coeliac disease

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The results of more than 500 D-xylose loading tests are described. In almost half of the cases proven or suspected to be coeliac disease, the blood xylose level was low. In 69 patients the result was compared to that of small bowel biopsy. Abnormal levels were found in 98% of total or subtotal villous atrophy. It is therefore suggested to apply the test for screening in severe cases.

Since with increasing age the absorption of xylose improves, this is to be considered when evaluating the test.

At the time of gluten readministration the D-xylose test suggests the presence of histological changes well before their clinical manifestation. Therefore the result of the D-xylose test serves as an indication for small bowel biopsy. An abnormal D-xylose test after introduction of the gluten-free diet points to its deficiency.

During the past two decades several methods have been worked out for diagnosing the malabsorption syndromes. Small intestinal biopsy is the most helpful of these. By now it has become a routine examination in most children's hospitals and it is generally accepted as the only reliable test in the diagnosis of coeliac disease [1].

In spite of all its advantages, intestinal biopsy cannot be carried out as an initial test, therefore it was necessary to find a way to prove its necessity. The D-xylose test serves this purpose.

D-xylose is a carbohydrate made up of 5 carbon atoms, which does not exist in the body. It is non-toxic and penetrates the intestinal wall by active absorption [3, 5], mainly in the upper small intestine, but if this area is damaged, in other areas as well. In case of impaired enterocyte function, the absorption of the D-xylose is reduced, therefore it can be used as a screening test in diseases involving villous damage in the small intestine [9].

In the last 6 years we have carried out more than 500 D-xylose tests. The present study reports on the results.

MATERIAL AND METHODS

Between 1974 and 1980, 553 D-xylose tests were done in 321 children who were examined for malabsorption. The patients ranged in age from 2 months to 14 years. In 69 children the test was done before biopsy and the results were compared to the degree of villous damage.

Histological grouping was done after Oehlert [12]. The test was applied in children suffering from coeliac disease both during a gluten-free diet and during the administration of gluten.

The D-xylose test and blood level determination was done according to Rolles et al [14]. Children under 30 kg were given 5.0 g, and over 30 kg, 15.0 g/m² body surface D-xylose after 8 hours fasting, making an effort to administer the full dose in a short time.

In the case of increased intestinal motility with a temperature the examination was postponed.

In 186 cases blood samples were taken also before the test. The fasting blood level was $\bar{x}$ 2.4 $\pm$ 1.2 mg/dl. Later, blood sampling before the test was omitted but the limit was modified to 1.65 mmol/l (25 mg/dl). This was possible as the test did not serve diagnostic purposes but was applied for screening and to examine the conditions of absorption.

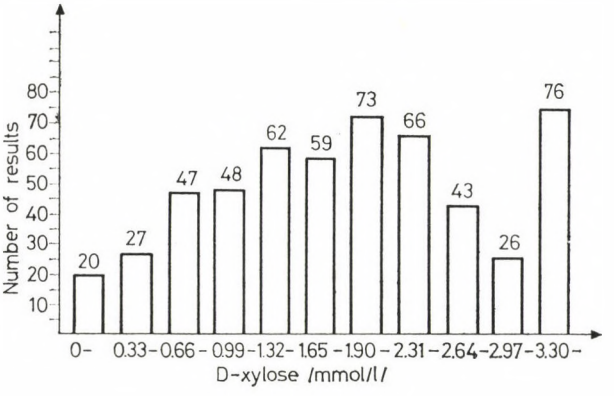

FIG. 1

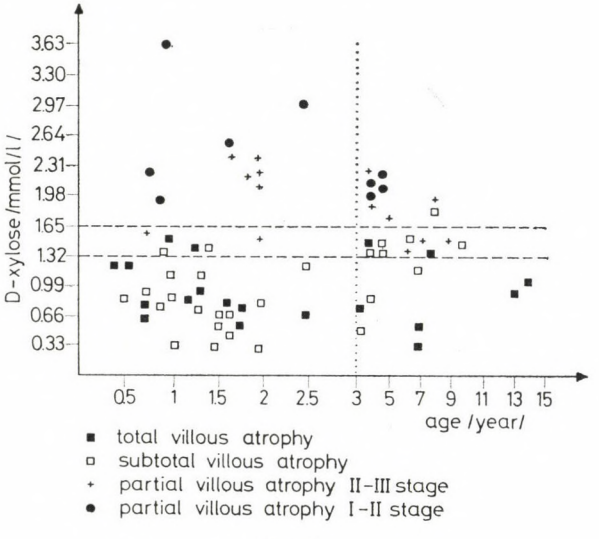

FIG. 2

TABLE I

Abnormal D-xylose test and clinical diagnosis

Diagnosis	Number of cases	Per cent
Coeliac disease	69	34
Coeliac disease suspects	30	15
Malabsorption syndrome	83	41
Herpetiform dermatitis	4	2
Giardiasis	2	1
Intestinal lymphangiectasis	2	1
Others	12	6

TABLE II

Result of small bowel biopsy and D-xylose level

Degree of villous damage	No. of cases	Below 1.65 mmol/l	Per cent
Partial villous atrophy I—II	9	0	0
Partial villous atrophy II—III	15	5	33
Subtotal villous atrophy	25	24	96
Total villous atrophy	20	20	100

RESULTS

The results and distribution of 553 D-xylose tests are shown in Fig. 1. The result was abnormal in 204 cases (37%). The clinical diagnosis in these cases is seen in Table I; 48% of the abnormal values were noted in children with proven or suspected coeliac disease but the percentage was high in cases of chronic enteritis, cow milk protein allergy and other conditions with malabsorption (40.6%).

