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*«Vieja friendo huevos», Velázquez.*

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# PLENARY LECTURE

## Geography and history of the frying process

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### SUMMARY

#### Geography and history of the frying process

How far back in time, frying with oil goes, it is difficult to tell. The rules for sacrifice in Leviticus, Chapter 2, the 3<sup>rd</sup> book in the Old Testament, which is commonly accepted to date from about 600 BC, distinguishes between bread baked in the oven and that cooked «on the griddle» or «in the pan». Roman authors also describe in the first century AD the frying of eggs.

Writers in the Middle Ages, Cervantes and Chaucer both describe the cooking in oil. A number of common proverbs deal with frying in one's own grease in the 14<sup>th</sup> Century.

Soyer describes the grid iron as a primitive utensil but with considerable possibilities in the use and variation of the cooking process. We need only to recall that splendid painting in the El Prado of the fried egg which Professor Varela used as a frontispiece for the first Frying of Food Conference in Madrid in 1986.

Different types of oils can be used for the frying of food. Variations in the composition of vegetable oils can normally be traced back to climatic effects and the location of the growing plants. We can expect the height above sea level, the daylight hour length, the mean temperature and the genetic make up of the plant, all to have an effect. Cool conditions during seed maturation can increase the linoleic acid content in plants such as *Guizotia Abyssinica* to almost 85% of the oil. Similar results have been reported for peanuts grown at different latitudes in the United States.

**KEY-WORDS:** *Climate – Daylight lenght – Elevation – Griddle – Leviticus.*

It is difficult to state a definite time when frying with oil began. Despite what Henbest and Couper say in «The Guide to the Galaxy» that the spiral arms are the most prominent feature of the disc in the galaxy, which is a thin flattened region of stars surrounding the galaxy's central regions like the white of a fried egg, there is no relationship to life on this planet. The comparison can be carried further as the centre of the disc is a bulge of yellowish-orange stars representing the yolk of the fried egg (even down to its colour!). The rules for sacrifice in Leviticus, Chapter 2, the 3<sup>rd</sup> book in the Old Testament, distinguish between bread baked in an oven and that cooked «on the griddle» or «in the pan». (verses 4-7). Leviticus is accepted as dating

from the period 600 BC and contains the rules by which the people had to prepare and cook food. Cooking with oil on the griddle or in the pan was clearly accepted.

The Latin writer Pliny in the first century AD records a prescription for spleen disease that required eggs steeped in vinegar and then fried in oil. (Pliny). We read in *Don Quixote*, Book I, Ch.37 that Sancho says «If you don't believe me you'll see it when the eggs are fried».

Also in Chaucer in the 14<sup>th</sup> Century, frying was a common enough cooking process, to be used as a metaphor. The wife of Bath in her Prologue, says of her fourth husband, «That in his owene grece I made him frye, for angre, and for verray jaleusye. By God! in erthe I was his purgatorie for which I hope his soule be in glorie».

We can imagine someone frying in purgatory or hell, as a popular process, perhaps because of the vivid crackling and spluttering (due to the sudden vaporisation of water in the food) characteristic of the process. «To fry in one's own grease» is a common proverb in the 14<sup>th</sup> Century. It is even used in the 19<sup>th</sup> Century by Lewis Carroll in «The Hunting of the Snark». «He would answer to "Hi!" or to any loud cry, such as "Fry me!" or "Fritter my wig". To "what-you-may-call-um" or "what-was-his-name!", but especially "thing-um-a-jig"».

We have also only to recall from the Programme of the 1<sup>st</sup> Conference on «The Frying of Food», here in Madrid in 1986 that splendid painting in the El Prado of the fried egg. Again on the Programme of this 2<sup>nd</sup> Conference there is the painting by Velázquez from the early sixteenth Century of the old lady frying eggs. Velázquez is well known as a painter of domestic scenes of the period as well as of the nobility.

Alexis Soyer describes the grid-iron as a primitive utensil but one which permits a great deal in the manner of cooking. It requires care, he states, or otherwise there is a great loss of food and also money. He describes what may be fried on a grid-iron with all types of fish and meat. He even includes a baking pan alongside the grid-iron. He compares the grid-iron with the frying pan and points out clearly the importance of what he calls «fat» in

the cooking process [Soyer, p. 58]. No doubt much of this was practised in the Crimean War of the middle of the last Century.

As we move into the modern era, the practice of frying of food has ebbed and flowed. Professor Varela in his paper at the 1st Conference discussed the advantages and disadvantages of frying and also the actual process of frying. We should consider the changes in the type of oil used, both in the home and industrially for frying food. There has been a swing from saturated animal fats to the use of unsaturated vegetable oils. I am not discussing here the theories as to the good and bad points in health from the use of different oils. We have seen in the Western World in the past thirty years a swing from saturated fats to highly unsaturated oils and now the oils which I must call mono-unsaturated with some poly-unsaturated are in favour: the so-called Mediterranean diet.

Regrettably I have not been able to find descriptions in the literature of the frying processes used in China in the Middle Ages. Their present procedures of very hot oil frying in a large pan does produce appetising and tasty food, but remember that the temperature can be relatively high.

The amount of oil absorbed by the food must always be considered. Some of these factors were discussed at the 1st Frying of Food Conference. There still is research being carried out on the function of the absorbed oil and how the «crust» of the food item can affect uptake. Pinthus, Weinberg and Saguy give their results in two papers (Pinthus *et al.*). Crust porosity decreases during frying and at a critical value oil uptake ceases. These authors have suggested a new term "net porosity" to describe the oil uptake mechanism. We should also recall that the «Deutsche Gesellschaft fuer Fettwissenschaft» held two symposia on baking and frying fats, one in May 1973 and the other in 1979. The papers were chiefly concerned with the quality of heated fat, analytical and nutritional considerations and not on the source and quality of the original oil.

