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Sensory Attributes and Sensory Evaluation Methods of Some Locally Consumed Foods

By

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Executive Summary

This compilation documents the principal sensory attributes of various food products of some locally consumed foods as well as procedures for the sensory evaluation of foods. It was possible to compile this pamphlet as a result of experiences gained over the years in conducting sensory evaluation studies as well as through informal interview of a cross section of people. The purpose is to make available concise reliable information that can serve as a reference for anyone who intends to carry out sensory studies on certain locally consumed foods. The food products covered include; cereal and grain products, starchy roots, tubers and their products, fish and meat products, fruit and vegetable products, soups, stews, confectionery products and others. The sensory procedures include amongst others facilities for sensory evaluation, environmental control, sample preparation, selection of panelists, sensory practices and methods and the factors affecting sensory measurements. Simple statistical analyses of sensory data are also covered in significant detail. The information provided is expected to be of much relevance to both students and professionals in the area of biochemistry, food science and technology and other agricultural sciences who may at one time or the other require the use of sensory studies in the course of food product development or general quality control.

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CHAPTER 9

TERMS AND DEFINITIONS

TERMS	DEFINITIONS
Flavour	
Odour	Refers to aroma or flavour of the sample
Raw	Aromatic associated with raw peanut.
Cook	Aromatic associated with peanuts boiled in water for one hour
Roasted	Aromatics associated with medium- roasted peanut.
Oxidized	Aromatic associated with stale peanuts.
Cardboard	Aromatic associated with flour.
Sweet	Taste on the tongue associated with sugars.
Bitter	Taste on the tongue associated with caffeine.
Salty	Degree of the taste sensation associated with the flavour of sodium chloride.
Fruity	Degree of aromatic or fruitlike flavour.
Texture	
Texture	Refers to finger feel
Adhesiveness	Force required to remove the material that adheres to the palate during the normal eating process.
Gumminess	Amount of energy needed to disintegrate a semi-solid food to a state ready for swallowing.
Graininess	Degree to which grains or granules are perceived in the mouth.
Saltiness	Various degrees of the taste sensation associated with the flavour of salt
Oiliness	Degree to which free oil is perceived in the mouth.
Overall acceptability	Various degrees of acceptability of a product having considered various attributes of such a product.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION TO SENSORY EVALUATION

Sensory Evaluation is a behavioural science designed to evoke, measure, analyze, interpret and quantify reactions to those characteristics of foods and materials as they are perceived by the senses of sight, smell, taste, touch and hearing (Karen Westerman, 1989). Sensory evaluation may be done under formal restricted panel situations or under less formal consumer type situations. The perception of quality characteristics (both external and internal) determines a consumer's decision to purchase a product (IFT, 1990).

Sensory quality of a food or food products is defines as "the acceptance of the sensory characteristics of a product by consumers who are regular users of the product category or who comprise the target market for the product" Galvez and Resurreccion, 1992).

Thus, sensory evaluation principles are applied by market researchers in their product tests, by home economists in their product showings, and by sensory scientists in all their work.

Again, according to Resurreccion (1998), much of the success or failure of a food product in the market place is as a result of consumers' perception of sensory quality. (Resurreccion, 1998). It is therefore very important to bring to light the sensory attributes of various food and food products.

Sensory attributes that are commonly used to describe food products include Colour, Appearance, Aroma or Flavour, Texture and Taste. Also, there are five basic taste sensations that are perceived through stimulation of taste receptor cells found in the taste buds, sweet, salty, sour (acid), bitter and monosodium glutamate(as in cube). Overall Acceptability of a product is also tested. Furthermore, random numbers are usually used in coding food products during sensory evaluation in order to reduce as much as possible any influence on the results obtained.

1.2 PURPOSE OF THE REPORT

The purpose of this report is to make available a pamphlet that will serve as reference for anyone who wants to carry out successful sensory evaluation studies of certain locally consumed foods.

CHAPTER 2

CEREALS AND GRAIN PRODUCTS

The major cereals/grains include rice, corn, millet, and sorghum. The respective food products made from them include: Raw rice, Plain rice, and *Waakye* from rice; *Koko*, *Banku* mix (powder) and *Banku* mix (cooked) from corn/maize. The principal sensory attributes of relative importance to each of the products together with the possible sensory descriptors are listed in tables below. The sensory attributes are specified in the first row of each table with the possible descriptors listed in the columns below each attribute.

2.1 Rice And Rice Products

Table 2.1.1 Rice (Raw): Sensory attributes of raw rice and their possible descriptors.

Colour	*Appearance*	*Overall Acceptability*
Uniform colour	Brightness	Slightly acceptable
Black specks	Translucent	Moderately acceptable
White specks	Clean	Extremely acceptable
Yellowness	Chalking appearance	
Brownness	Unshelled paddy	
Creamy colour	Polished	
	Whole grain shape	
	Long grain	
	Short grain	
	Slender	
	Clean appearance	

Table 2.1.2 Rice (Cooked): Sensory attributes of cooked rice and their possible descriptors.

Odour	*Taste*	*Colour*	*Texture*	*Appearance*	**Overall Acceptability**
Rice odour	Sweet taste	Yellow colour	Sticky texture	Uniform appearance	Slightly acceptable
Strength of odour	Sour taste	Brown colour	Gritty texture	Whitish appearance	Moderately acceptable
Old paper scent	Salty taste	Cream colour	Sandy texture	Black specks	Extremely acceptable
	Creamy taste	Whitish appearance	Hard texture	Uniform appearance	
				Whitish appearance	

Table 2.1.3 Waakye: Sensory attributes of *waakye* and their possible descriptors.

Odour	*Taste*	*Colour*	*Texture*	*Appearance*	*Overall Acceptability*
Rice and beans odour	Sweet taste	Brown colour	Sticky texture	Uniform appearance	Slightly acceptable
Strength of odour	Sour taste	Slightly brown colour	Grainy texture	Black specks	Moderately acceptable
Old paper scent	Salty taste		Sandy texture		Extremely acceptable
			Hard texture		

Table 2.2.1 Koko: Sensory attributes of *koko* and their possible descriptors.

Appearance	*Taste*	*Odour*	*Colour*	*Texture*	**Overall Acceptability**
Smooth appearance	Sour taste	Typical porridge odour	White-colour	Chaffy	Slightly acceptable
Rough appearance	Salty taste	Slightly fermented odour	Brown-colour	Gritty	Moderately acceptable
Chaffy appearance	Sweet taste	Moderately fermented odour	Off-colour	Rough texture	Extremely acceptable
Gritty appearance	Typical porridge taste	Extremely fermented odour		Smooth texture	
Skin formation					

Table 2.2.2 Banku Mix (Powder): Sensory attributes of powdered *banku* mix and their possible descriptors.

Appearance	*Colour*	*Odour/flavour*	*Texture*	*Overall Acceptability*
Smooth appearance	White	Typical fermented corn aroma	Chaffy	Slightly acceptable
Rough appearance	Light brown	Off-flavour	Gritty	Moderately acceptable
Chaffy appearance	Off-white colour		Rough texture	Extremely acceptable
Grittiness appearance			Smooth texture	
			Powdery texture	

Table 2.2.3 Banku Mix (Cooked): Sensory attributes of cooked *banku* mix and their possible descriptors.

