The 5 g. *d*-xylose absorption test

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SYNOPSIS The 5 g. *d*-xylose absorption test has been studied in 50 normal subjects. The five-hour urinary xylose content was 1.75 ± 0.43 g. Xylose absorption was more rapid and more complete with the 5 g. than with the 25 g. test. Comparative studies showed the results of the two tests to be significantly related, but the 5 g. test was a less sensitive indicator of malabsorption than the 25 g. test. The 25 g. test is considered the more suitable for routine use in temperate climates.

Assessment of carbohydrate absorption by the 25 g. *d*-xylose absorption test is standard practice in many laboratories. The normal range of this test, its relation to other indices of intestinal function, and the significance of abnormal results are now known with considerable accuracy (see review by Joske and Curnow, 1962). The test has two minor disadvantages in that *d*-xylose is relatively expensive and that a 25 g. dose of xylose provokes diarrhoea in a proportion of subjects. Because of these disadvantages, Santini, Sheehy, and Martinez-de Jesus (1961) have suggested replacement of the 25 g. dose of xylose with a 5 g. dose, and reported useful results with the modified test in a group of patients with tropical sprue.

The present paper reports further experience with the 5 g. xylose test in normal and abnormal subjects. In addition data are presented concerning urine volumes and blood xylose levels at one and two hours following a 5 g. dose of xylose. The latter were not studied by Santini and his colleagues.

MATERIALS AND METHODS

Except for the substitution of a 5 g. dose of xylose the test was performed as described previously (Joske and Curnow, 1962). Xylose estimations were made by the method of Roe and Rice (1948).

The normal values for the test were established from a series of 50 subjects without overt gastrointestinal or renal disease. These were members of the laboratory staff or convalescent orthopaedic patients. They included 28 males and 22 females, and ranged in age from 16 to 61 years with a mean of 28 years. In 14 of these subjects a 25 g. test was performed within a few days of the 5 g. test. In addition, both tests were performed on eight patients with

proven malabsorption from a variety of causes, including atrophic jejunitis, and following partial gastrectomy.

RESULTS

No subject experienced any side-effects following the 5 g. dose of xylose although one normal subject had some diarrhoea after the 25 g. test.

NORMAL VALUES FOR 5 g. TEST The five-hour urinary volumes in the 50 normal subjects ranged widely from 90 to 890 ml. with a mean of 360 ml. The distribution was skewed with a preponderance of volumes below the mean. Despite this, the corresponding five-hour xylose excretions showed a normal distribution, with a mean of 1.75 g. per five hours, and a standard deviation of 0.43.

Blood xylose levels were estimated at one hour in 14, and at two hours in 48 of the normal subjects. These are illustrated in Figure 1. The mean blood level at one hour was 11.6 mg. per 100 ml., with a range from 4.2 to 15.8 and a standard deviation of 3.8. The two-hour blood levels were generally lower, the mean of 48 observations being 9.4 mg. per 100 ml., with a range from 0.6 to 15.0 and a standard deviation of 2.8. The one-hour blood xylose level was greater than the two-hour level in 11 of 12 subjects in whom both were estimated.

COMPARISON OF 5 g. AND 25 g. TESTS Both 5 and 25 g. tests were performed on 22 subjects, 14 without and eight with intestinal disease. The results are shown in Fig. 2, in which the five-hour urinary xylose excretions of the two tests in each subject have been plotted against each other. There is a highly significant relation between them ($P < 0.001$), although this is not linear.

FIG. 1. Blood xylose levels at one and two hours following an oral dose of 5 g. d-xylose. The closed circles indicate mean values.

FIG. 2. Relation between five-hour urinary xylose excretions after oral doses of 5 and 25 g. d-xylose. Interrupted lines indicate the lower level of normal in each test.

It is noteworthy that the 25 g. test was the more sensitive indicator of intestinal dysfunction. The results with this test showed impaired absorption in eight of the 22 subjects (below 3.8 g. per five-hour urine). By comparison, the 5 g. test gave low results (below 0.9 g. per five-hour urine) in only two of the same 22 subjects. The 25 g. test also showed defective absorption in both of these.

DISCUSSION

The normal value for the five-hour urinary xylose following a 5 g. dose found in the present subjects agrees well with that of Santini *et al.* (1961), the respective values being 1.75 ± 0.43 and 1.8 ± 0.3 g. However, the scatter of results was greater in our experiments, giving a 'normal' range from 0.9 to 2.6 g. compared with Santini's range from 1.2 to 2.4 g. This agreement does not extend to the comparison of the 5 and 25 g. tests. The two sets of results were highly significantly related in the present series, while analysis of the data of Santini and his colleagues (1961, Table II) shows no significant relation between them. The discrepancy may be due to the fact that Santini *et al.* reported comparative results only from patients with untreated tropical sprue and advanced alimentary failure.

Comparing the 5 and 25 g. tests, it is apparent that in the former xylose absorption is both more rapid and relatively more complete. The peak blood level with the 5 g. tests is most often at one hour (Fig. 1), rather than at two hours as with the 25 g. test. Taking mean values, the proportion of xylose appearing in the five-hour urine with the 5 g. test is $1.75/5.0 \times 100 = 35\%$. The corresponding figure for the 25 g. test is $6.6/25 \times 100 = 26.4\%$. This difference occurs although there is no significant difference in urine volumes between the two tests.

The results of this study do not suggest that the 5 g. test will replace the 25 g. xylose test in routine clinical practice. Although it is cheaper and less frequently the cause of side-effects, it is not sufficiently sensitive to detect minor degrees of malabsorption which are clearly shown by the 25 g. test. In advanced alimentary insufficiency, such as tropical sprue, the 5 g. test may be of value, as was found by Santini *et al.* (1961), but this is relatively rare in temperate climates where minor degrees of impairment of intestinal absorption are not uncommon. In these circumstances the increased sensitivity of the 25 g. tests outweighs the disadvantages of expense and occasional side-effects.

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