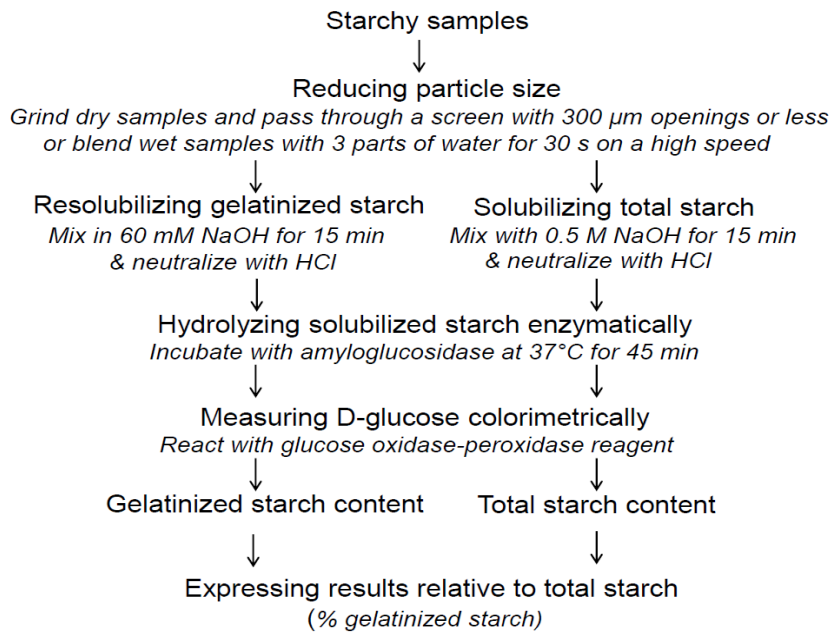
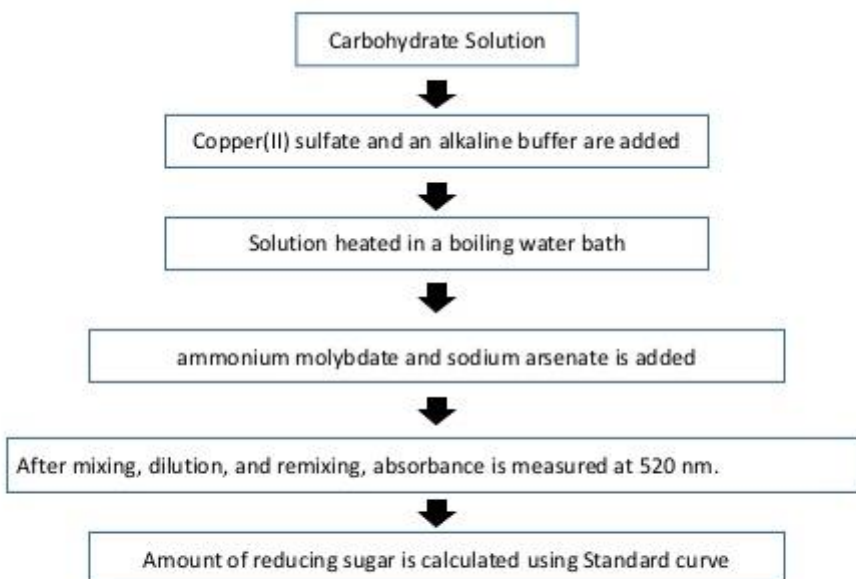


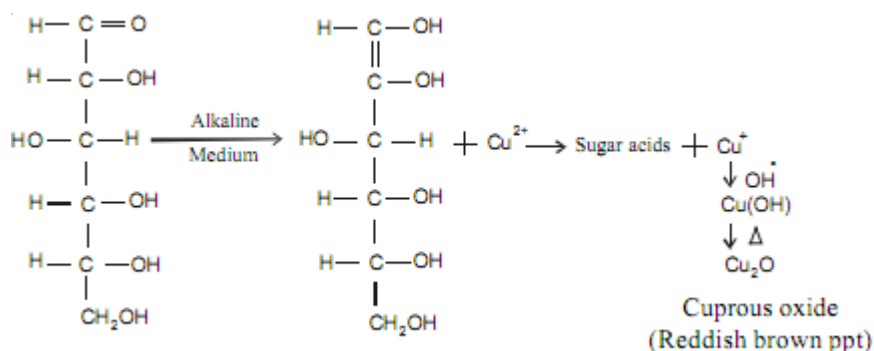
• *Method for measuring the degree of starch gelatinization*