Appearance	*Taste*	*Odour*	*Colour*	*Fermentation*	*Texture (finger feel)*	*Mouthfeel*
Rough appearance	Typical kenkey taste	Typical banku odour	Off-white	Low	Smooth Texture	Aftertaste
Smooth appearance	Slight sour taste	Slightly fermented odour	Creamy	Medium	Rough Texture	Sticky
	Extreme sourness	Moderately fermented odour	Slight yellowness	High	Chaffy texture	Lumpy
		Extremely fermented odour			Gritty texture	Chaffy
					Sticky texture	

Table 2.2.4 Kenkey: Sensory attributes of *kenkey* and their possible descriptors.

ppearance	*Taste*	*Odour*	*Colour*	*Fermentation*	*Texture (Finger Feel)*	*Mouthfeel (Aftertaste)*
Rough appearance	Typical kenkey taste	Typical kenkey aroma	Off-white	Low	Smooth Texture	Sticky texture
Smooth appearance	Slight sourness	Slight fermented odour	Creamy	Medium	Rough Texture	Lumpy texture
	Extreme sourness	Extremely fermented odour	Slightly yellowish	High	Chaffy texture	Chaffy texture
		Normal odour			Gritty texture	
					Sticky texture	

Table 2.2.5 Corn Grits: Sensory attributes of corn grits and their possible descriptors.

Appearance	*Odour*	*Colour*	*Texture*	*Overall Acceptability*
Whitish appearance	Fresh corn odour	White	Gritty texture	Slightly acceptable
Chaffy appearance	Old corn odour	Off-white	Rough texture	Moderately acceptable
			Chaffy texture	Extremely acceptable

Table 2.2.6 White Maize: Sensory attributes of white maize and their possible descriptors.

Appearance	*Odour*	*Colour*	*Texture*	*Cleanliness*	*Overall Acceptability*
White appearance	Fresh corn flavour	White colour	Extremely hard	Sandiness	Slightly acceptable
Off-white appearance	Old paper odour	Off-white colour	Very hard	Presence of stones	Moderately acceptable
			Moderately hard	Presence of weevils	Extremely acceptable
			Slightly hard		

2.3 WHEAT AND WHEAT PRODUCTS/ COMPOSITE FLOUR PRODUCTS

Table 2.3.1 Bread/Bread Rolls: Sensory attributes of bread and bread rolls and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Crust*	*Texture*	*Size*	*Chewiness*	*Mouth feel*
Golden brown appearance	Typical bread aroma	Sweet taste	Crumb colour	Crust Smooth	Tenderness	Loaf volume	Elasticity	Slightly bitter aftertaste
	Off-flavour	Bitter taste	Golden brown colour		Softness		Stickiness	
		Salty taste	Light brown colour		Compressi-bility		Gummi-ness	
					Crumb perforation		Flakiness	

Table 2.3.2 100% Wheat flour/ Sweet Potato Flour-Wheat Flour /Cassava Flour-Wheat Flour Products: Sensory attributes of some bakery products and their possible descriptors.

Yeast Doughnuts, Biscuit, Scones, Spice-Nut Cake, Raised Pancake, Queen Cakes, Pastry Pie, Butter Cake, Cake Doughnut, Muffins, Cookies, Savoury Pastry Chips, Meat Pie

Appearance	*Taste*	*Colour*	*Texture*	*Mouthfeel*	*Overall Acceptability*
Gold brown appearance (if baked)	Sweet taste	Cream	Softness	Sweet Aftertaste	Slightly acceptable
Oily appearance (if fried)	Sour taste	Brown	Hardness	Bitter aftertaste	Moderately acceptable
	Bitter taste	Golden brown	Sponginess	Sour aftertaste	Extremely acceptable
	Salty taste		Crunchiness (in the case of biscuit)	Coating of tongue	Slightly acceptable

CHAPTER 3

STARCHY ROOTS, TUBERS AND THEIR PRODUCTS

Product groups of starchy roots and tubers treated include: Yam/Cocoyam and their product, Cassava and its products, Plantain and its Products and Fufu flours from yam, cassava, cocoyam and plantain. The principal sensory attributes of relative importance to each of the products together with the possible sensory descriptors are listed in tables below. The sensory attributes are specified in the first row of each table with the possible descriptors listed in the columns below each attribute.

3.1 YAM,COCOYAM, CASSAVA AND THEIR PRODUCTS

Table 3.1.1 Boiled Yam/Boiled Cocoyam/Boiled cassava: Sensory attributes of boiled yam, cocoyam and cassava and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Overall Acceptability*
Typical boiled yam/cocoyam	Typical yam/cocoyam odour	Typical boiled yam/cocoyam taste	Typical boiled yam/cocoyam colour	Slightly acceptable
White appearance	Off-flavour		Cream	Moderately acceptable
Cream appearance			White /Off-white	Extremely acceptable
			Dull white	

Table 3.1.2 Agbelima (Raw): Sensory attributes of raw agbelima and their possible descriptors.

Appearance	*Odour*	*Colour*	*Texture*
Dry or moist appearance	Typical Agbelima odour	White colour	Smooth or rough finger feel
Smooth or rough appearance	Off-odour	Creamy colour	Presence of fiber
		Brown colour	Presence of particle

Table 3.1.3 Agbelima (Cooked): Sensory attributes of cooked agbelima and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Texture*
Typical agbelima appearance	Typical odour	Typical agbelima taste	White	Sticky texture
White appearance	Off-odour	Sweet taste	Brown	Smooth texture
Dry appearance		Salty taste	Black	Rough texture
Moist appearance		Sour taste		Chaffy texture
Smooth appearance				
Rough appearance				

Table 3.1.4 Kokonte (powdered): Sensory attributes of powdwered kokonte and their possible descriptors.

Appearance	*Odour*	*Colour*	*Texture*
Typical kokonte appearance	Typical kokonte odour	White colour	Powdery texture
White appearance	Off-odour	Off-white colour	Smooth texture
Off-white appearance			Rough texture

Table 3.1.5 Cooked Kokonte: Sensory attributes of cooked kokonte and their possible descriptors.

Appearance	*Odour*	*Colour*	*Texture*
Typical kokonte appearance	Typical kokonte odour	Brown colour	Smooth texture
Brown appearance	Off-odour	Off-white colour	Lumpy Texture
Off-white appearance			Elastic texture

Table 3.1.6 Tapioca (Raw): Sensory attributes of raw tapioca and their possible descriptors.

Appearance	*Odour*	*Colour*	*Texture*
Typical tapioca appearance	Typical tapioca odour	White colour	Slightly grainy texture
White appearance	Off-odour	Off-white colour	Moderately grainy texture
Off-white appearance			Extremely grainy texture

Table 3.1.6 Tapioca porridge: Sensory attributes of tapioca porridge and their possible descriptors.

Appearance	*Odour*	*Colour*	*Texture*	*Overall Acceptability*
Typical cooked tapioca appearance	Typical kokonte odour	White colour	Smooth texture	Slightly acceptable
Brown appearance	Off-odour	Off-white colour	Lumpy Texture	Moderately acceptable
Off-white appearance			Slightly elastic texture	Extremely acceptable

Table 3.1.7 Gari: Sensory attributes of gari and their possible descriptors.

