CC 14; Unit 1: Introduction to quality attributes of Foods

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Quality in general is defined as degree of excellence and is continuous process of improvement to meet the requirements of the consumer in the present context. The food has got several quality attributes not limited to only sensory qualities; however in the present chapter quality attributes with respect to sensory aspects of food will be dealt. Any food item raw (fresh) and processed will have its characteristics qualities. The raw or fresh produces such as nuts, fruits, vegetables, grains, milk, and eggs etc., the quality attributes are decided by the type, variety, place of origin, cultivations practices, and stage of harvesting and so on so forth. While in the processed foods quality attributes are controlled by the preparation methodology, cooking recipe, and food packing/serving type and purpose of processing either industrial scale for preservation suitable for marketable life or home scale for immediate consumption. Understanding or expression of food quality varies with individuals. A public health professional simply terms it as good quality food means the one which doesn't make people sick. While a food business operator will define it as food quality means product attributes that lead to consistent end product and manufacturing operations. The food safety /food standards and certification officials describes food quality as the one which meets the defined specifications such as viscosity, density, color, texture, etc. Whereas the consumer, the real king; needs a product tasty, safe and cost effective. Certain regulations describe that "Quality is the inherent properties of any processed product which determine the relative degree of excellence of such product and includes the effect of preparation and processing and mayor may not include the effects of packaging or added ingredients/ additives". The food quality attributes can be classified as Visible and Invisible characteristics in food science. The visible quality attributes refers to the sensory attributes of the food while the invisible or hidden quality refers to the nutritive value of the food. The hidden quality attribute include the nutritive compound such as carbohydrates, protein, fats, fibre, vitamins, minerals and as well as the non nutritive compounds such as phytates, tannins, pigments (though influence the color of the food), oxalates and certain undesirable compounds. Some of these attributes in addition to certain others such as yield of final product and meeting the legal specifications including microbial quality are referred as quantitative attributes of food quality usually useful in commerce. Sensory attributes of food has five aspects i.e. appearance (often referred as color), aroma (often referred as smell or odor), taste, and texture (also referred as consistency depending upon the type of food). The quality attributes related to eating of food are called as sensory attributes/quality because a range of senses are used in the process of eating food from its aroma, sight and actual putting in mouth giving the taste.

These senses include the aroma/smell, sight, hearing/sound, taste and touch/hand feel.

An amalgamated response from these senses will result into actual quality expression by an individual about a food item.

TASTE: It is the actual and ultimate thing on which the acceptability of a food is mainly dependent upon. The taste is mainly perceived through tongue. Taste is the sensation produced when a substance in the mouth reacts chemically with taste receptor cells located on taste buds in the oral cavity, mostly on the tongue. Taste, along with smell (olfaction) and trigeminal nerve stimulation (registering texture, pain, and temperature), determines flavors of food or other substances. Humans have taste receptors on

taste buds (gustatory calyculi) and other areas including the upper surface of the tongue and the epiglottis. The tongue can detect five basic tastes: bitter; salt; sour; sweet; umami. Each of these taste receptors is most highly concentrated in certain regions of the tongue's surface. Sweet receptors are mostly on the tip of the tongue (noted in a child's preference to lick a candy sucker rather than chew it). Sour receptors occur primarily along the sides of the tongue and are stimulated mainly by acids. Salt receptors are most common in the tip and upper front portion of the tongue. They are stimulated mainly by inorganic salts. Bitter receptors are located toward the back of the tongue. While some parts of the tongue may be able to detect a taste before the others do, all parts are equally good at conveying the perception of all tastes. In practice, evaluation of sensory attributes is very crucial and a trained panel of food testers mainly does the measurement of taste and related quality attributes. Although certain advancements include e-tongue & e-nose, the holistic human perception of sensory attributes is difficult to correlate by to specific foods by only instrumental means.

