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Implication of Sensory Evaluation and Quality Assessment in Food Product Development: a Review

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Abstract

The quality of food products is determined by physical properties, chemical composition, the level of contaminants (microbiological and toxic substances) and sensory attributes. Consumers around the world demand consistent supply of quality food products that reflect the value of the price they pay for them. The nature of raw materials and ingredients reflect the quality of food products in the market. Raw materials as well as packaging materials should be purchased based on the quality specifications that suppliers should adhere to. This review aimed at highlighting the importance of using objective assessment tools and consumer/sensory evaluation in determining the quality and acceptability of new food products. Objective tests are used to measure one particular attribute of a food product rather than its overall quality. They are generally rapid, reliable and repeatable. On the other hand sensory methods measure the reaction to stimuli resulting from the consumption of a product. Sensory testing is often used to determine consumer acceptability of a food product and contributes to the design of quality systems hence considered as a technical support for quality assurance during food production. Not only that but also it helps to obtain feedback for making decisions and carrying out proper modification of a particular food product. Therefore objective methods and sensory evaluation are indispensable tools for routine quality control of new food products as well as the existing ones.

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Introduction

Globally consumers demand consistent supply of high quality foods. Food quality may encompass parameters such as organoleptic characteristics, physical, functional properties, nutritional value and consumer protection from adulteration; on the other hand food safety is more associated with the content of various food chemical and microbiological characteristics.[1] Food safety can be measured via the examination of food items with regard to their microbial contamination, chemical contaminants or presence of physical foreign matter.[1] There is general view that food safety is of great concern especially when it comes to human health, and various efforts have been dedicated by several sectors to ensure that safer foods are obtained to the highest degree possible.[1]

In many developing countries consumers are substantially conscious about the existence of potential risks in their foods, hence the need for safety and quality standards in all stages along the food supply chain.[3] The impact of this awareness often observed when consumers buy foods that are made by big companies rather than the smaller ones, as they believe that quality products are normally produced by big companies.[4]

In developing countries, mid-size and small companies develop new food products and introduce them to the market, however these products are usually made from non-standardized materials and processes resulting into quality variations.[5] Poor quality control is common to small scale food processing enterprises and has been considered as the cause of the enterprises' weakness in terms of price, quality and delivery performance. Identifying internal and external requirements is imperative for a consistent improvement and maintenance of quality hence consumer satisfaction.[6]

In any company or organization, employee responsiveness, motivation and satisfaction are needed for ensuring quality, and the prevention of errors and faults should be preferred to detection and correction.[7] Food companies need to build their product specifications on consumer likings and ensure that markets are segmented on the basis of consumer wants and needs.[4] This is why most big companies use objective tests and subjective tests/ sensory evaluation as a daily routine to maintain safety and quality of food products.[8]

Objective tests/tools include physical, chemical and microbiological analyses of foods,[8] whereas subjective tools comprise of discriminative tests, descriptive tests and affective tests. They are essential part of both new product development and quality control, they also support marketing and marketing research activities.[9] In many cases quality means different things to different people, for example the appearance of the commodity is the most critical factor in the initial purchase while texture and flavor may determine subsequent purchases 10. The purpose of this review is to highlight the importance of using objective assessment tools and consumer/sensory evaluation in determining the quality and acceptability of new foods or food products.

Quality Control Programs

The major role of quality control programs is to ensure that raw materials and finished products are handled, processed, packaged and stored according to the required standards. Giovannucci and Satin[11] highlighted the fundamental functions of a quality control programs as:

- Physical and chemical evaluation of raw materials and processed products.
- In-process control of i) Raw materials, ingredients and packaging supplies ii) Processing parameters and iii) Finished products.
- Microbiological analysis of raw materials and finished products.
- Control of storage and handling environments.
- Sanitation and waste products control.
- Assurance that final products are within the established legal and marketing standards.

