II. Frequently asked questions:

1. Why preservation of vegetables is economically significant?

Ans: India is the world's second largest producer of fruits and vegetables. However,every year fresh produce worth INR 133 billion gets wasted. This accounts for 18 percent of total production. On the other hand large population of India is suffering from various nutritional deficiencies, which can be tackled effectively with the consumption of vegetables and fruits. Thus, the preservation of these vegetables are not only the need of the hour but also economically very significant.

2. How green leafy vegetable can contribute to overcome iron deficiency among Indian population?

Ans: Green leafy vegetables are photosynthetic organs of plant and supply carbohydrates to other parts of the plant. They contain low amount of carbohydrates but are good source of β-carotene, calcium, riboflavin, folic acid, ascorbic acid, iron & vitamin K. They play an important role in the diet and health of a consumer.

They are rich in carotenes which get converted to vitamin . Green leafy vegetables are also rich in iron, for example spinach and red amaranthus, agathi, colocasia leaves, drumstick leaves and fenugreek leaves contribute significantly for calcium in our diet. Large population of India is with anaemia or iron deficiency, which can easily be tackled by consumption of locally available green leafy vegetables.

3. Mention briefly the antioxidant property of vegetables?

Ans: Carotenoids present in carrots, oranges and spinach prevent oxidation of vitamin A and E. Limonoids present in citrus peel act as antioxidants protecting lung tissues from free oxygen radicals. Phenolic compounds present in berries, grapes and brinjals protect against oxidative damage of tissues and inflammation.

4.How vegetables are classified as per ICMR balanced food protocol?

Ans: Vegetables are classified under three groups as per ICMR as

a) Green leafy vegetables are good source of β-carotene, calcium, riboflavin, folic acid, ascorbic acid, iron & vitamin K.

b) Roots and tuber vegetables: Roots and tubers give more calories than leafy vegetables. Carrots contain high amount of carotene but still lesser than green leafy vegetables. Roots and tubers are fairly good sources of vitamin C.

c) Other vegetables: These are highly perishable but fairly good source of vitamin C.. Bright colors of many vegetables is due to variety of pigments. Further, these are rich in organic acids such as formic, citric, malic, succinic, tartaric, fumaric and benzoic acid etc.

5 Write a brief note on nutritional changes during dehydration of vegetables?

Ans: Drying alters the texture of the food, typically concentrating which, in turn modifies the taste. Dried food being safe to store, hardly requires any special storage condition. Dehydration reduces the moisture content of vegetables below the required level, limiting growth of microorganisms, but changes the flavour , aroma and appearance. During concentration proteins, carbohydrates and minerals undergo chemical changes. Fats are oxidatively degraded with reduced odour and flavour. Maillard reaction results in darker colour. Vitamins and original volatile flavour and aroma compounds are also reduced.

6 Why storage of vegetables is important? Write changes during storage of vegetables?

Ans: Vegetables can be stored depending on their type. Root and tuber vegetables such as potatoes, onions and turnips can be stored for few days, while beans, peas, cauliflower, cucumber, tomatoes and asparagus can be stored only for a few days. Storage of vegetables brings compositional changes. Storage temperatures for vegetables depend on their processing. Low respiring vegetables have a long shelf life in contrast to the short life of high respiring forms. Storage of vegetables at 1 to 4°C with humidity of 80 – 95% Rh is the most appropriate method.

Changes during storage of vegetables:

During storage :Weight loss ranges from 2-10%, ascorbic acid and carotene content decreases, degradation of starch and pectin occurs on storage. In some vegetables, such as cauliflower, lettuce and spinach, the free acid content increases during freezing or frozen state of storage.

7.What are the principle for dehydration of vegetable. Give examples of dehydration vegetables?

Ans: This method of food preservation has been known since ancient times. Principle of drying is based on management of water activity, lesser the water activity more the shelf life of the food product. Dehydration reduces the water content of the food products leading to reduction in water activity, hence extending shelf life.

India is also the leader in products like dehydrated mushrooms, truffles, green pepper in brine, asparagus dried, dehydrated garlic powder, dehydrated garlic flakes, dried potatoes etc.

8. Write the difference between waxing and modified atmosphere packaging?

Ans: The wax emulsion is based on partial coverage of surface cells of vegetable there by reducing respiration rates. This helps in the extension of storage life. Wax coating prevents moisture loss, maintains the appearance, decreases rate of decay and sprouting.