AROMA: Any property detected by the olfactory system. The other terms used to describe aroma are odour, fragrance and smell. The aroma or smell of a food item is important because it will create response without seeing it and without knowing its whereabouts. The smell of a flavourful food item (e.g. ripe mango or a freshly fried item or any product being prepared) can influence your sensory organs for craving of that item more so due to cognizance. The aroma is sensed or identified by nasal /olfactory glands. The aroma is highly individualistic character of particular food due the volatile compounds/aromas released from food. The several aromatic compounds of natural foods or released during preparations include: esters such as ethyl /

methyl /octyle acetates and butyrate (apple, pineapple, orange) in fruit fragrance, linear terpenes such as citral and linalool from fruits; cyclic terpenes such as limonene, menthol etc. Several volatile compounds from spices such as gingerol and zingiberene from ginger, cinnamaldehide from cinnamon, cuminaldehyde from cumin, thaymol, carvacrol, pinene, cymene, eugenol from ajwain& clove etc. are the key compounds involved in processed foods as theses spices are integral part of Indian cuisine. Certain other odorous compounds are also generated during fermentation e.g. in wines, curd and pickles. An odour may be described by associating it with a particular food item, e.g. herby, cheesy, fishy etc. The intensity can also be recorded. The expression of odor /aroma cane be made using words such as aromatic, pungent, spicy, floral, bland, tainted, perfumed, rancid, savory, rotten, tart, citrus, acrid, strong, mild, light musty, scented, fragrant. Certain terms such as roasted, burnt, overcooked are also used to express odour which are mainly processing related responses to the final product.

Flavor: The term flavor is usually used to combinely express the taste and odour of the food. The odour and taste work together to produce flavour. It’s often difficult to determine the flavours of foods with a blocked nose. Flavour is a combination of taste, smell/aroma and feeling (astringency, bite etc. especially in spices, wine and coffee) in short it is combination of taste and aroma. Flavour embraces the senses of taste, smell and a composite sensation known as mouth feel. Taste is due to sensation felt by tongue. Taste is limited to sweet, sour salty and bitter. The dimension of these can be measured chemically and can be related to the consumer's preferences. Smell /odour, an important factor in flavour can be estimated by gas chromatography and related to flavour acceptability. Aroma is due to stimulation of olfactory senses with volatile organic compounds. Aroma may be fragrant, acidic, burnt, pungent, enzymatic, spoilage.

Appearance [COLOR]

Appearance of a food is influenced by several factors. It encompasses the size, shape, ergonomics, colour, gloss/shine, physical state, temperature and surface texture of the food. Appearance is therefore vitally important for the food to be eaten and enjoyed. Several terms such as firm, dry, crumbly, flat, crisp, lumpy, fizzy, fluffy, smooth, stringy, crystalline, cuboid, fragile, dull etc. which are used to describe appearance. Most of these properties can be identified by seeing the food and without touching it. Color of food can be defined as energy distribution of light reflected by or transmitted through a particular food. It is one portion of the input signals to the human brain that ultimately results in human perception of the appearance. The portion of the electromagnetic spectrum to which our eye is sensitive ranges from 380-770nm; which a very small region of the total spectra. The color of foods varies from different shades of violet to red across the visible range of colors. The color plays an important role product preparation, quality control and determining the quality of certain foods as per the laid standards/law e.g. the color values for tomato products, jams, mustard oil, etc. Judgment of the ripening of the fruits is also influenced by colour. The strength of coffee and tea is also judged on the basis of the colour of the beverage. Apart from the subjective evaluation of the colour by human eye; the measurements of the color can also be one by instrument methods such as LovibondTintometer, Hunter color meter and color meters based on CIE (Commission Internationaled'Eciairage) system. The Hunter color system is based on the color space and expresses color in terms of L, a, and b. The parameter L represents brightness / lightness, 'a' represents redness when positive and greenness when negative whereas 'b' indicates yellowness when positive and blue when negative. The CIE system measurements are expressed in terms of hue, chroma and brightness.