Type of Objective Evaluation Methods and their Significance In Quality Assessment of Foods or Food Products

Objective methods involve the use of instruments in carrying out evaluation of various attributes in food instead of human sensory organs. They are important in identifying contaminants in foods and uncover faulty processing and adulteration.[8] These tools include chemical tests which are used

for the determination of chemical composition as well as chemical and metal contaminants in foods; microbiological methods that are used for detecting microbial contamination, insect excreta and other fragments in foods; and physical methods which are used for measuring characteristics like texture, viscosity, color intensity, turbidity and fill weight among others.[8] These methods focus on the determination of a specific characteristic of a food product than its overall quality. Usually they measure an attribute of the food that has a major effect on quality, so instruments need to be standardized with materials having properties that are comparable to the foods to be tested. To ensure quality and acceptability of new food products, objective tests should go hand in hand with sensory evaluation.[8]

Physical Methods

The physical methods deal with attributes like appearance (size and shape), texture, color, viscosity, turbidity, firmness and imperfection, not only that but also process variables such as headspace, fill weight, drained weight and vacuum.[12] These are the rapidest methods which involve the least amount of training.[12, 13] Appearance factors are useful in sizing and grading, which ensure uniformity and enhance the process of buying and selling. Therefore appropriate grading improves the quality of end products. Physical properties of food are important for the proper product designing and the prediction of the foods' response to processing, distribution and storage conditions.

Chemical Methods

These are used for quantitative and qualitative evaluations, as well as determination of nutritive values in foods. The composition of a food largely determines its safety, nutrition, physicochemical properties, quality attributes and sensory characteristics.[14] Chemical substances also play an important role in food production and preservation. For instance, coloring agents make food more attractive, flavorings make food tastier and stabilizers prolong the shelf life of food while food supplements are used as sources of nutrition.[14] Chemicals have a variety of toxicological properties, some of which might cause negative effects in humans and animals.[15] The control of food quality and safety is based on the determination of chemical composition as well as chemical and metal contaminants such as heavy metals and other toxic substances which can lead to acute poisoning and other health effects.[16] Usually, chemical substances are not harmful unless we are exposed to levels beyond standards for a long time. In new product development, chemical methods are useful in establishing safe levels which in turn notify decision makers who regulate the use of chemicals in foods or seek to limit their presence in the food chain.[17]

Chemical Contaminants in Foods

Chemicals of greatest concern for health are naturally occurring toxins, these include mycotoxins, marine biotoxins, cyanogenic glycosides and toxins occurring in poisonous mushrooms. Staple foods such as cereals (maize, sorghum, wheat) and nuts (peanut) can contain high levels of mycotoxins (aflatoxin and ochratoxin) produced by Aspergillus. A long-term exposure to these mycotoxins could cause cancer and affect normal development and immune system.[14]

Dioxins and polychlorinated biphenyls (PCBs) are example of persistent organic pollutants that can accumulate in the environment and human body. Dioxin is highly toxic substance that can cause reproductive and developmental problems, great human exposure to dioxin is through foods such as meat and dairy products, fish and shellfish. Health effects of dioxins to human include skin lesions and altered liver function. It may also results into compromised immune system, nervous system, endocrine system and reproductive functions. Additionally, chronic exposure of animals to dioxins has been reported to cause several types of cancer.[18, 19, 20]

Metal Contaminants in Food

Heavy metals such as lead, mercury, arsenic, cadmium, chromium and nickel are naturally occurring chemical compounds, they can be present at various levels in the soil, water and atmosphere.[21] Metals can also occur as residues in food as a result of human activities like farming, industrial operations and automobile exhausts.[16] Exposure to these metals is through both naturally occurring and man-made chemical compounds present at various levels in the environment including contaminated foods and water.[22] During food product development they must be checked to ensure food quality and safety.[17]

Concentrations of these metals are enhanced by human activities and can enter plant, animal and human tissues through inhalation, diet and manual handling which in turn can bind structural proteins, enzymes and nucleic acids hence interfering their normal functioning.[23] Generally, long-term exposure to toxic heavy metals is associated with carcinogenic, circulatory, central and peripheral nervous system effects.[16]