Appearance	*Odour*	*Colour*	*Texture*	*Overall Acceptability*
Typical gari appearance	Typical gari odour	Typical gari colour	Grainy texture	Slightly acceptable
White appearance	Off-odour	White colour	Lightly smooth texture	Moderately acceptable
		Off-white colour		Extremely acceptable

3.2 Plantain And Its Products

Table 3.2.1 Boiled Plantain (Unripe): Sensory attributes of boiled plantain and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Overall Acceptability*
Typical boiled plantain appearance	Typical boiled plantain odour	Typical boiled plantain taste	Typical boiled plantain colour	Slightly acceptable
				Moderately acceptable
				Extremely acceptable

Table 3.2.2 Ripe Fried Plantain/ Kelewele: Sensory attributes of *kelewele* and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Hotness/spiciness*	*Overall Acceptability*
Typical kelewele appearance	Typical kelewele odour	Typical kelewele taste	Typical kelewele colour	Slightly spicy	Slightly acceptable
Soggy appearance	Spicy odour	Spicy taste		Moderately spicy	Moderately acceptable
				Extremely spicy	Extremely acceptable

Table 3.2.3 Roasted Plantain: Sensory attributes of roasted plantain and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Overall Acceptable*
Typical roasted plantain appearance	Typical roasted plantain odour	Typical roasted plantain taste	Typical roasted plantain colour	Slightly acceptable
			Light brown	Moderately acceptable
			Dark brown	Extremely acceptable

3.1 FUFU FLOURS

Table 3.3.1 Plantain/ Cassava/ Cocoyam/ Yam: Sensory attributes of plantain, cassava, cocoyam and yam and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Texture*	*Overall Acceptability*
Smooth appearance	Typical fufu aroma (depends on fufu flour used)	Typical fufu taste (depends on fufu flour used)	White	Stickiness	Slightly acceptable
Lumpy appearance			Brown	Smoothness	Moderately acceptable
			Off-white	Lumpiness	Extremely acceptable
				Softness	
				Elasticity	

CHAPTER 4

NUTS AND OILY SEEDS

Product groups of nuts and oily seeds treated include peanut and peanut products, melon seeds and cashew nuts. The principal sensory attributes of relative importance to each of the products together with the possible sensory descriptors are listed in tables below. The sensory attributes are specified in the first row of each table with the possible descriptors listed in the columns below each attribute.

4.1 Peanut And Peanut Products

Table 4.1.1 Groundnut Soup: Sensory attributes of groundnut soup and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Texture*	*Mouthfeel*
Oily appearance	Fishy or meaty smell	Hotness (pepper, ginger or other spices)	Brown	Thickness	Bitter aftertaste
Dull appearance	Typical groundnut flavour	Salty taste	Light brown	Smooth texture	Sweet aftertaste
		Warmness (hot, cold, lukewarm)	Deep brown	Lumpy texture	
		Sweet taste			

Table 4.1.2 Peanut Butter: Sensory attributes of peanut butter and their possible descriptors.

Appearance	*Odour*	*Taste*
Brown colour	Raw	Sweet
Buttery appearance	Roasted peanutty	Bitter taste
	Oxidized	Salty taste
	Texture	
Prior to mastication	**First bite**	**Residual**
Stickness	Hardness	Oiliness
Graininess	Masticatory	Mouth coating
	Adhesiveness	Mouth dryness
	Gumminess	Spreadability

Table 4.1.3 Roasted Peanut: Sensory attributes of roasted peanut and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Mouthfeel*
Typical Roasted Peanut Appearance	Roasted Peanutty.	Sweet Taste	Light brown colour	Bitter aftertaste
Whole grain appearance	Rancid Flavour	Bitter Aftertaste	Golden brown colour	Sweet aftertaste
Broken grains appearance		Rancid Taste	Dark brown colour	Crunchiness

Table 4.1.4 "Nkaticake": Sensory attributes of *nkaticake* and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Mouthfeel*	*Overall Acceptability*
Typical "Nkaticake" Appearance	Roasted Peanut flavour	Sweet Taste	Light brown colour	Bitter aftertaste	Slightly acceptable
	Rancid Flavour	Bitter aftertaste	Golden brown colour	Sweet aftertaste	Moderately acceptable
		Rancid taste	Dark brown colour		Extremely acceptable

Table 4.1.5 "Dzowe": Sensory attributes of *dzowe* and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Texture*	*Mouthfeel*	**Hotness**	*Overall Acceptability*
Typical "Dzowe" Appearance	Roasted peanutty	Sweet Taste	Brown Colour	Smooth texture	Bitter aftertaste	Spiciness	Slightly acceptable
	Rancid Flavour	Bitter Taste		Rough Texture	Sweet aftertaste		Moderately acceptable
	Spicy flavour						Extremely acceptable

Table 4.1.6 Burger Peanut: Sensory attributes of burger peanut and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Texture*	*Mouthfeel*
Rough appearance	Roasted Peanut flavour	Sweet taste	Brown colour	Rough texture	Sweet aftertaste
Smooth appearance	Rancid Flavour	Bitter taste		Crunchy texture	Bitter aftertaste
		Salty taste			

4.2 Other Nuts and Oily Seeds

Table 4.2.1 Melon Seed (Powdered Agushi): Sensory attributes of gari and their possible descriptors.

Appearance	*Aroma*	*Colour*	*Texture*	*Fingerfeel*	*Overall Acceptability*
Oily appearance	Fresh nut aroma	Off-white colour	Gritty texture	Slightly powdered feel	Slightly acceptable
Slightly moist appearance					Moderately acceptable
					Extremely acceptable

Table 4.2.2 Roasted Cashew Nuts: Sensory attributes of roasted cashew nut and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Texture*	*Mouthfeel*	*Overall Acceptability*
Slightly Gold Appearance	Roasted nut odour	Slightly sweet taste	Gold colour	Hard texture	Rancid aftertaste	Slightly acceptable
Slightly off-white appearance			Off-white colour	Rough Texture	Bitter aftertaste	Moderately acceptable
				Crunchy texture		Extremely acceptable
				Hard texture		

CHAPTER 5

FISH, POULTRY, MEAT AND THEIR PRODUCTS

Product groups treated include fish, poultry, meat and their products. The principal sensory attributes of relative importance to each of the products together with the possible sensory descriptors are listed in tables below.

5.1 FISH AND FISH PRODUCTS

Table 5.1.1 Raw Fish: Sensory attributes of raw fish and their possible descriptors.

Odour	*Texture*
Very fresh odour, typical of species	Firm, succulent
Fresh odour	Firm
Weak fresh odour	Succulent mealy
Neutral or none	Soft, mealy
Slightly bad odour	Very soft, butter like, mushy
Slightly rotten odour	Firm, succulent
Spoilt milk odour	Firm
Spoilt butter odour	Succulent mealy
Noticeable rotten odour	
Very rotten repulsive odour	
Very fresh odour, typical of species	
Fresh odour	
Weak fresh odour	

Table 5.1.2 Cooked Fish: Sensory attributes of cooked fish and their possible descriptors.

