D- Xylose Absorption Test

- Objectives

a) To test the function of the upper small intestine.

b) To learn the technique of D-xylose estimation

- Introduction:

➢ The small intestine can be studied in **two parts** ,<u>the upper small intestine and the lower small intestine</u>.

➢ **Vitamin B12 absorption** is the best test for <u>the lower small bowl</u>, while **D- xylose absorption test** is considered the best test for <u>the upper small intestinal function</u>.

Small intestine
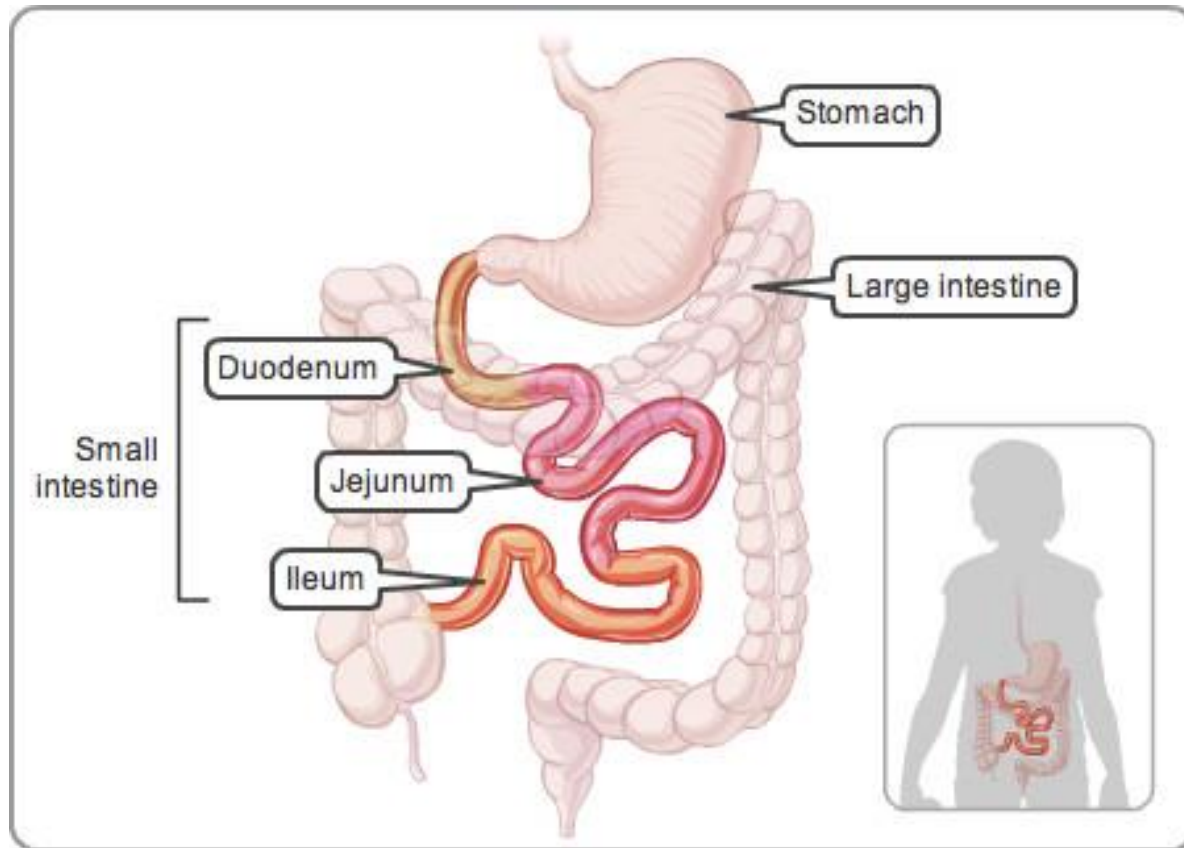
➢ **Impaired absorption of D- xylose** occurs <u>in conditions where there is flattening of the intestinal villi</u> and this results in abnormally low urinary excretion of the test does of D-xylose.