Table 1: Heavy metals and their effects to human health

Metal	Acute exposure	Chronic exposure
Lead	Loss of appetite, headache, hypertension, abdominal pains, renal dysfunction, fatigue and sleeplessness	Mental retardation, birth defects, allergies, weight loss, paralysis, anemia, kidney and brain damage
Mercury	Diarrhea, fever and vomiting	Microtubule destruction, swollen gums and mouth, mitochondrial damage, nephrotic syndrome and lipid peroxidation
Cadmium	Pneumonitis (lung inflammation) and oxidative stress	Cancer (lung, liver, bladder and skin) and proteinuria (excess protein in urine)
Arsenic	Nausea, vomiting, diarrhea, Encepha-lopathy, arrhythmia and painful neuropathy	Diabetes, cancer and Hypopigmentation/ Hyperkeratosis
Chromium	Gastrointestinal hemorrhage, hemolysis, acute renal failure, breathing problems	Pulmonary fibrosis and lung cancer
Nickel	Allergic reactions	Reproductive and developmental effects

Source: Interdisciplinary toxicology[15] Duruibe *et al*[21] CHSR[17] CHSR- Center for Hazardous Substance Research

Therefore, chemical methods are crucial during food product development as they help safeguarding the quality of new food product and hence consumers' health.

Microbiological Methods

These methods are used in detecting food contamination by microorganisms such as bacteria and fungi (yeast, mold), also used to detect the presence of insect fragments, insect excreta and other foreign materials in food products.[24] For efficient quality control programs, they require significant training of the technical personnel to properly interpret results. Microorganisms can cause food poisoning and spoilage which principally affect food quality, major pathogens for this include *Clostridium perfringens, Escherichia coli* (O157:H7) and Shigella spp.[25]

Microorganisms are all over the place and they are commonly found in faeces, soil and water; rats, mice, insects and pests; domestic, marine and farm animals (e.g. dogs, fish, cows, chickens and pigs); and human body parts (bowel, mouth, nose, intestines, hands, fingernails and skin).[26]

Soil-borne microorganisms such as clostridia are common on raw vegetables, while *Clostridium botulinum* are targeted when designing processing steps to destroy them. Many food borne microbes are present in intestines, hides, feathers of healthy animals which are raised for food. For example, Salmonella serotypes have been scientifically found to infect a hen's ovary.[27] Salmonella spp have been a particular concern with foods of animal origin (e.g. meat, poultry, eggs and dairy products).[28] For Campylobacter spp, the most common foodborne species are *Campylobacter jejuni* and *Campylobacter coli.* Members of this genus are susceptible to environmental stresses and cause gastroenteritis associated with headache, diarrhea, fever, abdominal pain and muscle pain.[29]

Environmental contamination may result from different sources including ingredients used in processing, either directly or indirectly, worker's hands, shoes, walls and floors. In food processing, food borne microbes can be introduced through humans who handle the food, or by cross contamination from some other raw agricultural materials and/or the establishment environment.[30] Insect damage, physical injury, enzymatic degradation and microbial activity can make food undesirable for human consumption.[27] Toxigenic pathogens create food "poisoning" by producing an enterotoxin in the food, a good example is staphylococcal enterotoxin-induced illness. Common foodborne bacteria are Campylobacter, Salmonella (non-typhoidal), *Listeria monocytogenes, E. coli* (O157:H7), *Clostridium perfringens*, Staphylococcus and Shigella spp.[27]

On one hand, food spoilage can be caused by molds, these are the major agents especially in vegetables where bacterial growth is not favored (e.g. low pH). Most molds invade plant tissue through surfaces such as a bruise or crack and spores are frequently deposited at these sites by insects for instance *Drosophila melanogaster,* the common fruit fly.[30] Yeasts, molds and lactic acid bacteria can as well spoil fermented vegetables such as sauerkraut and pickles, not only that but also other acid foods like salad dressings and mayonnaise. Spoilage in fermented vegetables is often manifested by off odors or changes in the color known as chromogenic colony growth or texture (eg. softening) of the product.[31] Some common routes in which microorganisms enter food products include soil, water, established environment, animal feeds, animal hides, food handlers, food utilities, air, dust, vegetable products and imported and exported products.[27]