• *Estimation of reducing sugar by Nelson-Somogyi method*

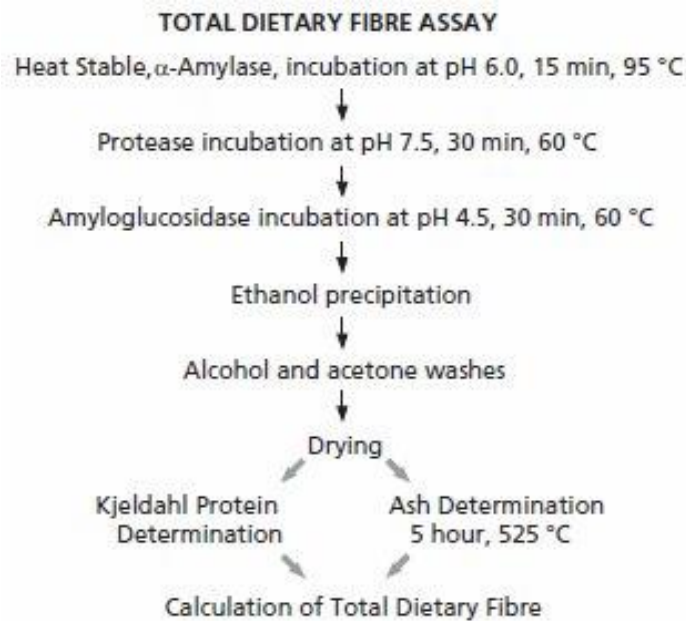


Somogyi-Nelson Method Flow chart

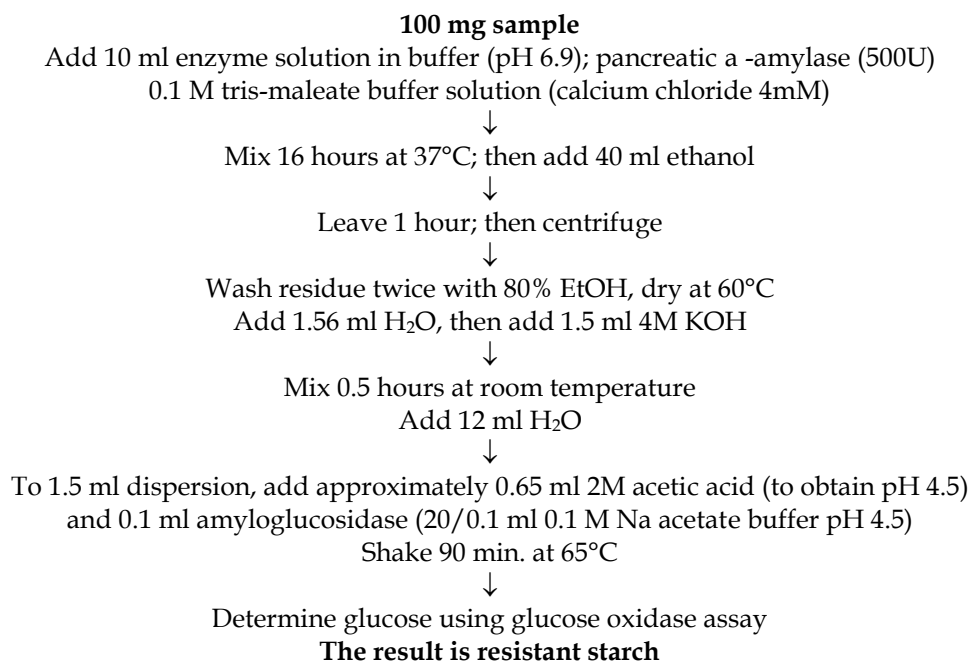


- *Total dietary fibre assay*

- The total dietary fibre content is determined by a combination of enzymatic and gravimetric methods.
- Samples of dried, fat-free foods are gelatinised with heat-stable amylase and then enzymatically digested with protease and amyloglucosidase to remove protein and starch in the sample.
- Ethanol is added to precipitate the soluble dietary fibre.
- The residue is then filtered and washed with ethanol and acetone.
- After drying, the residue is weighed.
- Half of the sample is analysed for protein and the other half is ashed.
- Total dietary fibre equals weight of residue minus weight of protein and ash.



