

The Sense That Excites

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Human craving for flavour has not been acknowledged as a force in history. However, we are aware that royal empires have grown, unexplored lands traversed, great religions and philosophies changed, due to spice trade. In 1492, Christopher Columbus set sail to discover spice. In modern times too, the influence of flavour is decisive as the rise and fall of corporate empires manufacturing soft drinks; snack and fast food chains are often determined by how their products taste.

Pre-human hominoids tracked the giant herds that once roamed the earth. The weak and the ailing animals that fell to die were welcome prey. This was all before the discovery of tools for hunting. The earliest evidence of tools being used for hunting for meat dates back about one and half million years. A million years later with the harnessing of fire, hominoids evolved into human beings.

The evidence marking this major step in human evolution has been found in different parts of the world as disparate as France and China. Hominoids eating butchered animals, raw and uncooked, became humans by heating food over fire, making it more digestible and tasty. Now with the advancement of scientific knowledge, we understand that the main ingredients of meat namely proteins, sugar, and fat begin to react at around 180°C during cooking to form substances that give off aroma and flavour.

Archaeologists have found a thick layer of ash containing singed and charred bones in a cave near Beijing, China. Open hearths have also been found in the remains of the stone and wood dwellings built by early humans in Terra Amata, Nice. The harnessing of fire to make meat safer and tastier further led to the development of kitchen techniques and so of the human race.

Natural vessels made from turtle shells to animal skins to pits dug in the ground have been used by humans to cook food during that period. Advanced civi-

lisation, like early India & Persia, invented the use of clay ovens and refined the art of baking and cooking to lead to the development of multiple hearths in China.

Meat was a regular diet of humans until the beginning of the Modern Age. Other foods that were a part of regular nutrition included fish and other seafood. Bone or stone tipped implements, precursors of modern day spears and harpoons, were used for hunting. Catching fishes with hook and line were a part of fishing equipment during the Stone Age. The diet then consisted of wild grasses, leafy plants, and vegetation now known to us as vegetables. Other forms of nutrition consisted of tubers, roots, and wild corn. Archaeologists have excavated tools used in harvesting wild grains and primitive spades used in digging out roots and tubers.

Eighteen thousand years ago, wild barley was harvested by settlers in the Nile Valley of Egypt, using stone blades. People became farmers, sowing and breeding plants like rice, wheat, corn, beans, etc., and heralding the start of ancient civilisation almost seven thousand years ago. Later, wheat, rye, barley, oats, legumes, peas, beans, lentils, spinach, radishes, carrots, beets, asparagus, onions and garlic, pumpkins and melons and a variety of cabbages were grown as food. Potatoes and tomatoes, fruits like bananas, oranges, mango, peaches, pears, plums and other vegetables increased popularity and became widespread.

Today, the world is not isolated, but part of the global village. Advanced methods of transportation and preservation techniques as deep freezing have enabled vegetable products produced in one part of the globe being made available in another.

As people began to form groups and live in settlements, they started consuming milk of domesticated animals like mare, goat, cow, sheep, reindeer, yaks, camels, buffaloes, etc. Today, cow's milk is consumed by almost 90% of humans, apart from China, where virtually no one drinks milk as such.

Men, by experience, knew that all natural food remain fresh only for a limited period. The freshness of foodstuffs is dependent on the quality and the type of food. Grains that ripe are dried by the sun and wind and so keeps fit for consumption, but all other spoils. This led to the discovery of the drying technique now used in the storage life of meat and fish.

Continuous experimentation of early humans was also responsible for discovering other different methods of food preservation, namely salting, pickling, etc. Ingeniously, over the years, human discovered that milk was preserved by specifically spoiling it to make cheese. Today, cheese is a delicacy to many around the globe. The use of cheese is estimated to be more than five thousand years old as determined by early cave writings. Notably, these methods of food preservation favourably improved the taste of food and were very much appreciated by early humans.