Most agricultural products and foods of animal's origin carry a wide range of bacteria. During production, processing, packaging, transportation, preparation, storage, and service, any food may be exposed to bacterial contamination and or microbial toxins that may result into mild to severe illnesses.[32] Since it is not possible to produce food with zero pathogens, microbiological methods help to ensure that manufactured food products are within the level of pathogen contamination that provides a scientifically acceptable risk.[14] Generally, objective methods (physical, chemical and microbiological) provide a milestone for quality control. In new food product development these methods should be well implemented and their final results should positively reflect the expected quality of the new food products. Emphasis should be directed to small scale food processing as well as indigenous food production.

Sensory Evaluation Methods

Sensory evaluation measures the reaction to stimuli resulting from the consumption of a food or food product.[33 34] It is concerned with providing answers to questions about product quality and existing competitor products as well as questions that are most often asked by persons concerned with technical, development, research and production; not only that but also factory managers, quality assurance managers and marketing managers.[35] Normally, the personal preference and powers of perception involve the use of sense organs.[8]

The right answers to sensory questions are extremely important for the existence of any food product tested as they determine its acceptability and provide effective decisions for future product success in the market.[36] Sensory evaluation helps in eliminating or controlling sources of unwanted error, which can either be through control of the environment, proper experimental design and sampling of human subjects to test the products.[37] When conducting sensory analysis on food quality, it is imperative to know that there is possibility of getting wrong answers, which in turn can risk the competition of a particular food product in the market. Wrong information on food product could lead to miscommunication, improper decisions, wasted consumer research, and much more wasted time, effort and material costs.[8]

Panel members form an important tool of sensory analysis. Its value depends on the objectivity, precision and reproducibility of their judgments. Panelists need to be carefully screened, trained, calibrated and validated.[38] Training enhance individual's understanding of sensory attributes and hence enable them provide accurate, valid, consistent, and standardized sensory measurements that can be reproduced. Each panelist must detect, recognize, and agree upon the exact connotation of each descriptive term.[39] The panelists may be guided

to ensure consistence in their judgments by using reference standards that demonstrate variation in specific descriptive terms.[9]

Panelists are given test samples (food product) and should state their preferences. The word "preferred" can mean most acceptable, tastes best, looks best, would buy and the like.[38] Consumer responses from the product are used to modify the product. The new food product can again be tested and where possible or necessary, modified further. Sensory analysis can therefore play a fundamental role in the management of product quality in the food industry.[35]

Types of Sensory Evaluation Methods

Discriminative Tests

These tests are designed to determine if a difference exists between food products.[37] Panelists should be knowledgeable about the product in question for easy choice. Each member is required to make a choice among the given food products. Discriminative tests at some point may be used for different purposes (eg. determining sample differences/ similarities and or quantity of degree of difference/similarities).[34] To perform these tests about 10-50 panelists are recommended. Discriminative tests include triangular test, duo-trio test and paired-comparison test.

Triangular Test

In this test, normally three samples are involved when determining the overall difference between two products. Out of the three samples, two are similar and one is dissimilar. The samples must be coded with individual three-digit numbers. The taster is required to select the sample which is different from others. In these tests the chance of choosing the required sample correctly is greater. It is recommended that no more than six samples be evaluated at one testing session because the method is liable to fatigue of panelists. The tests require fewer tasters, at least 4-8 tasters are considered enough to carry single testing.[37 40]

Duo-Trio Tests

This determines whether or not a sensory difference exists between two samples. There is always a reference sample and two test samples; of the two test samples, one sample is identical to the reference, and the other one is the test sample.[41] The panel members are asked to identify the sample that is similar to reference sample. Duo-trio tests are sometimes used instead of triangle tests to compare unknown differences between samples, however they are considered less efficient than triangle tests. At least 7-10 evaluators are recommended.[42 40]