Modified atmosphere packaging (MAP): MAP is the method for extending the shelf life of perishable and semi-perishable food products by altering the relative proportion of atmospheric gases that surround the food. The storage life of different vegetables in MAP varies.

9. List methods for preservation of vegetables?

Ans:

- Dehydration of vegetables
- Fermentation of vegetables
- Pickling of vegetables
- Canning of vegetables
- Vegetable concentrates, juice and powder and puree
- Refrigeration and Freezing
- Irradiation

10.What are the prerequisite for dehydration of vegetables?

Ans: Vegetables are washed, peeled, cleaned and may be sliced or diced prior to dehydration. Blanching for 2-7 minutes using hot water or steam and SO2 inactivates the native enzymes. Vegetables are then dehydrated in a conveyor tube drier at 55-60°C till it reaches final moisture content of 4-8%. Dehydration is done either by freeze drying or sun drying. Freeze drying yields high quality products like peas and cauliflower for the production of soup powder.

11.How fermentation preserve the vegetables?

Ans: Internationally the most popular fermented vegetable is sauerkraut prepared from cabbage. Most of the fermented products are lactic fermentation. Spontaneous lactic acid fermentation of vegetables such as cabbage, cucumber and beans yield good quality fermented vegetables. Fermentation lowers the pH, inhibits the growth of spoilage microorganisms. Further it aids in enzymatic softening of cells and tissues, thus improving the digestibility and wholesomeness of the vegetables. Salt is added as a preservative and to facilitate fermentation. *Leuconostoc mesenteroides* dominates, producing a mix of acids, alcohol, and aroma compounds. At higher temperatures *Lactobacillus plantarum* dominates, which produces primarily lactic acid.

12.What are the methods of canning for vegetables?

Ans: Canning is an important, safe method for preserving food if practiced properly. Canning involves cooking food, sealing it in sterile cans or jars, and boiling the containers to kill or weaken any remaining bacteria as a form of sterilization. Canned goods can be stored on shelves for years. There are two methods, i.e pressure canning method and other is simple canning method.

13.What are the problem associated with canning?

Ans: Food preserved by canning or bottling is at immediate risk of spoilage once the can or bottle has been opened. Lack of quality control in the canning process may allow invasion of water or micro-organisms. Canned food can be a major source of dietary salt (sodium chloride). Too much salt increases the risk of health problems, including high blood pressure.

13. How vegetable powders are prepared and what are the end use vegetable prodders?

Ans: Vegetable powders are produced by spray drying, vacuum drum drying or freeze drying the vegetable juice with or without the addition of a drying enhancer such as starch to a residual moisture content of 3%. Tomato powder is the most important product. Spinach and red beet powder are used for food colouring.

14. What is the advantage of refrigeration as preservation method? How it is different from freezing?

Ans: Freezing fruit and vegetables soon after they are picked serves to 'lock in' the flavour and freshness of the produce. Freezing and then thawing a vegetable or fruit is the preservation method wherein end product resembles the taste of fresh food. It is recommended that vegetables are blanched before freezing them. This limits the activity of enzymes, thus, preventing spoilage during storage. For effective long term storage temperature, below freezing point is recommended. Deep freezing is advised for longer duration storage. Freezing fruits and vegetables actually consists of freezing the water contained in the plant cells. When the water freezes, it expands and the ice crystals cause the cell walls to rupture. Refrigeration and freezing are probably the most popular forms of food preservation in use today.

In the case of refrigeration bacterial action slows down. Thus, requires longer time to spoil. In the case of freezing, bacterial action is almost stopped or arrested. Frozen bacteria are completely inactive. Refrigeration is done for short duration storage. Chemical changes during freezing and refrigeration can lead to the development of rancid oxidative flavors. This problem can be controlled by using a wrapping material which prevents air to pass into the product.

15.What is irradiation or cold sterilization as method for vegetable preservation?

Ans: One of the important methods for the preservation of onions, potatoes, garlic and carrots throughout the world is Irradiation. The advantages of this method is limiting sprouting and rotting without changing chemical and nutrient composition. It can be can be used to treat produce in large quantity. Low quantities of isotopes are used in this method so, there is a perception that it carries radioactive material which experiments throughout the world has shown, is not true.