In early times, people probably found food bland and boring. This discontent led them to employ use of spices and ingredients obtained from herbs and fruits in their meat and fish preparations. Similarly, application of heat to vegetables gave rise to distinctive aromas that delighted them. Continuous experimentation with food to make it more pleasurable helped mankind discover processes like extraction of taste, like tea and coffee, distillation and fermentation like beer, wine, and yoghurt. The oldest evidence in the use of spice is obtained in Mexico almost twelve hundred years ago. Excavations have proved wild chilli pepper to be grown some nine thousand years ago in Peru.

According to early Indian writings, coriander has been in use for more than 7000 years. Cinnamon, mint, juniper, myrrh, onions and garlic have been used in Mesopotamia around 3000 BC. Historical sources say that construction workers building the royal pyramids in Egypt went on a strike because they did not receive their daily ration of garlic during meals. During the third century BC, spice trade flourished in the city of Mohenjodaro during the Indus valley civilisations. Spices like pepper, cloves, cardamom and saffron were abundant and was traded with other countries. In Europe, these spices were very popular among nobility and a matter of prestige to use them daily. Can anyone forget the fact that cultivation and trade of these taste producers were a major driving force in the colonisa-

tion of our country, along with other spice producing areas of the world?

“Presiding over the ear, the eye, the touch, the taste, and the smell, as also the mind, he experiences objects,” said Lord Krishna in the *Bhagavadgita* (Chapter 15, Verse 9). As ordained, we have five sensory perceptions — vision, sound, touch, taste and smell — using which we enjoy life on earth. It is not wrong to believe that God almighty has endowed the sense of taste and smell as a way for animals to avoid being poisoned, as normally all edible plants are sweet and harmful ones bitter.

Taste is the sum of the sensations produced by the flavouring substance because of the excitement of the sense of taste, smell and the sensory nerves. Our judgement is based not only on the taste of the product, but also on its smell.

Our tongue normally functions in conjunction with our noses, to give us our complete experience. Without smell, food will no doubt taste, sweet, sour, salty, or bitter, but the pleasure of having it is lost. Human nose is photogenetically very old, functioning at a subconscious level as a chemical tool. We know that in case of our eyes, ears and touch, the message to the brain is passed through the lengthy and complex nervous system. However in case of the nose, the passage is through the limbic system or the rhinencephalon, also called the olfactory brain.

The limbic system is associated to the hypothalamus and the brain stem. This is present in all living animals and is responsible for basic instincts like eating drinking, breathing and sex. However, in case of humans, the neocortex or the thinking layer is evolved and gives instructions to impulses like hunger, thirst, arousal and other emotions generated by the limbic system. The aroma that arrives at the receptive region of the limbic system is directed to the neocortex-thinking portion to be understood and assessed.

The nose consists of two parts divided by the inter-nasal bone. The nasal cavity is covered with mucus membrane. The upper part of the internal bone on both sides bears a small piece of yellowish brown mucus membrane of about three square centimetre surface area called the olfactory bulb. The olfactory

nerves that are situated within the mucus membrane bear a long flagellum. The act of drinking, sucking, or chewing a substance releases its volatile gases. The aroma molecules given off by our food pass through our nasal route and from the back of the throat pass the areas of yellow brownish mucus membrane or nasal epithelium located high up in our nasal cavity. The odour molecules that pass through our nose, along with the air flow, dissolves in the mucus membrane and makes contact with the flagellum that are about 1/1000 mm in size and made up of about 10 mn olfactive cells.

The structure of the odour molecule determines the kind of signal that passes from the flagellum through the membrane to the olfactive nerve that is directly connected to the limbic system of our brain. The nasal epithelium is made up of receptor cells passing on the taste and smell to the olfactory bulb of the brain. Our brain combines the complex smell signals from our olfactory epithelium with the simple taste signals from our tongue, assigns a flavour to what's in our mouth, and decides if it's something we want to eat.