TEXTURE. The texture is expressed as consistency depending upon the physical state of the food item, usually referred for liquid or semisolid foods. It also plays an important role in governing the appearance of the food part from color and is assessed by sight of the food. However, principally, texture of food is assessed through touch by hand and the responses from the oral cavity and mouth. When food is placed in the mouth, the surface of the tongue and other sensitive skin reacts to the feel of the surface of the food. The sensation is also known as mouth-feel. Different sensations are felt as the food is chewed. The resistance to chewing also affects texture, e.g. chewiness, springiness. The different terms used to express the texture are: brittle, rubbery, gritty, bubbly, sandy, tender, waxy, soft, firm, flaky, crisp, fluffy, dry, crumbly, lumpy, smooth, hard, mushy or soggy, sticky, chalky, grainy and fibrous. The expressions sandy, chalky are also used to express taste. The consistency expression is highly correlated with viscosity characteristics of liquid and semisolid foods wherein the terms such as runny, thick, watery, fluid etc are used. Temperature plays a significant role in deciding the texture of a food material on the other hand the mouth also detects temperature of food e.g. cold icecream, warm bread, hot soup/ coffee, chilled beverage etc which are equally important quality attribute when the food is being served and can play crucial role in consumer's reaction to the food. Hence, the texture is overall assessment of the feeling by hand and mouth.

There are three categories of textural characteristics. The mechanical characteristics related to the reaction of food to stress, geometrical characteristics related to size, shape and orientation of the particles within the food, while the other characteristics refers to the perception of the moisture and fat contents of the food. The mechanical characteristics are further divided into primary properties such as Hardness, Cohesiveness, Viscosity, adhesiveness etc:

1) Cohesiveness: Degree to which the sample deforms before rupturing when biting with molars.

2) Hardness: Force required for deforming the product to given distance, i.e. force to compress between molars, bite through with incisors, compress between tongue and palate.

3) Viscosity: Force required for drawing a liquid from a spoon over the tongue.

4) The secondary properties involve terms such as brittleness, chewiness, gumminess, fracturability, firm, soft, juiciness, greasy etc.

5) Denseness: Compactness of cross section of the sample after biting completely with the molars.

6) Dryness: Degree to which the sample feels dry in the mouth.

7) Fracturability: Force with which the sample crumbles or cracks or shatters. Factorability encompasses, Crumbliness, crispiness, crunchiness and brittleness.

8) Graininess: Degree to which a sample contains small grainy particles.

9) Gumminess: Energy required disintegrating a semi-solid food to a state ready for swallowing.

10) Roughness: Degree of abrasiveness of product's surface perceived by the tongue.

11) Heaviness: Weight of product perceived when first placed on tongue. Moisture absorption: Amount of saliva absorbed by product. Moisture release: Amount of wetness/juiciness released from sample.
12) Mouth coating: Type and degree of coating in the mouth after mastication

13) Slipperiness: Degree to which the product slides over the tongue.

14) Smoothness: Absence of any particles, lumps, bumps, etc., in the product.

15) Uniformity: Degree to which the sample is even throughout.

16) Uniformity of Chew: Degree to which the chewing characteristics of the product are even throughout mastication.

17) Uniformity of bite: Evenness of force through bite.

18) Wetness: Amount of moisture perceived on product's surface. Mouth-feel is a product's physical and chemical interaction in the mouth.

The sensation of mouthfeel encompasses astringent, hot, cold and cooling effects. It is a concept used in many areas related to the testing and evaluation of foodstuffs, such as wine-tasting and bread rheology. It is evaluated from initial perception on the palate, to first bite, through mastication to swallowing and aftertaste. In wine-tasting, for example, mouth-feel is usually used with a modifier (big, sweet, tannic, chewy, etc.) to the general sensation of the wine in the mouth. Several instrumental methods are available for measurement of these attributes, which could be correlated to the consumer's preferences. The texture related parameter measuring instruments are Universal Texturometer, Brookfield Viscometer, Roto-viscometer, Shear press (Cutting force measurement equipment), Penetrometer (grain tester), Digital Texture analyzer, Rapid visco analyzer (RVA) etc.