Flavour
Fresh sweet flavour
Slight loss of flavour
Slight sweetness and loss of the flavour
Characteristics of the specie
Neutral flavour, definite loss of flavour but no off-flavour
Absolutely no flavour
Trace of off-flavour
Bitterness
Some off-flavour
Strong bitter flavour, some rubber-like flavour

Table 5.1.3 Herrings (Raw): Sensory attributes of raw herrings and their possible descriptors.

Firmness	*Odour*
Very stiff	Fresh, Seaweedy
Fairly stiff	Less fresh seaweedy odour, plus slight oily odour
Stiffness completely gone	Stale seaweedy odour
Very soft to touch	Putrid odour

Table 5.1.4 Viscera (Raw): Sensory attributes of raw viscera and their possible descriptors.

Odour	*Flavour*
Fresh, seaweedy odour	Fresh, sweet, seaweedy flavour
Less fresh seaweedy odour, plus slight oily odour	Less sweet, seaweedy flavour, plus oily flavour
Slight oily odour, sweaty odour	Stronger oily flavour
Blown oily odour	Bown oil flavour,
Stale odour	Stale flavour
Fresh, seaweedy odour	Rancid flavour

Table 5.1.5 Nile Perch (Iced)

Colour	*Gill-Colour*	*Gill-Odour*	*Texture*	*Eyes*	*Overall Acceptability*
Dull	Red	Fresh	Firm, elastic	Transparent	Slightly acceptable
Few metallic patches	Purple	Seaweed	Firm, reduced elasticity	Yellow sheen	Moderately acceptable
Dark on dorsal side	Maroon	Light stinky	Soft, reduced elasticity	Red	Extremely acceptable
Yellow streaks on belly area	No slime	Slightly rotten odour	Very soft	Turbid	Slightly acceptable
Dark	Reddish with brown, bleached patches	Rotten	Finger-prints leave	Flat	
Yellow slime		Stinky	Firm, elastic	Red	
Scales loose		Sulphur odour	Firm, reduced elasticity	Bloody	
		Slightly rotten odour		Concave	

Table 5.1.6 Nile Perch (Cooked): Sensory attributes of cooked Nile perch and their possible descriptors.

Odour	*Flavour*	*Colour*	*Texture*	*Overall Acceptability*
Typical of Nile perch	Typical of Niles perch	Ivory-like	Succulent, firm	Slightly acceptable
Fresh broth-like, steamed vegetable	Cooked cassava or sweet potatoes	White, clear	Elastic, easy to swallow	Moderately acceptable
Weak, fresh	Creamy	White-greyish	Soft, mealy	Extremely acceptable
Neutral	Weak broth	Greyish, dark meat	Very soft	
Light off-flavour	Neutral, sweetish			
Sour	Slightly rotten			
Muddy	Rotten			
Typical of Nile perch	Sour			
	Muddy			
	Typical of Niles perch			

5.2 MEAT AND MEAT PRODUCTS

Table 5.2.1 Beef Cuts: Sensory attributes of beef cuts and their possible descriptors.

Appearance	*Odour*	*Texture*	*Colour*
Slightly moist appearance	Off-Flavour	Juiciness	Bright red colour
	Beef Flavour Intensity	Tenderness	Dull red colour
		Meatiness	
		Connective Tissue	

Table 5.2.3 Beef Sausage: Sensory attributes of gari and their possible descriptors.

Appearance	*Odour*	*Texture*	*Colour*
Slightly moist appearance	Off-Flavour	Juiciness	Bright red colour
	Beef Flavour	Tenderness	Dull red colour
			Slight pink colour

Table 5.2.2 Beef Khebab: Sensory attributes of beef khebab and their possible descriptors.

Appearance	*Odour*	*Colour*	*Taste*	*Hotness/ spiciness*	*Thickness*	*Texture*	*Overall Acceptability*
Oily appearance	Spicy Odour	Light brown	Spicy taste	Slightly spicy	Slightly thick	Slightly hard texture	Slightly acceptable
Cuts umiformity		Brown	Peppery taste	Moderately spicy	Moderately thick	Slightly soft texture	Moderately acceptable
		Dark brown	Salty taste	Extremely spicy	Extremely thick		Extremely acceptable

Table 5.2.3 Cowhide: Sensory attributes of cowhide and their possible descriptors.

Appearance	*Odour*	*Colour*	*Texture*	*Overall Acceptability*
Slightly moist appearance	Typical cowhide odour	Light brown colour	Slightly hard texture	Slightly acceptable
Slightly dry appearance		Dark brown colour	Slightly soft texture	Moderately acceptable
Flabby appearance			Firmness	Extremely acceptable

5.3 Poultry And Poultry Products

Table 5.3.1 Ground Chicken Meat: Sensory attributes of ground chicken meat and their possible descriptors.

Odour	*Colour*
No Off-Odour	Cream colour
Slightly Perceptible	Light cream colour
Perceptible	Off-white colour
Slightly Pronounced	
Pronounced	
Very Pronounced	

5.4 Milk And Milk Products

Table 5.4.1 Liquid Milk/Evaporated Milk/Skimmed Milk Powder/Whey Powder: Sensory attributes of milk and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Consistency*	*Texture*	*Overall Acceptability*
Uniform appearance	Creamy flavour	Slight sweetness	Light cream colour	Uniform consistency	Powdery texture	Slightly acceptable
Non-uniform appearance	Rancidity	Flattened taste	Off-white colour	Non-uniform consistency	Lumpy texture	Moderately acceptable
						Extremely acceptable

Table 5.4.2 Ice Cream/Yoghurt/Milkshake: Sensory attributes of ice cream, yoghurt and milkshake and their possible descriptors.

Appearance	*Flavour*	*Taste*	*Colour*	*Consistency*	*Mouthfeel*	*Overall Acceptability*
Creamy appearance	Creamy flavour	Sweet taste	Creamy colour	Uniform consistency	Sweet aftertaste	Slightly acceptable
	Vanilla flavour	Creamy taste	Chocolate colour	Non-uniform consistency	Bitter aftertaste	Moderately acceptable
	Chocolate flavour		Coffee colour			Extremely acceptable
	Coffee flavour					

Table 5.4.3 Soymilk: Sensory attributes of soymilk and their possible descriptors.

Appearance	*Taste*	*Colour*	*Texture*	*Overall Acceptability*
Milky appearance	Sweet taste	Off-white colour	Smooth	Slightly acceptable
Uniform appearance	Salty taste	White colour	Chaffy	Moderately acceptable
Non-uniform appearance	Rancid taste			Extremely acceptable

CHAPTER 6

FRUITS AND VEGETABLES AND THEIR PRODUCTS

Product groups treated include fruits and vegetables and their products. The principal sensory attributes of relative importance to each of the products together with the possible sensory descriptors are listed in tables below. The sensory attributes are specified in the first row of each table with the possible descriptors listed in the columns below each attribute.