➢ **In adults ,** the standard oral dose is **25 g** after which *<u>the urinary output during the next five hours is 5.8 g</u>* (about **25%** of the dose) **in normal subjects.**

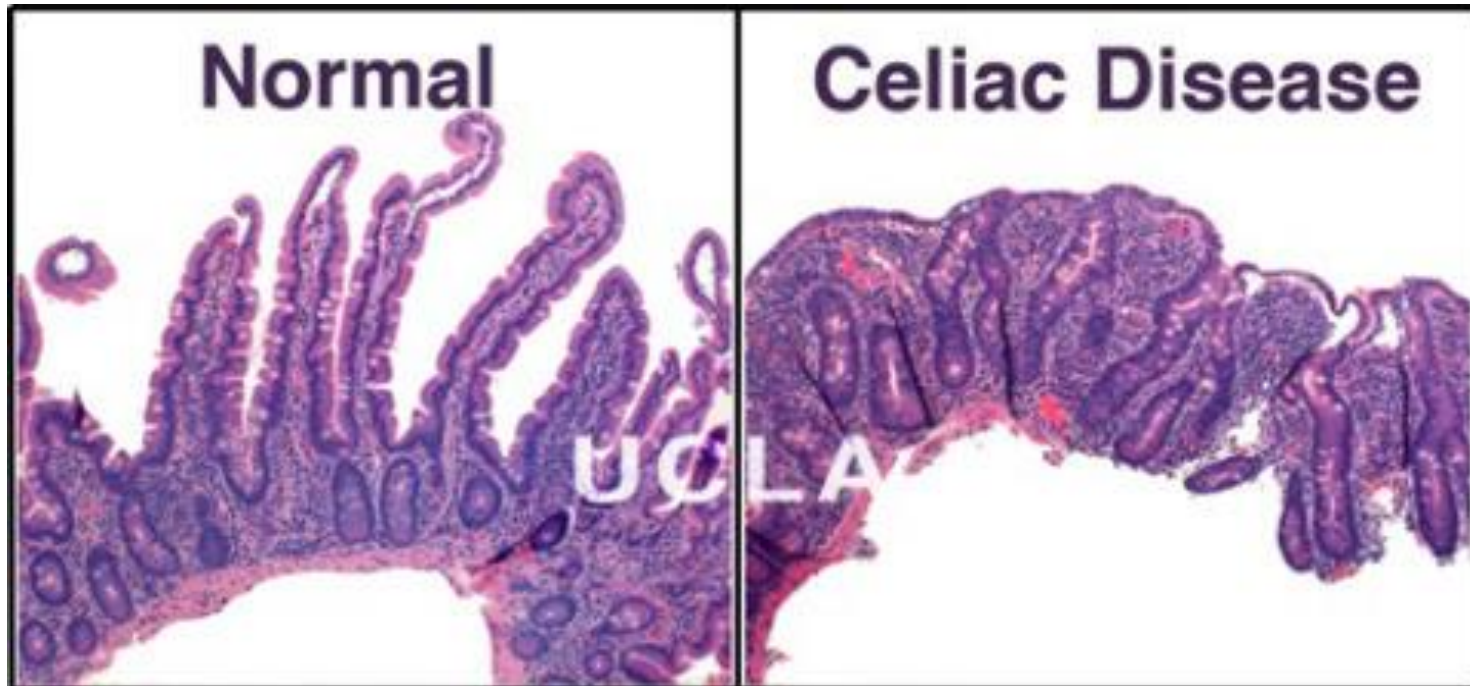➢ **In children,** a **5g dose of D- xylose**, and the normal output in the urine is 25 % of the dose.

➢ **Using the 25g dose** , 5 hours excretion of less than 2.5g occurs in patients with:

 1- Gluten sensitive enteropathy (coeliac or celiac disease).

2- **Non-gluten sensitive enteropathies (idiopathic steatorrhea)**

3- **Tropical sprue .**

Intestinal villi

Tropical sprue

- Tropical sprue is a disorder of unknown cause (infection..) affecting people living in tropical areas who develop abnormalities of the small intestine structure (destruction of the villi), leading to malabsorption and deficiencies of many nutrients.

➢ The test is a **<u>diagnostic value</u>** since **in children** the test is most useful <u>in the differential diagnosis</u> of **coeliac disease and cystic fibrosis.**

➢ Treatment of coeliac disease with **a gluten free diet improves D-xylose absorption** <u>but it remains low normal</u>.