- *Method for the determination of resistant starch*



Dietary fibre, Crude fibre and application of food carbohydrates

Dietary fiber

- Dietary fiber (British spelling fibre) or roughage is the portion of plant-derived food that cannot be completely broken down by human digestive enzymes.
- Dietary fibers are diverse in chemical composition, and can be grouped generally by their solubility, viscosity, and fermentability, which affect how fibers are processed in the body.
- **Dietary fiber has two main components:** Soluble fiber and insoluble fiber, which are components of plant foods, such as legumes, whole grains and cereals, vegetables, fruits, and nuts or seeds.
- All types of soluble fibers slow digestion, so it takes longer for our body to absorb sugar (glucose) from the foods you eat. This helps prevent quick spikes in our blood sugar levels -- an important part of managing diabetes. Soluble fibers also bind with fatty acids, flushing them out of the body and helping to lower LDL (bad) cholesterol.
- Insoluble fibers help hydrate and move waste through your intestines. That's one thing it does that helps prevent constipation and keeps regular.
- **Benefits of a Dietary Fiber:** *Normalize the bowel movement, Promote bowel health, Lower the cholesterol level [reduce Low-Density Lipoprotein (LDL) in total cholesterol], Control blood sugar level [Soluble fiber reduces the absorption of sugar and keeps the blood sugar level normal. Insoluble fiber also helps to reduce type II diabetes], Support to maintain healthy weight [Dietary fiber provides less energy dense by facilitating few calories from the same volume of foods]*

Crude Fiber

- Crude fiber is a part of insoluble fiber found in the edible portion of the plant cell wall. It is basically cellulose material obtained as a residue of the chemical analysis of vegetable substances.
- The main health benefit of crude fiber is that it facilitates regular bowel movement. Leafy greens, whole grains, and beans (black beans) are some common examples of crude fiber.

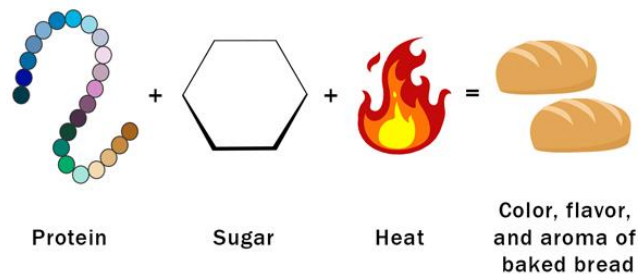
The difference between Dietary Fiber and Crude Fiber

	<i>Dietary Fiber</i>	<i>Crude Fibers</i>
Origin	Dietary fiber is the sum of both soluble and non-soluble fiber groups.	Crude fiber is a part of insoluble fiber found in the edible portion of the plant cell wall.
Solubility	Dietary fiber is either soluble or non-soluble in water	Crude fiber is not soluble in water.
Fermentation	Some dietary fibers are subjected to fermentation inside the digestive system.	Crude fibers are not fermented inside the digestive tract.
Nature Inside The Digestive Tract	Dietary fiber might be relatively intact when it passes through the digestive tract, but this is based on the type of dietary fiber.	Crude fiber is relative intact through a period of passage.
Composition	Dietary fiber contains pectins, gums, and mucilages.	Crude fibers do not contain pectins, gums, and mucilages.