6.1 FRUITS/VEGETABLES

Table 6.1.1 Orange, Pear, Pineapple, Pawpaw , Carrots, Tomatoes, etc: Sensory attributes of fruits and vegetables and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Texture*	*Overall Acceptability*
Tenderness	Typical Fruit/Vegetable Flavour	Sweet	Typical fruit/vegetable colour	Softness	Slightly acceptable
Freshness	Off-Flavour/ Rotten falvour	Bitter	Green	Hardness	Moderately acceptable
Ripeness		Sour	Yellow	Firmness	Extremely acceptable
		Rotten taste	Brown	Juiciness	

Table 6.1.2 Table 6.1.2 Pineapple Jam: Sensory attributes of soymilk and its possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Texture*	*Thickness*	*Overall acceptability*
Jelly appearance	Fruity flavour	Sweetness	Yellow colour	Smooth texture	Pouring consistency	Slightly acceptable
		Sourness	Red colour	Lumpy texture		Moderately acceptable
		Bitterness	Wine colour (depending on the fruit colour)			Extremely acceptable
			Brown colour			

6.2 FRUIT JUICES

Table 6.2.1 Pineapple Juice: Sensory attributes of pineapple juice and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Thickness*	*Mouthfeel*	*Overall acceptability*
Uniform appearance	Pineapple Flavour	Sweet taste	Light Yellow colour	Not too light	Bitter aftertaste	Slightly acceptable
Non-uniform appearance				Not too thick		Moderately acceptable
						Extremely acceptable

Table 6.2.2 Orange Juice: Sensory attributes of orange juice and their possible descriptors.

Appearance	*Odour/Flavour*	*Taste*	*Colour*	*Thickness*	*Mouthfeel*	*Overall Acceptability*
Uniform appearance	Orange flavour	Sweet taste	Yellow colour	Not too light	Bitter aftertaste	Slightly acceptable
Non-appearance		Sour taste		Not too thick	Sweet after taste	Moderately acceptable
						Extremely acceptable

Table 6.2.3 Watermelon Juice: Sensory attributes of watermelon juice and their possible descriptors.

Appearance	*Odour/Flavour*	*Taste*	*Colour*	*Thickness*	*Mouthfeel*	*Overall Acceptability*
Uniform appearance	Watermelon flavour	Sweet taste	Reddish-wine colour	Not too light	Sweet after taste	Slightly acceptable
Non-appearance		Slight sourness		Not too thick		Moderately acceptable
						Extremely acceptable

CHAPTER 7

MISCELLANEOUS

Product groups treated include cocoa powder, chocolate, chocolate toffees/pebbles, beer, *dawadawa* powder, soups and stews. The principal sensory attributes of relative importance to each of the products together with the possible sensory descriptors are listed in tables below. The sensory attributes are specified in the first row of each table with the possible descriptors listed in the columns below each attribute.

Table 7.1 Cocoa Powder: Sensory attributes of cocoa powder and their possible descriptors.

Appearance	*Odour/Flavour*	*Taste*	*Colour*	*Texture*	*Overall Acceptability*
Powdery appearance	Cocoa-flavour	Sweet taste	Brown colour	Powdery Texture	Slightly acceptable
					Moderately acceptable
					Extremely acceptable

Table 7.2 Chocolate: Sensory attributes of chocolate and their possible descriptors.

Appearance	*Odour/Flavour*	*Taste*	*Colour*	*Texture*	*Overall acceptability*
Brown appearance	Cocoa flavour	Sweetness	Brown colour	Hard texture Soft texture	Slightly acceptable
					Moderately acceptable
					Extremely acceptable

Table 7.3 Chocolate Toffees/ Pebbles: Sensory attributes of chocolate toffees and pebbles and their possible descriptors.

Appearance	*Odour/Flavour*	*Taste*	*Colour*	*Mouthfeel*	*Overall Acceptability*
Round appearance	Cocoa flavour	Sweet taste	Yellow	Sweet aftertaste	Slightly acceptable
Oval appearance	Coffee flavour	Sour taste	Red	Sour aftertaste	Moderately acceptable
Square appearance	Orange flavour	Peantty	Blue	Bitter aftertaste	Extremely acceptable
		Coffee taste	Green		

Table 7.4 Beer: Sensory attributes of beer and their possible descriptors.

Appearance	*Aroma*	*Taste*	*Colour*	*Mouthfeel*	*Thickness*	*Overall Acceptability*
Crystal clear appearance	Estery aroma	Alcoholic taste	Gold colour	Bitter After Taste	Not too light	Slightly acceptable
	Smell of alcohol	Astringency	Dark colour	Slightly Sweet After Taste	Not too thick	Moderately acceptable
	Off-flavour					Extremely acceptable

Table 7.5 Dawadawa Powder: Sensory attributes of cocoa powder and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Texture*	*Overall Acceptability*
Deep brown appearance	Rotten fish smell	Sour taste	Deep brown colour	Powdery texture	Slightly acceptable
	Rancid taste	Slightly bitter	Light brown colour		Moderately acceptable
					Extremely acceptable

7.9 SOUPS AND STEWS

Table 7.9.1 Fresh Tomato Gravy/Light Soup with Fresh Tomato: Sensory attributes of tomato gravy and light soup and their possible descriptors.

Appearance	*Odour*	*Taste*	*Consistency*	*Overall Acceptability*
Slightly oily appearance	Cooked tomato aroma	Slightly sweet taste	Slightly light	Slightly acceptable
		Sour taste	Slightly thick	Moderately acceptable
				Extremely acceptable

Table 7.9.2 Shito: Sensory attributes of shito and their possible descriptors.

Appearance	*Odour*	*Taste*	*Colour*	*Texture*	*Overall Acceptability*
Oily appearance	Spicy aroma	Slightly sweet taste	Light Brown colour	Rough texture	Slightly acceptable
Dry appearance	Fishy aroma	Slightly spicy taste	Reddish wine colour	Smooth texture	Moderately acceptable
		Hotness			Extremely acceptable
		Fishy taste			

CHAPTER 8
GENERAL REQUIREMENTS FOR SENSORY TESTING

8.1 FACILITIES

8.1.1 Location

The test facility should be located as close to potential panelists as possible. Panelist should not have to pass through the food preparation or office areas.

On the other hand, the reception room and booth areas should preferably occupy areas that are distant from high traffic areas to minimize noise and confusion, but this would sacrifice accessibility of the test location to panelists.

8.1.2 Layout

In most sensory facilities, the area consists of the booth area, a discussion area, food preparation facilities, and a waiting room for panelists.

The design of the area should ensure the following

Efficient physical operations

Avoidance of distractions of panelists due to laboratory equipment and personnel

Minimization of distraction among respondents

8.1.3 Evaluation Area

The booth area and discussion room should be separated adequately from the kitchen area to prevent the migration of odours from cooking or from highly flavoured substances. Partitioned booths are desirable to minimize distraction from other panel members, but these should not leave the panels with the feeling of isolation. The aisle behind the booth should allow the panelists to comfortably slide in and out without disturbing the other panelists.

When partitioned booths are not available, temporary booths (Lawless and Heyman, 1977) may be used to minimize distraction between panelists. If temporary booths are feasible to use, participants should be positioned so that they do not face each other.

The furnishings should be a neutral colour. When planning for a booth area, the practitioner should attempt to have the maximum possible number of booths, as space

will allow. The countertop heights may be desk height or counter-height. Disposable personnel spittoons should be provided instead of sink for sanitary reasons.

8.1.4 Waiting Room

Waiting room should be located from the booth area to prevent waiting panelists from distracting those in the booth area. The waiting room will be used for social interaction, payment or incentives or other activities that need to take place prior to the test. Waiting room could be used as orientation or briefing room. Must be comfortable and have adequate lighting.