The olfactive system also sends return messages back from the brain changing the pleasure of food aroma as the brain signals that the stomach is full to capacity. When the air passages are blocked, smells have a difficulty in reaching the sensory cells of the brain and the food loses its taste.

In contrast to all other nerves cells of the brain, the olfactory nerves are able to reproduce. If the cells of the spinal cord is damaged you have paralysis and as the nerves affected cannot be repaired. It is also the case with the nerves of the eye and ear. Nature realising the importance of the olfactory nerves, has ordained that it can repair itself when damaged. The nuances of flavour come from inhaling aromas or exhaling them through the nose as we drink or chew food.

The taste buds on our tongues can detect the presence of half a dozen or so basic tastes, including sweet, sour, bitter, salty, astringent, and umami a taste discovered by Japanese researchers. Umami is reminiscent of a rich and full sense of deliciousness triggered by amino acids in foods such as meat, shellfish, mushrooms, potatoes, seaweed, synthetic agent mono sodium glutamate and the likes. The sensations of taste

are registered by the taste buds situated on the tongue, due to changes occurring is dissolved in saliva.

These buds have minuscule canals, which contain extremely thin taste cells. When stimulated by change in temperature, variation in the composition of food components, or food structure, a signal is sent to the brain. The signal is then translated into a phenomenon of awareness, which then we recognise as hot or cold, sweet or bitter, sour or salty, hard or soft. The tongue of an average middle aged person contains about 10,000 taste buds. Younger people have higher number of taste buds that reduce, as one grows older.

We know that tasty and palatable food appeals to our brain, stimulate the flow of saliva, and help in the digestive process. Although a balanced diet is essential for our wellbeing, this is possible only if the food selected is sensible to taste to make us consume the food happily. To bring variety to our diet, aroma and taste is essential in the ingredients selected. Any edible food product we purchase has an appealing aroma and taste.

Our daily food contains natural flavour ingredients. If not inherently present, it is created during preparation, cooking, baking, or frying. In case of processed foods, either natural or artificial flavour is used to make it tasty. Consumers buy the product for the first time largely due to packing, appearance or promotional offers. However, repurchase of any food item normally depends on the taste of the product.

A person's food preferences, like ones personality, are formed during infancy and childhood. Socialisation plays a very important role in forming these preferences. Babies inherently prefer sweet tastes and dislike bitter tastes; Children learn to enjoy hot and spicy food, bland health food, or fast food, depending on what the people associated with them eat. The flavours liked during ones childhood foods seem to leave an indelible mark. On growing up adults often, return to them, without actually knowing why. These foods give pleasure, comfort and reassurance, a fact that fast-food chains use to their advantage.

The increasing movement of the ever-growing population from one part of the country to other parts, in search of employment opportunities, has resulted in

the growth of food preservation techniques. Various processes like pasteurising, sterilising, canning, freezing, concentration and dehydrating used in the processing industry destroy most of the natural food flavours. External addition of flavours to counter the loss and to make the processed food item palatable is hence necessary. We know that soya protein supplements are very nutritious. However, it is virtually tasteless and not easily acceptable to eat. Either soya food product is combined with other tasty food items or an acceptable flavouring is added so that it becomes palatable. Small sized fruits that take longer time to harvest normally taste better. The increasing population and the demand of food products has triggered a revolution in agricultural methods. Typically, newer varieties of high yielding fruits that have better disease resistance, preservability, better looking and of larger sizes are more important at present times.

However, in the process of fulfilling this requirement, the inherent taste of the product is compromised. Poor tasting products are not liked by people, and even essential food nutrients are rejected if the item is tasteless. It is therefore necessary to compensate the loss of taste and aroma that occurs in food processing. This compensation is generally done by adding similar flavouring substances externally. Flavour ingredients added are normally found either in the same food item or in other foods, but make the product acceptable when added. The flavour industry emerged during the mid nineteenth century to cater to the processed food-manufacturing units that grew during that time. The flavour industry distinguishes flavour and flavouring materials into three distinct categories: natural flavours, nature identical flavours and artificial flavours.