Types of Fiber	Soluble or Insoluble	Sources	Health Benefits
Cellulose, some hemicellulose	Insoluble	Naturally found in nuts, whole wheat, whole grains, bran, seeds, edible brown rice, skins of produce.	"Nature's laxative": Reduces constipation , lowers risk of diverticulitis , can help with weight loss.
Inulin oligofructose	Soluble	Extracted from onions and byproducts of sugar production from beets or chicory root. Added to processed foods to boost fiber.	May increase "good" bacteria in the gut and enhance immune function.
Lignin	Insoluble	Found naturally in flax, rye, some vegetables.	Good for heart health and possibly immune function. Use caution if you have celiac disease or are gluten intolerant.
Mucilage, beta-glucans	Soluble	Naturally found in oats, oat bran, beans, peas, barley, flaxseed, berries, soybeans, bananas, oranges, apples, carrots.	Helps lower bad LDL cholesterol, reduces risk of coronary heart disease and Type II diabetes . Use caution if you have celiac disease or are gluten intolerant.
Pectin and gums	Soluble (some pectins can be insoluble)	Naturally found in fruits, berries, and seeds. Also extracted from citrus peel and other plants boost fiber in processed foods.	Slows the passage of food through the intestinal GI tract, helps lower blood cholesterol.
Polydextrose polyols	Soluble	Added to processed foods as a bulking agent and sugar substitute. Made from dextrose, sorbitol, and citric acid.	Adds bulk to stools, helps prevent constipation. May cause bloating or gas.
Psyllium	Soluble	Extracted from rashed seeds or husks of <i>Plantago ovata</i> plant. Used in supplements, fiber drinks, and added to foods.	Helps lower cholesterol and prevent constipation.
Resistant starch	Soluble	Starch in plant cell walls naturally found in unripened bananas, oatmeal, and legumes. Also extracted and added to processed foods to boost fiber.	May help manage weight by increasing fullness; helps control blood sugars. It increases insulin sensitivity and may reduce the risk of diabetes.
Wheat dextrin	Soluble	Extracted from wheat starch, and widely used to add fiber in processed foods.	Helps lower cholesterol (LDL and total cholesterol) and may lower blood sugar and reduce risk for heart disease; more research is needed. Avoid if you have celiac disease or are gluten intolerant.

Changes in food carbohydrates during processing

- Carbohydrates can be said to be relatively stable to processing and storage compared to sensitive nutrients such as vitamins.
- There is no significant loss in the nutritional value of carbohydrates in frozen, canned or dried foods.
- Infact, some carbohydrates are made more digestible through processing and thus nutritionally available and complex carbohydrates are converted to simple sugars.
- Adverse brown pigments occur in frozen and dried foods when carbohydrates react with proteins.
- During wet heat treatment as in blanching and boiling; there is considerable loss of low molecular weight carbohydrates as well as micro nutrients into the processing water. The loss of glucose and fructose at boiling is higher than that of sucrose. The loss of low molecular weight carbohydrates also may vary between species and cultivars.
- **Maillard reactions:** Non enzymatic browning reactions occur between reducing sugars and amino groups in foods during processing and storage. These reactions are temperature dependent and most extensive at intermediate water activities. They are important nutritionally as they may diminish the bio availability of amino acids especially lysine and thus diminishing the protein nutritional value. The carbohydrate content and availability are influenced only marginally.



Maillard reaction (MR), also known as glycation

- **Starch - heat-induced effects:** When starch is heated in the presence of water, the starch granules ruptures and form gels. The **gelatinization** increases the availability of starch for digestion by amylolytic enzymes. Gelatinized starch is not in thermodynamic equilibrium, therefore a progressive re-association of the starch molecules upon ageing. This recrystallization is referred to as **retrogradation** and may reduce the digestibility of the starch.
- **Par-boiling:** During par-boiling of rice, the kernels are subjected to a pre-treatment involving heating and drying. This process reduces the stickiness of the rice, possibly by allowing leached amylose to retrograde and/or form inclusion complexes with polar lipids on the kernel surface. Parboiling also affects the final cooking properties of the rice.
- **Starch-texturization:** Chemicals are used in foods to carry out specialized functions. As foods are processed for alteration in selected products, additives are usually used. The demand for starch-based texturizing agents is increasing day by day. Among all the additives, starch-based texturizing agents are used in a large quantity. Starch-based texturizing agents are meant to add or modify the whole texture of the food products. The primary starch-based texturizing agents are emulsifiers, stabilizers, phosphates, dough conditioners, etc., each one has its own unique functions. Apart from improving the texture of the foods, some of the other applications of starch-based texturizing agents are dispersion of oil and flavours of the foods, prevent evaporation of volatile flavour oil, and enhance the water-holding capacity of the food components.
- **Milling and peeling:** During milling of cereal grains to refined flours the outer fibre-rich layers are removed, resulting in a lower content of total dietary fibre.
- **Heat-treatment:** Processes involving heat-treatment may affect the dietary fibre in different ways. An increased temperature leads to a breakage of weak bonds between polysaccharide chains. Also, glycosidic linkages in the dietary fibre polysaccharides may be broken. These changes are important from analytical, functional, and nutritional points of view.