Paired Comparison Tests

These are applied when a difference in chemical composition of the sample which requires a sensory assessment is well known. Two differently coded samples are presented to each panelist at the same time and the task is to choose the sample that is perceived higher in the specified sensory attribute.[43] Tasters are asked to judge the samples by comparing them without needing to rate the magnitude of the difference, for example, "are the two samples identical or different?" or "which of the two samples sugary?".[43] Compared to triangular test, paired comparison test is less tedious and frequently used for strongly flavored or complex products. At least 7-10 panelists as for duo-trio are recommended in this test.[40 43]

Descriptive Tests

In these tests, sensory attributes of products are characterized in order of their appearances and relative intensities are assigned.[37] They provide more detailed profiles of a product by identifying the different characteristics within the product and quantifying them. Descriptive tests are more comprehensive and sophisticated as compared to discriminative tests.[44] They provide the basis for mapping product similarities and variances and determining those sensory characteristics that are important to acceptance. It is normally performed by 6 to 15 meticulously selected and trained panelists. Panelists are trained to evaluate products similar to how any instrument would give a reading. Descriptive tests include Free Choice Profile (FCP), Quantitative Descriptive Analysis (QDA), Flavor Profile Analysis (FPA), Texture Profile Analysis (TPF) and Time Intensity Analysis (TIA).[45]

Free Choice Profile

In this method, there is no prior training of the panelists, each judge decides his/her own list of attributes to label the product. The judge should constantly be trained and the response computerized, then a time-intensity curve obtained

for the determined attribute. Analysis of variance is used to analyze three parameter from the curve, namely maximum intensity, the point at which maximum is reached, and the first point at which no more perception occurs.[46]

Quantitative Descriptive Analysis

This consists of progressive survey of sensory terms for a product generated by a trained sensory panelists using nontechnical language. Trained judges normally reach a consensus on the relative discrepancies between the samples.[47] QDA and FCP have the same purpose of determining the intensities of all product attributes and also defining the complete sensory profile.

Flavor Profile Analysis

This is useful for identifying sample taste and odor. It is a technique that provides a written record of noticeable aroma of a product, flavor and aftertaste components. Panelists characterize individual aroma and flavor in the order perceived and assign a constant rating scale. Normally 4-6 panelists are suggested. They independently examine the product and record their impression in terms of aroma, flavor and aftertaste. Finally report is presented to a panel leader in an open discussion.[48]

Texture profile analysis: This has been widely applied to test solid and semisolid food products. Usually it involves a panel of 6-9 members; textural attributes and other evaluation procedures are established unanimously by panel members before carrying out the evaluation of the products in question.[49 50] TPA is convenient for rapid evaluation of food texture which is normally measured only by humans. In some experiments, liquid samples that cannot keep their shape but flow under gravity are poured into a cup and subjected to uniaxial compression.

Then the parameters obtained from uniaxial compression are then discussed without considering the physical meaning of these parameters namely hardness, cohesiveness and adhesiveness.[51]

Time Intensity Analysis

This is used to estimate the change in intensity of a determined characteristic with time. It has the main role of determining the intensity of any descriptor term in a product with time. TIA and FCP are among the descriptive sensory tests mostly used in scientific studies and by the food companies.[46]

Affective/ Consumer Acceptance Tests

Affective methods are also called subjective methods. These are very useful for evaluating food acceptability or preference (which product is liked or preferred). Normally large number of respondents is required (50-150 panelists considered adequate). Panelists are not trained but selected based on previous use of product, economic social level and geographical area.[33]

Preference Ranking

In this technique, three or more samples are rank-ordered with one sample being preferred over the other. This type of test supply information about people's likes and dislikes of a product and determine how various samples differ based on a single distinguishing attribute. In consumer analysis, the panelists are asked to rank the coded samples according to their preference.[52]

