Q5 Outline the process of digestion and absorption of dietary carbohydrate. (March 2011)

Digestion is the process in which macromolecules are broken down into smaller molecules for absorption.

Dietary CHO are usually ingested in the form of large polysaccharides or disaccharides (mainly sucrose, or cane sugar, and lactose) and starch (amylopectin), which must be broken down into their component monosaccharides for absorption.

Digestion of amylopectin starts at the mouth with salivary α-amylase (ptyalin), which performs 20-40% of starch breakdown. Salivary amylase continues to act within the food bolus in the stomach until gastric acid penetrates the bolus and inactivates it at a pH of 4. Pancreatic α-amylase starts to act on intestinal chyme as it enters the duodenum, and perofms the remaining 60-80% of starch breakdown. The end result of this is the production of oligosaccharides – maltose, maltotriose, α limit dextrins, and various other small glucose polymers. These, along with lactose and sucrose, are broken down further by brush border enzymes:

- Sucrase – cleaves sucrose into one glucose and one fructose molecule
- Lactase – cleaves lactose into one glucose and one galactose molecule
- Maltase – cleaves one molecule of maltose into two molecules of glucose
- Isomaltase – cleaves isomaltose into glucose
- α limit dextrinase – cleaves α1 limit dextrins into glucose

Finally, three water-soluble monosaccharides are produced (glucose, galactose and fructose) which can be absorbed primarily in the small intestine. Glucose is the most prevalent at more than 80%; fructose and galactose rarely represent more than 10% each.

- Glucose is absorbed with sodium (SGLUT-1) via a secondary active transport mechanism
- Galactose competes with glucose for the same symporter at the apical membrane
- Fructose is absorbed across the membrane via a GLUT5 transporter (facilitated diffusion)
- Glucose and fructose both use GLUT2 to cross the basolateral membrane and enter the bloodstream