➢ <u>In case of impaired</u> **<u>renal function</u>** the D-xylose level in a 5- hours urine sample **is low** ,which can lead to **false diagnosis of coeliac disease.**

- What happens to the D-xylose?

- When D- xylose is given orally most of D-xylose will be absorbed in the small intestine (duodenum and jejunum).

- The rest will be subsequently excreted by **the kidneys.**

- The amount of D-xylose detected in urine or blood in a specified time interval after administration of a measured dose of D-xylose, is used to evaluate Intestinal Absorption Ability.

- **Low Absorption of D-Xylose** is observed in <u>Intestinal Mal absorption</u>.

- When there is a problem in the small intestine that prevent absorption, D-xylose (<u>ingested orally</u>) is not absorbed by the intestine, and **its level in blood and urine will be low.**

- Principle

❖ **D- xylose is a pentose** which produces a **brown color** with <u>o-toluidine</u> in the presence of <u>acetic acid and heat.</u>

❖ <u>A brown complex will be formed with</u> a maximum absorption at 475 nm which is used for the **estimation of xylose.**

- METHOD:

➤ The patient/volunteer should keep **an over night fast**, in the morning empties the bladder and discards the urine.

➤ **Before breaking the fast, 25g of D-xylose in 250ml water is taken by mouth.**

➤ The patient /volunteer should then drink water at one and two hours after drinking the D-xylose solution .

➤ All urine passed during the next five hours is collected .

➤ **Normal value:** 5.8-10 gm

➤ **Abnormal value:** less than 2.5 gm

- Estimation of D-xylose in urine:

	Urine	Standard	dH2O	O-toluidine reagent
Sample (A)Test (1)	0.1	-	-	7 ml
Sample (A)Test (2)	0.1	-	-	7 ml
Sample (B) Test (3)	0.1	-	-	7 ml
Sample (B) Test (4)	0.1	-	-	7 ml
Standard (1)	-	0.1	-	7 ml
Standard (2)	-	0.1	-	7 ml
Blank	-	-	0.1	7 ml

Mix the contents of each tube

Boiling water bath for 5 minutes

cool the tubes for 1-3 min

Read absorbance at 475 nm

- Result:

Tubes	Absorbance at 475
Test (1)	
Test (2)	
Test (3)	
Test (4)	
Standard (1)	
Standard (2)	

- Calculations:

- Conc. Of Std.= 0.01 g/ml   **Dilution factor=** 10

- Total volume sample 1= 5 ml

- Total volume sample 2= 5 ml

- Conc. Of urine D-xylose (Sample 1)= $\dfrac{\text{Mean abs of test 1}}{\text{Mean abs of std.}} \times 0.01 = $ g/ml

- Conc. Of urine D-xylose (Sample 2)= $\dfrac{\text{Mean abs of test 2}}{\text{Mean abs of std.}} \times 0.01 = $ g/ml

- Example:

- **Abs. sample 1=** 0.843   **Abs. std.=** 0.558
- **Abs. sample 2=** 0.234   Dilution factor= 10

- **Conc. Of urine D-xylose (Sample 1)=** $\underline{0.843}$ x 0.01 x 10 = 0.151 g/0.1 ml
    0.558

- **Conc. Of urine D-xylose (Sample 1)=** 0.151 g $\longrightarrow$ 0.1 ml

    ? $\longrightarrow$ 1 ml

    = 1.51 g/ml

    1.51 g $\longrightarrow$ 1 ml

    ? $\longrightarrow$ 5 ml

- **Conc. Of urine D-xylose (Sample 1)= 7.6 gm/5 ml**   **Normal**

- **Conc. Of urine D-xylose (Sample 2)=** $\underline{0.235}$ x 0.01 x 10 = **0.04** g/0.1 ml
$$0.558$$

- **Conc. Of urine D-xylose (Sample 2)=** 0.04 g $\longrightarrow$ 0.1 ml

   ? $\longrightarrow$ 1 ml

   = **0.42g/ml**

   0.42 g $\longrightarrow$ 1 ml

   ? $\longrightarrow$ 5 ml

- **Conc. Of urine D-xylose (Sample 2)= 2.1 gm/5ml**   **Abnormal**

Thank you