Natural flavours

Natural Flavours are products made using some of the different single compounds of natural origin. There are about 2000 different products in this category. These natural chemical compounds are separated by physical process from mixtures by distillation, extraction, or solidification. Sometimes, a combination of microbiological or enzymatic process are also employed. Some examples of natural flavours include menthol derived from peppermint oil, citral from lemon grass oil, methylsalicylate from winter green oil, amyl acetate distilled from banana, etc.

Nature identical flavours

Nature identical flavours are the most important category that comprises about 3000 substances that are synthetically created. The substances that are artificially created are identical with the chemical composition of compounds found in the natural product and found suitable for human consumption. A typical example is the vitamin C tablet that we consume. Chemically it is ascorbic acid. It is found in lemons, but can also be prepared artificially from D- glucose, which is, in turn, produced from sugar. The chemical molecule of vitamin C obtained from lemon and sugar are structurally identical and same. Similarly amyl acetate distilled from banana and the one synthetically produced by mixing vinegar with amyl alcohol in presence of sulphuric acid are structurally identical and smell and taste the same. Menthol, Citral, Vanillin, etc are other examples.

Artificial flavours

Artificial flavours are non-identical flavour ingredients that have been discovered by scientist and researchers. These substances are not naturally present in foodstuffs. If, at any future date, the chemical is identified in any natural food product, then it is reclassified as nature-identical. Artificial flavours discovered are about 200 and are prohibited in use till it is proved to be completely harmless for human consumption through a series of evaluation and clinical testing. It is believed that the first artificial flavour was accidentally discovered in Germany. A scientist at work while mixing a group of chemicals in his laboratory suddenly found that his lab was filled with a sweet smell of grapes. It was only later discovered that the chemical obtained by the accidental mixing was methyl anthranilate, now a very important flavour ingredient in grape flavours.

The inventions of equipment like gas chromatographs and mass spectrometers that are capable of detecting volatile gases at low levels, helped in the synthesis of a number of synthetic flavours during early 1960s. Today, spectrometers, gas chromatographs, headspace vapour analysers, and other sophisticated instruments are available to help provide details of flavour components by detecting the chemicals present in amounts as low as ppb. Although human nose is more sensitive, with an ability to smell at ppt levels, instruments help scientists to work continuously with

the same efficiency. This is not possible with the human nose that gets tired in continuous usage and has to be rested and be refreshed intermittently.

Complex smells and tastes like roasted Indian coffee are composed of volatile gases from nearly a thousand different chemicals. A simple smell of strawberry is obtained by the interaction of about 350 chemicals that are present in strawberry flavour in very small or infinitesimal amounts. Although flavour normally is obtained from a mixture of different volatile chemicals, often a single compound provides the dominant smell. A typical example is that of Ethyl-2-methyl butyrate that smell just like apples, Amyl acetate smells like bananas.

One question that always rankles in the mind of the consumer is whether natural flavouring agents is preferable to nature-identical or artificial flavours and so safer to use than synthetic substitutes. Consumers prefer to see natural flavour on any labels of processed food, believing it to be safer for health. There is nothing further from the truth than this. A natural flavour is not necessarily healthier or purer than an artificial one. Differences between artificial and natural flavour can be arbitrary, and absurd if one only looks whether it is natural or artificial, and not what it contains or how the flavour has been made.

In principle, there is no difference between the safety of natural and nature identical flavour. In some case, the naturally derived flavour may be harmful than the synthetic one. Almond flavour predominantly contains benzaldehyde. When benzaldehyde is derived from natural fruits like peach and apricot, trace amounts of hydrogen cyanide, a deadly poison, is also extracted along with the natural flavour. However benzaldehyde derived synthetically by mixing clove oil and amyl acetate does not contain any cyanide and is completely safe for use. Nevertheless it is considered an artificial flavour and sells cheaper to the dangerous natural one, that is expensive, and contains cyanide that can kill. Surprising isn't it?