Table II shows the D-xylose test results connected with intestinal biopsy. Biopsy revealed in 20 patients a total and in 25 patients a subtotal villous atrophy. Among these 45 cases there was only a single one whose D-xylose value was within normal limits; so the test was diagnostic in 98% of the severe cases.

One-third of the II and III stage cases of partial villous atrophy showed abnormal values; these were never lower than 1.32 mmol/l (20 mg/dl).

The results are classified by age in Fig. 2. The examination was carried out mostly in children under 3 years of age (44 cases) where in cases of subtotal atrophy the average D-xylose level was 0.84 mmol/l (12.8 mg/dl). Over 3 years this value was 1.44 mmol/l (21.4 mg/dl). In the younger children, 13% of the results and in the older children, 46% of the results fell between 1.32 and 1.65

mmol/l (20—25 mg/dl). This proves that in the case of comparable villous damage, the absorption of D-xylose is better in older children:

Discussion

The D-xylose test has been employed in the diagnostics of coeliac disease for almost 3 decades. First, the urine excretion was measured. Then Rolles et al. [14] suggested the easier and more reliable method of measuring the D-xylose level in blood. The values vary in the different studies for different reasons; for instance, some authors do not use Somogyi's protein agglutination. A misleading factor can be the administration of other actively absorbing substances just before the test.

There is no standard D-xylose dosage; it is important that the patient with coeliac disease should receive 10—20 g of gluten daily prior to the test. Elimination of the gluten for a few days affects the result [14]. It is necessary therefore to ensure the normal daily gluten intake in these cases before the examination.

Since D-xylose is actively absorbed from the intestine, normal enterocyte function is a prerequisite of the presence of D-xylose in blood. In diseases with villous damage (coeliac disease, cow milk protein allergy, Duhring syndrome, viral enteritis, etc.) the epithelial cells are affected. The absorption is diminished also by protozoa, bacteria or fungi in the small intestine. Utilization of D-xylose by intraluminal bacteria and the absorption-reducing effect of alien flora have been reported [6, 7]. Among the patients with low D-xylose level, there were many for whose malabsorption or severe atrophy the ascending small intestinal flora was responsible.

The low D-xylose level, especially if it is repeatedly low, is an indication for duodenal juice analysis or intestinal biopsy.

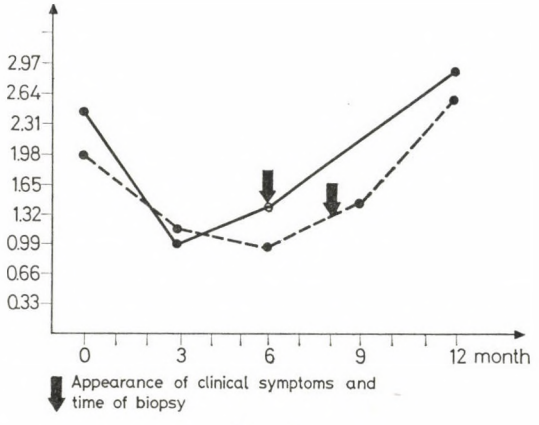

Fig. 3

Out of the 192 patients reported in 6 papers [2, 9, 10, 13, 14, 16] the result was abnormal in 180 cases. Our results were similar. The only patient whose D-xylose level was abnormal was an 8 year old boy with subtotal villous atrophy. The patients of Ose and Rolles who had levels over 1.32 mmol/l (20 mg/dl) were 5 and 6 years old respectively [13, 14].

The clinical symptoms of coeliac disease are known to improve with age and often only a retardation of height and weight indicates the presence of malabsorption. This is explained by the compensating function of the ileum [8].

In our patients over 3 years the D-xylose level showed higher values even with comparable villous damage. In these cases, if the value is 1.65—1.98 mmol/l, the test should be repeated, and if the same result is obtained, duodenal juice analysis or biopsy is indicated to elucidate the cause of malabsorption.

During the follow-up period the test should be repeated every 3 months especially when gluten is again added to the diet or in the case of complaints.

In our experience, the D-xylose level points to intestinal damage well before its clinical manifestation. This is demonstrated in 2 patients (Fig. 3.)

In the cases of proven coeliac disease the change of the D-xylose level was seen at different points of time. This could be due to the varying individual sensitivity and the different amount of ingested gluten.

According to the European Paediatric Gastroenterologists' Association, a relapse may occur even as late as 2 years after gluten readministration [11]. On a gluten-free diet the D-xylose test becomes normal before clinical symptoms would appear. If this is not the case then the diet should be controlled and the eventual presence of an abnormal small intestinal flora has to be excluded.

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Received 11 April 1982

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