8.1.5 Food-Preparation Areas

These will be designed on the basis of products to be evaluated. Standard pieces of equipment that should go in every kitchen include ample cabinet, refrigerated and frozen storage etc.

8.2 Environmental Control

8.2.1 Odour

The test area must be as free from odours as possible. A slight positive pressure in the evaluation areas will reduce the migration of odours from the food preparation and other areas. Air from the sample preparation and areas should be vented through activated charcoal filters. All materials and equipment in the room should be odour free or have a low odour level.

8.2.2 Lighting

Adequate illumination is important in the testing areas. Lighting should be uniform and should not influence the appearance of the product to be tested. The type of light used should be carefully chosen if colour and appearance are important factors to be judged, since many fluorescent lights distort colour. Hence, special light effects such as coloured bulbs or sodium Lamps may be designed, in some instances, to hide or eliminate differences in colour.

8.2.3 Testing schedule

The time of day that tests are run influences results. Although this cannot be controlled if the number of tests is large, Late morning and mid-afternoon are generally the best times for testing.

8.2.4 General Comfort

Controlled temperature and humidity will result in comfortable surroundings that encourage concentration of panelists during a test. Furnishings, counter heights and computer placement should be ergonomically designed.

8.3 SAMPLE PREPARATION

Preparation procedures are dependent on the test objectives. In general, the samples must be consistent and uniform. Product characteristics should be considered when planning on sample preparation steps. Preparation methods should be clearly outlined. Preliminary testing is particularly useful during this stage of planning.

Preparation of all samples should be standardized such that sources of variability due to the preparation and serving procedure should be eliminated, if not minimized, so that the only variability will be that inherent in the samples. When cooking samples identical cooking units or appliances should be used.

When sample cannot be prepared side-by-side in identical cooking units or appliances, cooking should be randomized among cooking units.

Many foods usually require heating for a specified length of time to a specific endpoint temperature for microbiological safety and appropriate flavour development. When measuring cooking endpoints, monitoring with the use of appropriate temperature-measuring device is necessary. The selection of the temperature-measuring device depends on the specific location in the sample where temperature needs to be monitored.

The measuring device used should be consistent for all samples. Furthermore, their placement in the food where temperature has to be measured should be consistent throughout the food preparation process. (Resurreccion, 1998).

8.3.1 Utensils

Serving utensils should not impact any taste or odour to the product. Identical containers should be used for each sample so that no bias will be introduced from this source. Unless differences in colour are being masked, it is wise to use colourless or white containers. Disposable dishes made from plastics, paper, or styrofoam are convenient when large numbers are to be served, as in consumer tests, but it must be determined beforehand that no taste is transferred to the product. For odour testing, stemmed wine glasses covered with watch glasses are often used.

8.3.2 Quantity of Sample

The amount of sample given to each panelist is often limited by the quantity of experimental material available. The Sensory Evaluation Committee of ASTM (1968) recommends that in discrimination tests, each panelist should receive at least 16ml (0.5 oz) of liquid and 28g (1oz) of a solid, and the amount should be doubled for preference tests.

The amount of samples presented should be constant through out the testing. Panelists should receive enough samples to taste back and forth until they can make a decision. With some products such as spices, the amount the panelist taste each time must be controlled. But for products with pleasing taste larger quantities can be drunk.

8.3.3 Number of Samples

The number of samples that can be effectively evaluated in one session should be determined during preliminary testing. The type of product being tested and the experience of the judges must be considered when deciding on the number of samples to test in one session. Motivation is an important factor in this regard. Panelists often loose their desire to discriminate before they lose their capability.

8.3.4 Coding and Order of Presentation

The effect of order of presentation of samples to the panelists has been investigated by many researchers. The presentation of a sample of good quality just before one of

poor quality results in the rating of the second being lower than it would normally be. Similarly, if a good sample follows a poor one, it will be given a higher rating. This phenomenon is called contrast effect.

Because of convergence effect, which also operates when two or more samples are evaluated at the same time, a sample tends to be judged as similar to the samples it is being evaluated against, regardless of the quality. In some tests, particularly the triangle test, a positional bias has been demonstrated. When very small differences are present, there is a tendency to choose the middle sample as odd.

Because of these and other psychological and physiological effects, the order of presentation of the samples to each panelist is randomized or balanced. With a small number of samples and panelists, the order can be balanced so that every possible order occurs an equal number of times.

8.3.5 Rinsing

The panelists are provided with an agent for oral rinsing between samples. Taste-neutral water at room temperature is preferred by many investigators. When fatty foods are being tested, warm water is more effective rinsing agent. Crackers, apples, celery, and bread have all been used for removing flavour from the mouth. It is advised that the panelists rinse in between each samples.

The time period between samples should be constant and in some cases must be rigidly controlled. In some cases, the panelists can work at their own speed.

8.3.6 Information About Samples

As little information as possible about the test should be given to the panelists, because this information may influence results. When panelists have certain information about a product they tend to rate the product higher than they would have. This preconceived impression is called expectation error, persons who are directly involved with the experiment should not be included on the panel.

8.4 SELECTION OF PANELISTS

8.4.1 Panel

The panel would be comprised of a few people who may had been specially trained for their skill in sensory evaluation and who may have been made atypical as a result of their training, (Michael O'Mahony, 1985). During panel selection a sensory analyst must take into consideration the following: sampling and demographics, user group, use of employees, local residents and the general population, local residents and the general population, use of trained panelists, health status of panelists as well as biases.

Sampling and Demographics

Whenever a sensory test is conducted, a group of panelists is selected as a sample of some large population, about which the sensory analyst is to draw some conclusions. E.g. use children for a pre-sweetened cereal; use upscale young professionals for a fruit and yogurt blend.

The panelist participating in an acceptance test should be qualified based on typical demographic criteria such as: age, gender, income, nationality, religion, race, education, and employment

Selection and maintenance of a consumer panel is a key problem; Cooperation rate is variable.

New panel members must continually be recruited to compensate for the aging of a selected to panel over the course of several years of testing, and to offset dropouts.

User Group

The overall scheme is to select a relatively homogenous group, all of whom are "likers" of the products.

Non-users should be used only where there is a compelling reason why non-users should be used (i.e. with an entirely new product there is no user group established.)

Individuals who show extremes in scoring and exhibit unusual response patterns should be excluded from the test.

Use of Employees, Local Residents and the General Population

When product maintenance is the objective, employees and local residents do not represent a great risk when used as the panel.

In product development, optimization, and improvement, employees should not be used.

If employees are to be used, attitudinal responses should be compared with data from other sources to determine that their attitudinal responses are comparable.

Use of a pre-screen is advisable and the range of scores of the respondents should preferably be within 1 S.D. of the grand mean for all participants.

Example of biases:

Employees tend to prefer products they make or if moral are bad, find reasons to reject products.

Employees do not rate characteristics of products the way consumers would.

Employees do not usually represent the target segment.

Use 0f Trained Panelists

Individuals who are qualified for discrimination and descriptive tests should not be used for acceptance regardless of their willingness to participate.

Persons who have technical information about the product should not be used because of their potential bias.