Other factors affecting the human perception of quality attributes

Although the senses play an important role in determining our food preferences, and helping us to evaluate food, other factors are also involved. The psychological and physiological status of an individual plays a major role in his response to a particular food. The several factors involved in individual expression about the quality attribute of a food material include:

a. Previous experiences with food: if a particular food consumed was disliked earlier, the next response prior to consuming it will start with reduced acceptance. Or if the product is your favorite fruit or dish, the response in expressing its quality will likely to have its effect.

b. Hunger and satiety: The food craving of an individual depends upon the physiological status of energy level in the body and emptiness of stomach.

c. Mood: it refers to the psychological status

d. Surroundings: It refers to the locations and ambience where the food is being served or being eaten, e.g. home, canteen, picnic.

e. Beliefs and values: The preferences and reactions to the food are also dependent on individuals, e.g. religion, culture, tradition and eating habits

. f. Social aspects: Social aspects such as special occasions, events, and parties also influence the expression about the quality attributes of food.

The time of tasting a particular product is also important e.g. eating ice-cream early morning may not be very pleasant while the icecream post dinner may be more enjoyable. Therefore commercial food testing is recommended to carry out in sensory laboratories with uniform surroundings to all the testers.

Other factors affecting the quality attributes of food:

The initial quality of any food item is governed by certain factors. These are genetics or origin of the food, Pre-harvest environment, Harvesting practices, and Post Harvest handling. Specific recommended cultivars for one area of the country or even within the state may not apply to another area. Although high visual quality is desirable for most processing methods, the composition of the fruit in relation to flavour, texture, colour and nutritional value is of paramount importance. Certain pre-harvest factors include irrigation, sunlight, hygiene etc. In citrus fruits such as oranges, mandarins and lemons, excess irrigation cause high acidity and deficiency of moisture reduce fruit size, juice content and increases thickness of peel. Harvesting factors: method of slaughtering in meat products (halaal or zatka), Stage of maturity in cereals and pulses, ripeness and physiological age in fruits and vegetables, method of milking the dairy animals etc. are important factors affecting quality.

Methods for Determining Quality: Broadly two methods are used for determination of the quality in food industry as shown below:

Subjective Method: In this method, individual is required to give his opinion about qualitative/quantitative values. This method is also referred as sensory analysis. It is by experience of the individual. Different subjective methods are used for estimation like: 9 -point Hedonic Scale, Triangular test or Composite test. This evaluation by trained panelists (limited number) is also referred as effective analysis. Results of such method are fairly reproducible. However, another sensory

evaluation called as affective analysis refers to untrained individuals evaluating the food but involves a large group of population. This provides general opinion about the food acceptably.

Objective Methods: These are based on recognized standard's scientific tests to any sample of the product without regard to its previous history. They represent the modern idea in quality control (QC) because the human element has been excluded. The methods include physical, chemical and microbiological approaches. The physical method mainly covers the appearance, colour, odour and texture of the food item and is done by several instrumental methods assisting the human judgments. While the chemical methods are used for evaluation of include the hidden quality attributes. These are standard food analysis methods. These are used for quantitative evaluation of nutritive value e.g. moisture, specific gravity, fat, oil, protein, carbohydrates, fibre, enzyme, vitamins and pH, Total soluble solids (TSS) etc. The microbiological quality attributes involve analysis mainly to ensure safety aspects of food for human consumption. It is essential to meet standard specifications with respect to total plate count, yeast & mold count and presence of coli forms. Microbiological quality is also used as markers

ConclusionThe importance of each quality attribute differs with the type of product. The appearance is governed by color and ergonomics of the product while the texture is studied depending upon the physical state of the product. The maturity and processing steps involved are the important factors controlling the initial quality of the finished product. Among the other factors influencing the consumer perception to food include psychological status, physiological status, age and social surroundings. There are several instrumental methods for evaluating sensory parameters to avoid human bias; however on a commercial scales either a trained panel or instrument based judgments by expert is used to monitor the food quality attributes. monitor certain process quality.