

Frying: Types and Effects

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Abstract:

Frying is referred as a process of cooking and drying through contact with hot oil. It is intended to make food more palatable and tasteful, but at the same time makes food safer and provides a preservative effect that results from thermal destruction of microorganisms and enzymes, and a reduction in water activity at the surface or throughout the food. The shelf life of fried products is mostly determined by the moisture content after frying. Products that retain a moist interior should be consumed shortly after preparation, can be stored for a relatively short time under chilling conditions or for a longer time under freezing conditions. Most of these foods-with the exception of par-fried goods-are not produced on a commercial scale for distribution to retail stores but are important in catering applications. Foods that are dried throughout during frying have a shelf life up to several months, which is mostly limited by quality deterioration of the absorbed oil and development of a rancid odour and flavour. Storage stability of these products may be increased by using packaging materials with adequate barrier properties.

Introduction:

Frying is a cooking technique whereby heat is transferred to a food item from the hot oil that surrounds it. People have been frying food in oil for centuries, not least because frying oil transfers heat much faster than air in baking or water in boiling. Frying is done in hot oils or fats, usually done with a shallow oil bath in a pan over a fire or so-called deep fat frying, in which the food is immersed in a deeper vessel of hot oil. Frying is believed to have first appeared in the Ancient Egyptian kitchen, during the old kingdom, around 2500 BC.

Frying Theory:

- When food is placed in hot oil, the surface temperature rises rapidly and water is vaporised as steam.

- The plane of evaporation moves inside the food, crust is formed.
- The surface temperature of the food then rises to that of hot oil, and the internal temperature rises more slowly towards 100 degrees Celsius. The rate of heat transfer is controlled by the temperature difference between the oil and the food by the surface heat transfer coefficient.
- The surface crust has a porous structure, consisting of different-sized capillaries.
- During frying, both water and water vapour are removed from larger capillaries first and replaced by hot oil
- Foods that retain moisture interior are fried until the thermal centre has received sufficient heat to destroy contaminating microbes, specifically meat products.
- The time taken for food to be completely fried depends on:
 - the type of food
 - the temperature of oil
 - the method of frying
 - the thickness of the food
 - the required change in eating quality
- Frying is done at high temperatures (180-200 degree Celsius)

Types of Frying:

1. **Shallow frying (Contact frying):** Food is partially submerged in a shallow layer of hot oil, and only one side is cooked at a time. This method is also known as pan-frying. Shallow frying is a healthier option than deep frying because it uses less oil.
2. **Stir-frying:** A Chinese cooking technique that involves frying ingredients in a wok with very hot oil while stirring constantly. Stir-frying is a healthier option because it only requires a small amount of oil.
3. **Dry frying:** Some foods can be fried without the addition of fat or oil, as they contain sufficient fat to prevent sticking to the pan. Non-stick pans are most suitable for this type of cooking. Ex.- bacon, sausages etc.
4. **Air frying:** It involves air fryer which is a kitchen appliance that cooks by circulating hot air around the food using the convection mechanism. A mechanical fan circulates the hot air around the food at high speed, cooking the food and producing a crispy layer, the food sits in a perforated basket which increases its contact with the hot moving air.

- 5. Deep Fat frying:** FOOD is completely submerged in hot oil. Heat transfer is a combination of convection within the hot oil and conduction through the interior of the food, surface receive uniform heat treatment from all sides to produce a uniform colour and appearance, suitable for foods of all shapes.
- 6. Sauteing:** It involves cooking food quickly in a small amount oil or fat. It is often used for delicate items like seafood, thinly sliced meat, or vegetables, the food is cooked in a flat- bottomed pan, and frequent tossing or flipping ensures even cooking and browning. Ex- shrimp scampi, flash fried vegetables etc.

Changes During Frying:

➤ In Food:

- Loss of moisture
- Development of dark colour, firm texture and fried flavour

➤ In Oil:

- Bland flavour at initial frying
- Changes due to chemical reactions
- Dark and viscous
- Unsaturated fatty acid decreases with increasing number or time of frying
- Oil and food both undergo severe changes due to frying, different frying process, variables of oil, food and process conditions
- Understanding new compounds in different oils and their reactions and functions are important study during the frying process
- New compounds formed in oils during frying process

Causative agent	Change effect	New compounds
Moisture	Hydrolysis	Free fatty acids Diacylglycerol Monoacylglycerol
Air and metals	Oxidation	Oxidised monomers Volatile compounds (aldehydes, ketones, hydrocarbons)
High temperature		Sterol oxides

Effects of Frying on Food and Oil:

- **Nutritional quality:** Frying can destroy nutrients in food and make it less healthy, by altering the structure of proteins, vitamins, and antioxidants. Water-soluble molecules like ascorbic acid can also be lost during evaporation
- **Health risks:** Eating too many fried foods can increase the risk of obesity, heart disease, diabetes and chronic conditions. This is because fried foods are often high in calories, saturated fat and sodium
- **Flavour and texture:** Frying can create a unique flavour and texture through the Maillard reaction. It can also change the flavour stability and quality of fried foods
- **Oil quality:** The oils undergo chemical reactions like hydrolysis, oxidation and polymerisation, which produce volatile or non-volatile compounds
- **Starch structure:** Frying can alter the molecular architecture of starch granules, which can change their functional properties. This can affect the ability of starch tends to thicken, gel or stabilize foods

Compounds	Changes During Frying
Fats	Increased concentration and change in composition
Water	Significant loss
Reducing Sugars	Maillard reaction
Starch	Gelatinization
Proteins	Alteration of the composition
Amino Acids	Formation of heterocyclic flavouring substances
Flavouring Substances	Formed by oxidative and Maillard reactions
Vitamins	Interactions with frying oil
Minerals	Moderate loss
Antioxidants	Small loss
	Moderate loss

Advantages Of Frying:

- Taste is improved, along with the texture

- Increases the calorific value
- Fastest method of cooking
- In shallow fat frying the oil consumption can be controlled

Disadvantages Of Frying:

- The food may become oily or soggy with too much absorption of oil
- The food becomes very expensive
- Fried foods are unhealthy and takes long time to digest
- Repeated use of heated oils may produce harmful substance and reduce the smoking point

Conclusion:

Although fried food has been part of the world menu for a long time, results from literature revealed that one of the main problems associated with fried food is its high oil content as a result, owing to its association with the high incidence of diseases such as obesity, high cholesterol, or high blood pressure. However, previous studies have revealed that coating can reduce the oil uptake or lower the oil content of fried food. Therefore, it is very important that the shelf stability and packaging materials used for fried food products are checked. However, there is need for adequate process, quality control, and regulatory monitoring of fried food products in order to safeguard the health of the consumer from unwanted diseases.

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