Health status of panelists

Persons who serve as panelists should be in good health and should absent themselves when suffering from conditions that might interfere with normal functions of taste and smell. Emotional factors, interest, and motivation appear to be more important than the age or sex of a panelist. It is generally recommended that panelists refrain from smoking, chewing gum, eating, or drinking for at least 30 min before testing.

8.5 SENSORY PRACTICES

Sensory Practices are crucial to carrying out successful sensory evaluation

8.5.1 Rules on Question Structure and Wording

- Keep the question clear and similar in style. To avoid confusion, the direction of the scales should be uniform.

- Direct questions to address differences that are detectable and can differentiate products.
- Consider the importance of including a personal question such as "what is your family income?" Respondents may consider this question obtrusive and may not answer the question.
- Over elaboration can produce contradictions.
- Do not overestimate the respondent's ability to answer specific questions such as those recall and estimation.
- Avoid double negatives.
- Questions that talk down to respondents should be reworded.
- Questions should be simple, direct, and encourage consumers to respond.
- Questions should be actionable.

8.5.2 Types of Scale Used

- Nominal scales are used to denote membership in category, group, or class.
- Ordinal scales are used in ordering or ranking.
- Interval scales are used to denote equal distances between points and used in measuring magnitudes, with a zero point that is usually arbitrary.
- Ratio scales are used in measuring magnitudes, assuming equality of ratios between points and the zero point is a "real" zero

8.5.3 Criteria for Selecting or Developing Scales

- The scale should be valid. It should measure the attribute, property, or performance characteristic that needs to be measured as defined by the objectives of the study.
- The scale should be unambiguous and easily understood by panelists. Questions as well as the responses should be easily understood by panelists.
- The scale should be easy to use. Consumer test involves panelists who are not trained.

- It should be unbiased (Stone and Sidel, 1993). Results should not be an artifact of the scale. Bias may result from the words or numbers used in a scale.
- It should be sensitive to differences. The number of categories used and the scale length will influence the sensitivity of the scale in measuring differences.
- The scale should consider end point effects.
- The scale should allow for statistical analyses of responses.

8.6 Factors Influencing Sensory Measurements

Standard procedures for planning and conducting sensory panels have been developed in an effort to minimize or control the effect that psychological errors and physical conditions of the person or environment can have on human judgment. There is therefore the need to standardize procedures by describing some factors that influence human judgment and illustrating the means of minimizing or eliminating these errors perhaps be emphasized.

8.6.1 Expectation Error

Any information the panelists receive about the test will influence the results. This preconceived impression is called expectation error. Panelists usually find what they expect to find. Therefore, panelists should not be given detailed information about the test and those persons who are directly involved with the experiment should not be included on the panel. The samples should be coded so that the panelists cannot identify them. The code itself should not introduce any bias. Since people generally associate "1" or "A" with "best," it is recommended that three-digit random numbers be used. A few of these random numbers can be found in the last chapter of this pamphlet.

8.6.2 Stimulus Error

In his desire to be right, the judgment of the panelist may be influenced by irreversible characteristics of the samples. For example, when asked if there is a difference in the sweetness of two samples of orange halves, a panelist may look for help in every possible direction. He may ask himself: are the pieces of uniform size,

is there a difference in colour, is one firmer than the other? Because of this stimulus error all samples should be uniform as possible. If unwanted differences occur between samples they should be masked whenever possible.

8.6.3 Logical Error

Closely associated with logical error is stimulus error, which causes the panelists to assign ratings to particular characteristics because they appear to him to be logically associated with other characteristics. A slight yellow colour in dehydrated potatoes, for example, may indicate oxidation to the panelists and he will logically find a different flavour in the sample. This error can be controlled by keeping the samples uniform and masking differences.

8.6.4 Halo Error

When more than one factor in a sample is evaluated, a halo effect may be produced. The panelist often forms a general impression of a product and if asked to evaluate it for odour, texture, colour, and taste at the same time, the results may be different from those when each factor is rated individually. To eliminate this effect only one characteristic should be valuated at a time.

8.6.5 Suggestion

The response of a panelist can be influenced by the reactions of other panelists. Because of this influence, the panelists are separated from each other in individual booths. Conversation and discussion are not permitted during testing so that a suggestion from one panelist will not influence another. The testing areas should be free from noise and distraction and separate from the preparation area.

8.6.6 Motivation

The motivation of the panelist will affect his sensory perception. An interested panelist is always more efficient. The interest of the panelists can be maintained by giving them reports of their results. Trained panelists are generally more motivated than those than those who are not trained (Ellis 1967). The panelists should be made

to feel that the panels are an important activity. This can be subtly accomplished by running the tests in a controlled, efficient manner.

8.6.7 Contrast Effect

The presentation of a sample of good quality just before one of poor quality causes the sample lower than it would normally be rated. Similarly, if a good sample follows a poor one it will be given a rating higher than expected. This phenomenon is called contrast effect. The order of presentation of the samples should be randomized for each panelist so that contrast effect will be equalized.

8.6.8 Positional Bias

In some tests, particularly the triangle test, a positional bias has been demonstrating. When very small differences are found, panelists have a tendency to choose the middle sample as being different. This phenomenon can be eliminated by random presentation.

8.7 Sensory Test Methods

Consumer Sensory Research can be classified into two major categories: qualitative and quantitative. Quantitative research involves measurement, whereas qualitative research is descriptive and does not involve measurements.

Quantitative consumer research methods are useful in defining critical attributes of a product and these include preference/acceptance tests and Discriminatory tests. Discriminatory test methods include the following:

- Triangle test
- Two-out-of five test
- Duo-trio test
- 3-Alternative Force Choice (3-AFC)
- "A"- "Not A" Test
- Difference Test

8.8 Discrimination Tests

8.8.1 Triangle Test

Principle: Present to each panelist three coded samples (triad); instruct panelists that two samples are identical and one is different; ask panelists to taste (feel, examine) each product from left to right and select the odd sample.

Applications

Determine if product differences result from a change in ingredients, processing, packaging, or storage.

Determine if an overall difference exists, where no specific attributes can be identified as having been affected.

Select and monitor panelists for their ability to discriminate given differences.

Panelists: 20-40

Test procedure: Control of lighting may be necessary to reduce any colour variables; offer samples simultaneously if possible. There are ABA, BAA, AAB, ABB, BAB, and BBA.

Advantages: It is statistically more efficient than paired comparison and duo-trio methods.

Disadvantages: The test has limited use with products than involve sensory fatigue, carryover, or adaptation, and subjects who find testing three samples too confusing.

8.8.2 Two-Out-Of Five Test

Principle: Present to each panelist five coded samples. Instruct panelist that two samples belong to one type and three to another. Ask the panelist to taste (feel, view, examine) each product from left to right and select the two samples that are different from the other three.

Count the number of correct replies and refer to Table 3 for interpretation

Applications

Determine if product differences result from a change in ingredients, processing, packaging, or storage

Determine if an overall difference exist, where no specific attributes can be identified as having been affected.

Select and monitor panelists for ability to discriminate given differences.

Panelists: 10-20

Test procedure: Offer samples simultaneously if possible; however, samples which are bulky, or show slight differences in appearance, may be offered sequentially without invalidating the test.