Hedonic Rating Scale

This is among of the widely used sensory evaluation methods that measure consumers' level of liking of food products.[53] In practice there are 9-point Hedonic scale, 7-point Hedonic scale and 5-point Hedonic scale. The 9-point Hedonic scale range from "like extremely'' to "dislike extremely''. Practically, not fewer than five points are recommended.[34]

Some of the Requirements for Sensory Evaluation

There should be clear objective for conducting sensory analysis, appropriate area for preparation of food samples to be tasted, test procedures which should be properly implemented in a way that reduce risks to health of participants, good laboratory, proper method of sample presentation, sensory panel members suitable for evaluation (If training is needed, they must be trained), utensils / glass wares suitable for different foods to be tested, sophisticated sensory booths with controlled temperature (20°C – 22°C) and relative humidity at 40 ± 5%, suitable lighting in booths, right coding of samples (usually 3 digit coding is preferred) and special software for statistical analysis of sensory data.[35 54] Sensory evaluation is very crucial in the new product development. When properly implemented with controls, careful screening of panelists, effective

training as well as proper statistical interpretation, it can provide many benefits and form a basis on which accurate decisions can be made relating to the food product in question.[55]

Table 2: Summary of sensory methods

Question	Method	Types
Are products different?	Discrimination test	-Triangle test -Duo-trio test -Paired comparison test
If products are different, how are they different?	Descriptive tests	-Quantitative descriptive analysis -Free choice profile -Time intensity analysis -Flavor profile analysis -Texture profile analysis
What is the acceptability of a product? Is one product preferred over another?	Affective/Acceptance	-Hedonic rating scale (5- Point, 7-Point and 9-Point Hedonic scale) -Preference ranking

Source: Stone[34] Cruz *et al*[46] Rosenthal[50] Kemp *et al*[54]

Linkage between Objective Evaluation Methods and Subjective/Sensory Evaluation

Objective tools use equipment for routine quality control, involve physical, chemical and microbiological techniques. They are faster and more efficient in a way that one can perform the test on many samples in a day.[8] On the other hand subjective/sensory evaluation methods involve the use of human subjects by means of their sense organs, can determine sensitivity to changes in ingredients, processing and packaging hence marked crucial for food product development and evaluation of market performance of new foods or food products.[37 38] They are expensive and time consuming (for example, it can take almost a day to perform a complete sensory analysis of two samples only). Sensory evaluation can determine the overall acceptability of food or food products than can objective tools do.[8] Therefore, in order to provide reliable information regarding acceptability and routine quality control of a particular food or food product, objective evaluation methods must be linked with sensory evaluation.

Controlling Food Quality and Safety in Small-Scale Food Production

Low compliance to Good Manufacturing and Good Hygiene Practices by small scale food producers and processors constantly lead to food contamination resulting into poor food quality and safety hence exposing consumers to risks of foodborne diseases.[5 56] Small food producers, processors and distributors are faced with several challenges associated with food supply chain which involves stages like sourcing of raw materials, production, processing and packaging, storage, wholesale distribution and retail redistribution to consumers. Disruption of any of the stages would put the whole supply chain at risk.[57] Small-scale food industry is confronted with practical challenges of developing, implementing and maintaining food safety and quality programs.[11] Major problems associated with small-scale food production especially in developing countries include; lack of right technology, inadequate power for industrial operations, poor water supply for processing and portable use, lack of traceability, failure to control inventory in warehouses and stores, inability to maintain the safety and quality of food or food products, lack of qualified personnel with experience and technical expertise in food safety, lack of training, poor equipment layout, lack of in-house microbial risk evaluation and insufficient funds for maintaining quality standards.[57 58 59] Due to these factors, the hygienic position of facilities in small-scale food production and processing is generally low and pose a great public health risk to

consumers. It is therefore necessary to address food quality and safety challenges faced by small-scale businesses by good planning and risk assessment, regular trainings and routine observation of quality standards.[57] [56] It has to be remembered that, an efficient food supply chain not only ensure quality of food products but also maintain customers for the particular food or food products.