The composition and content of the oil in seeds depends on a number of variables. These can be broadly included under the heading of climatic and geographical effects. We should include here the height above sea level, the mean temperature, the length of daylight and above all, the genetic make-up of the plant. The genotype and the environment can react with each other to produce a wide range of variations. I have not included the drought conditions or the shortage of water. This factor normally exhibits itself by a decrease in yield and some variation in fatty acid composition. I need not refer to the difficult conditions in Spain and other Mediterranean countries in 1995 when there was a distinct short fall in the quantity of oil produced by the olive plantations.

Slack and Roughan studying the soybean and linseed cotyledons found that the molar proportion of

oleate increased when the temperature was increased but linoleate and linolenate increased when the temperature was lowered. B.F. Carver and his colleagues studied the response to environmental variation of soybean lines selected for altered unsaturated fatty acid composition. Two maturity groups were taken and planted in eight environments in N. Carolina, Mississippi and Puerto Rico. The genotype/environmental interactions for each type of unsaturated acid, could be attributed to differences arising from the environment mean. Temperature was found to play an important role, both minimum and maximum. Genetic manipulation could also play an important role in influencing the soybean fatty acid composition and glycerolipid fatty acid composition as established by R.F. Wilson and colleagues.

Soil water stress is another factor which should not be disregarded. I have already mentioned the 1995 drought but twenty years earlier, Talha and Osman investigated the effect of soil water stress on water economy and oil composition in sunflower (*Helianthus annuus L.*). They used field experiments in which sunflower plants were subjected to soil water stress at -15 bar during the stages of slow elongation, rapid elongation, flowering and ripening. Significant decreases in yield and oil content was found as a result of soil water stress. The iodine value of the oil was affected, low values were found, indicating an increase in oleic acid and some decrease in the linolenic fatty acid content. This is the reverse picture of work reported on sunflower plants grown in a cool temperature in Egypt (J.W. Purseglove) but the work of Talha and Osman here reported appears sound and in line with other work that slow maturing seeds and crops grown in a cool climate are the richest in linoleic acid with a lower oleic acid content. Riley and coworkers report similar conclusions with the *Guizotia* species (*G. Abyssinica* and wild species of *Guizotia*). Under cool conditions of seed maturation the linolic acid content rises to about 85%.

The oil content and fatty acid composition of Chia (*Salvia hispanica L.*), a lime flavoured leafed sage, has been investigated by R. Ayerza. Chia is a possible new crop for food use and grows well in N.W. Argentina. The Aztec peoples used the plant in early Mesoamerica. The oil has good nutritional application, being particularly high in w-3 linolenic acid, 50-57% and with 17-26% linoleic acid. At the present time, Chia is only cultivated in Jalisco State, Mexico. The author obtained Chia seeds, harvested in June 1993 in Catamarca, Argentina and sowed the seeds in the 1994 growing season in 5 North Western locations. The height above sea level varied from 306 to 1332m; planting dates were at the end of December or 20 January. The first frost was consistent at all five locations on 24, 25 and 26 June. The maximum and minimum temperatures are listed as well as the rainfall over the period January to

June 1994. The relative relationships of the fatty acids, linolenic, linoleic, oleic, stearic and palmitic acids differed among the locations. Except for one region, all Chia plots produced seed oil with a higher linolenic acid content than in the Chia grown in the natural Mexican habitat.

Lotti *et al.*, (1977) reviewed the composition of the oils from 17 varieties of groundnuts grown in various localities between 31° parallel South and 39° North and compared this data with that for the same varieties grown in Pisa. Their results clearly indicated that seed weight increased for the crops grown in warmer climate whilst percentage composition of the fatty acids indicated higher quantities of linoleic acid and lower quantities of oleic acid present in the crops from colder climates. Interestingly enough, these authors also investigated the chemical structure and relative amounts of sterols present. There was an increase in  $\beta$ -sitosterol and a decrease in campesterol and stigmasterol in the oils from cooler climate crops. Lotti *et al.*, (1976) also studied the effect of climate on the composition of rapeseed and showed that the low erucic acid varieties grown in a warmer climate had a higher erucic acid concentration than those grown in a cooler climate. The reverse was found to be the case for the high erucic acid varieties of rapeseed.

Marquard *et al.*, (1977) reviewed the composition of linseed from crops grown in Finland, Canada, Morocco, New Zealand and other countries. They concluded that differences due to location of growth were much greater than those due to any difference in variety. Temperatures and day length also had an effect on the fatty acid composition of summer linseed oil. Marquard *et al.*, (1980) has confirmed the high linoleic and linolenic acid concentrations are always associated with low temperature and incomplete maturity of the seed.

Considerable research has been carried out on the vegetable oils, the effect of climate and location on the yield and quality of the oils. We should not forget the animal fats. Such fats have been used from time immemorial for the cooking and frying of food. When fire was known, animals slaughtered, no doubt some of the flesh was cooked and made appetising by the use of the fat in a dish or pan on the fire.

We know that the composition of animal fat, particularly the depot fat does depend, to a very large extent, on the food eaten and the type of fat ingested. This means that animals fed with plant material with a relatively higher unsaturated fatty acid content, will produce similar fat in the animal.

I have omitted fish oils which are a very specialised area. Because of their high unsaturation and flavouring materials present, they have only a limited use. The regions where they are used are generally by the sea and often in a developing area. Oil substitutes are now being developed but their use as frying oils giving products with very low calorific value from the oil, must await approval of their use from the Food and Drug Administration, Washington DC.

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