Thousands of flavouring agents are used in food preparation. According to experts who have evaluated the products, flavouring substances are generally recognised as safe when used in recommended dosages and as advised by the manufacturer. Ironically, how-

ever some naturally occurring substances are restricted. Naturally containing substances when consumed beyond a specified level are harmful. Typical examples include Solanine in potatoes, Myristicin in nutmeg (Jaiphal), and Coumarin in strawberries, raspberries, tea, and cinnamon. All the above materials are permitted if the quantity used is low, but not allowed at higher concentrations. However, use of Coumarin, both natural and synthetic, in flavour is not permitted.

All flavouring substances are regulated by legislation, issued by FDA. Government departments that control the safety of foods are also responsible to control the safety of flavours used in the food products. The flavour industry too, over the years, have accumulated a lot of information and data regarding use, occurrence, biological properties and all the information have been used to carry out independent safety evaluation by various experts.

The manufacturers of flavour ingredients around the world have set up the 'International Organisation of the Flavour Industry' (IOFI) based in Geneva, Switzerland. IOFI issues guidelines to the members, makes recommendations, draw up rules and make available their expertise, to harmonise the diverse rules in various countries for the betterment of the industry and for the benefit of the consumer. Intergovernmental organisations like European Flavour & Fragrance Association, European Council, The Scientific Committee for Food of European Commission (SCF), The Food and Agriculture Organisation (FAO), and the World Health Organisation (WHO) of the United Nations also conduct independent study group to evaluate the safety of the flavouring substances. Fragrances and Flavour Association of India (FAFAI), Essential Oil Association of India (EOAI) are similar bodies set up by the Indian Industry.

Tens and thousands of flavouring ingredients occur naturally in food and it is practically impossible to establish safety on an individual basis of all substances in the near future. If such a prohibition does come through, we all will have to stop eating completely and life will truly become unbearable. Imagine, if one has to forgo all the tasty items that have been consumed from the beginning of human civilisation, but not sufficiently tested as safe. People believe that natural flavours are safe and good to be used. Synthetics

are synonymous to second rate poor quality stuff. The high degree of confidence an individual exhibits towards natural stuff tends to mistrust and lack of faith towards synthetic. A good example is the flavouring of ice cream with vanilla flavour. Natural vanilla flavour is rare and prohibitively expensive.

If a rule is implemented that only completely natural vanilla is to be used to flavour ice-cream, then it can be consumed only by the very rich as this luxury can only be affordable to them. Organic chemistry and modern technology has now made it possible to produce synthetic vanilla flavour and ice-cream made out of this can be enjoyed by all at a very reasonable and affordable price.

Although absolute safety can never be guaranteed for any food item or flavour, the flavour industry does promise with assurance that approved and properly manufactured flavours do not present any risk in use. However, the industry & manufacturers recommended dosage levels have to be strictly adhered. Individual intake of solid food products annually amounts to about 900 to 1000 kg. Of this total amount

about 500 gms of flavouring is found to occur naturally in our foodstuff. These amounts to less than 0.05 per cent dosage of flavouring consumed. To make the menu more interesting, attractive and palatable concentrated aromas are added to foods that either do not have their own natural aroma and taste or have very little of them. This extra addition too does not add up to more than 25 gms per person per year, as the quantity used is very low usually less than 0.05 per cent.

We consume food and drink to get the much-needed energy to survive and live life at the fullest. Taste is a very important component during the consumption of food and drink.

The taste of the selected food and the aroma released by it is responsible for recognition and acceptance. A tasty food that appeals to our brain contributes to our general sense of well being by assisting the digestive process. Supposing flavours are eliminated from our food, life will become dull and boring, not good enough to live. That is the importance of flavours in our day to day life.