Effect of cooking on nutrients

Cooking brings a lot many changes on nutrients, colour, texture and flavor of the food products. The various effects of cooking on the nutrients are discussed below-

Changes in proteins

The principal effect of heat on protein is denaturation. This results in the destruction of micro-organisms and inactivation of microbial and natural enzymes within the food. Cooking also destroys the toxic proteins and peptides, enzyme inhibitors, antivitamins and other natural toxicants in food, which can seriously affect their nutritive value. Legumes contain Trypsin inhibitors, Haemagglutinins and other toxic substances which affect the digestibility and availability of sulphur containing amino acids. They are destroyed by heat. Cereal grains also contain Trypsin inhibitors and some other natural toxicants. Heat destroys these anti metabolites in rice, wheat and oats but has little effect in other cereals.

Cooking can also result in the interaction of protein with non – protein components of the food system; there can be interaction of protein with carbohydrate or lipid peroxidation products. There can also be inter-protein and intra-protein reactions in the presence or absence of oxygen. These changes in cooking result in nutritional unavailability of proteins.

There is significant loss of Lysine and sulphur containing amino acid- Cysteine after heating proteins. On prolonged heating, Tryptophan, Methionine and the basic amino acids are also lost. Charring and the presence of off odours during cooking is due to destruction of amino acids and proteins. These changes affect the palatability of the final product.

Interaction between the free amino groups of proteins with reducing sugars or carbonyl groups formed by lipid peroxidation results in non- enzymatic browning (Maillard Browning).This reaction is of importance because it is responsible for many of the specific tastes, aromas and colours of food. e.g. Browning of biscuits etc.

Egg proteins coagulate on heating. Milk proteins coagulate on addition of acids. Severe heating processes such as roasting, baking and frying have been reported to affect adversely the nutritive value of certain cereals, oilseeds and animal foods.

Changes in Carbohydrates

Monosaccharides, oligosaccharides and polysaccharides undergo many transformations when cooked in an aqueous medium. The sugars are subjected to degradation and epimerization and, over 100 compounds are formed by such transformations. These compounds have no adverse effects. Sugar when cooked in water, syrups of various strengths can be formed and also the different balls (soft, hard and brittle) stage can be reached in sugar cookery.

Starch molecules which are the main source of calories in many diets when heated in an aqueous or moist environment, swell, rupture and burst and starch gets gelatinized and this permits greater enzymatic digestion by enzymes like Amylases. Cooking thus increases the digestibility of carbohydrates. Starch when subjected to dry heat at a temp. of 200 degree centigrade or higher, breaks down resulting in the formation of brown coloured intermediate compound called dextrin and the process is called Dextrinization. e.g. Toasting of bread.

Changes in lipids (Fats)

Lipids, when heated, undergo hydrolytic, oxidative, polymeric and other degradative changes which modify not only the physical properties of the lipids but also their biological properties. When heated, the hydrolytic and oxidative changes result in rancidity. Hydrolytic rancidity is catalyzed in food at high temp. in an aqueous medium in the presence of acids, alkalies and lipolytic enzymes(lipases). Hydrolytic rancidity by itself does not bring about any significant change In the nutritive value of the food. However, the objectionable flavour imparted by free fatty acids lowers the consumption of food.

Oxidative rancidity is responsible for more losses in the quality and nutritive value of lipids than any other change. This rancidity results in the formation of hydroperoxides as primary products. The products of oxidation e.g. ketones and aldehydes exhibit strong unpleasant flavours even when present in extremely low amounts.

In addition to the effect on the biological properties of lipids, thermal effects bring about physical and chemical changes also. In sautéing and shallow frying, the quantity of oil used is small, cooking time is also short and there is generally no reuse of fat and thus there is little concern over the nutritional effects of lipids absorbed from such cooking. In contrast, there is great deal of concern over deep fried foods. If the deep frying is continuous, oxidative changes are small because the fat absorbed by food is constantly replaced. In discontinuous deep frying, there is liberation of fatty acids due to addition of water to the oil from the food, decreased unsaturation and increase in peroxides, conjugated double bonds and polymers. Such fats absorbed by foods could be toxic when consumed. Temperature of the frying process should be controlled so that the smoke point of the fat is not reached, since it causes its decomposition. Fat should not be heated above 200 centigrade as it causes fat to hydrolyse and form acrolein compounds which have an unpleasant acrid flavour. Fat used for deep frying should not be used repeatedly since prolonged use of fat causes polymerization and inter-esterification of the fat resulting in the formation of certain compounds which irritate the GIT and these compounds are suspected to be potential carcinogens.

Changes in vitamins and minerals

Vitamins and minerals are lost primarily by leaching, oxidation of water soluble nutrients and thermal destruction.

<u>Changes in vitamins</u>

The loss of water soluble vitamins ranges from 0-60% as a result of leaching (drain away) , thermal destruction and oxidation. Frying and roasting can cause the loss of fat soluble vitamins ranging from 40-60 %

Vitamin A and Carotene do not leach out in water because these are insoluble in water. There is slight destruction of these vitamins during cooking in water due to oxidation by air.

Thiamine (Vit. B_1)

Loss of vit. B_1 during cooking can occur in the following ways:

- Its destruction by heat during cooking
- Its leaching out in cooking water

- If cooking soda is used, most of this vit. Is lost.

Riboflavin is lost in following different ways:

- Exposure of food to strong light during cooking
- Due to heat
- Due to solubility in water
- Due to soda

Niacin is lost in cooking water

Pyridoxine is lost by leaching out in cooking water

Ascorbic Acid (Vitamin C) is lost in two ways:

- By oxidation due to exposure to air during cooking
- By leaching out in excess cooking water

Minerals

Minerals are also lost on account of leaching and their losses are smaller i.e. 0-35 %

Caicium and Phosphorus are lost in excess of cooking water.

Iron is lost in excess cooking water. Iron content of the foods can be increased. When vegetables are cut with iron knives or cooked in iron pans, an appreciable amount of iron is incorporated in the foods.

Sodium, Potassium and Magnesium loss occurs by leaching out in water. NaCl is added to foods as salt which increases the Sodium content of the cooked food.