Global Application of Objective Methods and Sensory Evaluation in Quality Control of Food Products

Globally, physical, chemical, microbiological and sensory evaluation methods are among the analytical procedures used to provide informed features on diverse food products (eg. composition, physicochemical properties and sensory qualities). Such information enhances the ability of most food companies/ industries to economically produce foods that are constantly safe, nutritious and suitable for consumers.[36] However, current findings indicate that these methods are underutilized in a wide range of food industries/ companies particularly under small scale production. For example, in most African countries application of quality assessment and sensory evaluation methods in product development is still a big challenge. This is reflected by a wide range of unsafe foods available in the local markets across the region. Most foods used are subject to hazards and microbial contamination, including mycotoxins which in turn represent serious threats to human health within the continent.[60] [61] Problems occur as a result of poor postharvest handling practices. Not only that but also inadequate or absence of facilities such as storage facilities (eg. cold stores), and transport facilities increase microbial contamination and food loss.[59] Poor delivery of quality food products is also contributed by low access to modern equipment and inappropriate packaging materials as well as low quality of raw materials by small-scale food processing enterprises.[5] Therefore authorities responsible for quality control and food safety management at the national level are given an alert that they still have a lot to do in ensuring quality and safety of foods towards safeguarding consumer's health.

Challenges Facing Food Control Authorities In Developing Countries

According to FAO/WHO,[56] some of the challenges that food control authorities still encounter are:

- Increasing burden of food-related illness and emerging foodborne hazards.
- Changes in technological advancement in food production, processing and marketing.
- Problems to food processors as related to timely delivery of raw materials.
- Lack of trained analytical staff in most of food control laboratories impedes quality standards.
- Need for harmonization of food safety and quality standards globally.
- Rapid urbanization and increasing consumer awareness about food safety and quality issues.

These influence changes in lifestyle.

Strategies to be Implemented at The National Level to Ensure Food Safety and Quality Control

Attainment of food control system at the national level requires consideration of current or emerging food safety and quality issues.

- Effective quality control should be focused on the following crucial areas; the factory building; machinery and equipment design and installation; manufacturing system; process and product identification; product design; raw and ingredient materials and packaging materials, and the market through intensive consumer response program which can provide the required feedback.
- Appropriate and consistent training of food inspectors should be compulsory. They must be well trained to understand the industrial processes, identification of potential safety and quality problems, and have all the required skills to inspect the premises, collect food samples and carry out general assessment. The food inspectors should also be well trained and equipped with Hazard Analysis and Critical Control Points (HACCPs) and handle HACCP audit responsibilities.
- Routine hygienic control of street foods should

be observed, these foods are mostly prepared and retailed under unclean environments.

- Control measures should mostly focus on training of food producers, shippers, processors, distributors and handlers in hygiene practices to improve safety of particular foods.
- Governments should effectively support small food processing units so that they absorb better technology and finally deliver quality food products.
- The Food Control Management should lay down the standards for food control laboratories and regularly monitor their performance. Additionally, food control agencies should prioritize and promote the specific requirements for the training of their food inspectors and laboratory analysts.
- The need for Quality Management Systems (QMS) involving farmers, processors, handlers and traders is imperative. Sound measures should address Good Agricultural Practices (GAP), Good Hygienic Practices (GHP), Good manufacturing Practices (GMP), Good Transportation Practices and Good Storage Practices (GSP).

Conclusion

Objective tools (physical, chemical and microbiological tests) and sensory /consumer evaluation are very significant in new product development as they ensure food product quality and safety. Product manufacturers and service industries/ companies require persistent and committed efforts for enhancement of products and service quality. This will maintain constant acceptability of the new food products and hence competition in the local and global markets. Consumer acceptance mainly determines the sensory quality of products, therefore sensory evaluation should always go hand in hand with instrumental analysis in laboratories and food manufacturing companies. It is also important to have specialized professionals within food industries/companies, who can help avoiding the use of wrong sensory results which in turn may threaten the success of the particular food or food products during marketing.

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