Advantages: It is statistically very efficient because the chances of correctly guessing two out of five samples are 1 in 10, as compared with 1 in 3 for the Triangle Test.

Disadvantage: The test is strongly affected by sensory fatigue and by memory effects that its principal use has been in visual, auditory, and tactille applications, and not flavors testing.

8.8.3 Duo-Trio Test

Principle: Present to each panelist an identified reference sample(R), followed by two-coded sample, one of which matches the references sample. Ask panelists to indicate which coded sample matches the reference.

Applications

Determine if product differences result from a change in ingredients, processing, packaging, or storage. Determine if an overall difference exists where no specific attributes can be identified as having been affected

Panelists: Over 30

***Test procedure*:** Offer samples simultaneously if possible, or else sequentially; prepare equal number of the possible combinations and allocate the sets at random among the panelists.

Advantage: It is statistically inefficient compared with the Triangle test because the chance of obtaining a correct result by guessing is 1 in 2.

8.8.4 3-Alternative Forced Choice Test (3-AFC)

Principle: It is a variant of the Triangle test where the same sample always is used as the matched pair. The 3-AFC test is used when the samples vary in strength, but not

character. Instead of asking panelists to select the odd sample, they are asked to select the "stronger" sample. The data analysis is similar to the Triangle Test.

Application: Similar to Triangle test

Panelists: 20-40

Advantages: Similar to Triangle test

Disadvantage: Similar to Triangle test

8.8.5 "A"-"Not A" Test

Principle: Familiarize the panelists with samples "A" and "not A"; present each panelist with samples, some of which are product "A" while others are product "not A"; for each samples the panelists judge ability to discriminate by comparing the correct identifications with the incorrect ones using the chi-square test.

Applications

Determine if product differences result from a change in ingredients, processing, packaging, or storage

Determine if an overall differences exists, where no specific attributes can be identified as having been affected.

Panelists: 10 to 50 trained panelists; 20-50 presentations of each sample in the study

Test procedure: Present samples with score sheet one at a time. Code all samples with random numbers and present them in random order so that the panelists do not detect a pattern of "A" vs. "NOT A" samples in any series. Do not disclose the identity of samples until after the panelist has completed the test series.

Advantages: It can be used when the Triangle test and Duo-trio tests cannot be used.

Disadvantages: N/A

8.8.6 Simple Difference Test

Principle: Present each panelist with 2 samples, asking whether the samples are the "same" or "different". Analyze results by comparing the number of "different" responses for the different pairs, using the chi-square test.

Applications

Determine if product differences result from a change in ingredients, processing, packaging, or storage

Determine if an overall difference exists, where no specific attributes can be identified as having been affected.

Panelist: 20-50 panelists

Test procedure: Offer samples simultaneously if possible, or else successively; prepare equal possible, or else successively; prepare equal numbers of the four pairs and present them at random to the subjects, if each is to evaluate one pair only.

Advantage: It is used when the Triangle and the Duo-trio tests cannot be used.

Disadvantages: Time consuming

8.9 DESCRIPTIVE ANALYSIS

Sensory method by which the attributes of a food or product are identified and quantified using highly trained human panelists. (ASTM,1993). They are used to determine the nature and intensity of the differences.

8.9.1 DESCRIPTIVE ANALYSIS METHODS

- Flavour Profile
- Quantitative Descriptive Analysis (QDA)
- Spectrum Method
- Texture Profile

Flavour Profile

Minimum of 4 panelists

Quiet, well-lit, odour-free room

Round table suggested to facilitate discussion

Requires 6 months training

15 min/sample, 1-3 sessions

Independent evaluation

Character note intensities (7-point from threshold to strong)

Quantitative Descriptive Analysis (QDA)

Quantitative Descriptive Analysis (QDA) is a very useful tool in product evaluation, quality control, comparison of sensory data and instrumental data of foods and detecting differences between products.

The use of QDA requires trained panelists with ability to describe various sensory attributes, to differentiate attributes using structured and unstructured scales. A trained panel of 8 or more is required for QDA.

Selection of Taste Panelist

Selection is based on taste and smell acuity, the ability to describe and quantify the perceived intensity of the sensory characteristics.

To organize and train a descriptive sensory panel, a group of volunteers showing degree of liking for shito are screened for proper sensory responses in recognition of typical shito flavour, hotness, spiciness, oiliness, and other tastes attributes. During training sessions, panelists are presented with a varieties of shito are allowed to develop vocabularies for the various brand of the shito. For each sample, the panelist is asked to describe in his words the sensory characteristics perceived by the eyes, the nose and then by mouth. To obtain a common vocabulary the panelists in a round table discussion, reconcile their different vocabularies for the sensory characteristics.

The panel reaches a consensus on flavour attributes, appearance attributes, aroma attributes, etc.

Description intensity is rated using a 10cm or 15cm, unstructured line scale with low intensity on the left side and high intensity on the right side as anchored terms.

To avoid bias in descriptive tests, the panel leader does not influence panelists into including more attributes to describe the shito flavour and aroma. The panel leader

leads the panelists' discussion until agreement is obtained on each component. Many methods are used to assess the intensity of the sensory attributes.

After the panelists have completed their evaluation, the leader (sensory analyst) compiles the data. The descriptive sensory panel scores are analyzed as complete block design with panelists as blocks and (formulae as treatments). The scores for each attribute are summed up and the means are calculated.

Main Points to Note

- Led by sensory professional
- Requires 10-12 panelists (some tests 8-15)
- Training in conference style room
- Panelists develop terminology, definitions, and evaluation procedures.
- Requires 2 weeks training (8-10 hrs)
- Data collection in booths
- 3-10 min/product (min reps)
- References provided as needed
- Graphical rating scales used

Spectrum Method

- Led by sensory professional trained in descriptive analysis
- Requires 12-15 panelists
- Room with round table for discussion
- Panelists develop terminology, definitions, evaluation techniques, and references
- Requires 3-4 months training (60-80 hrs)
- Booths for evaluation
- 15 min/product
- 150-point scales used.

Texture Profile

- Led by sensory professional trained in texture profile analysis
- Round table to facilitate discussion and evaluation
- Requires 4-6 months training (90-100)
- Training on texture definitions, evaluation procedures, and standard reference scales
- 5-15 min/product
- Intensity scale used
- Panel discussion to reach consensus on each attributes

8.10 Consumer Test Methods

These are preference and acceptance tests and they are based on a measure of preference or a measure from which relative preference can be determined. In these tests the personal feeling of a panelist towards the product direct his response.

Acceptance tests

- How much do you like the product?
- How acceptable is the product?

Preference test

- Which sample do you like?
- Which sample do you like better?

Acceptance tests

Consumer acceptance of a food may be defined as

An experience, or feature of experience, characterized by a positive attitude towards the food; and/or (2) actual utilization (such as purchase or eating) of food by consumers.

May be measured by preference or liking of a specific food item

(Amerine et al., 1965)

Can be made on single products and do not require comparison to another product

Gives an estimate of product acceptance based on sensory properties.

Preference tests

Refers to all affective tests based on a measurement of preference, or a measurement from which relative preference may be determined (IFT/SED, 1981)

Definitions: 1.An expression of higher degree of liking; 2. Choice of one object over the other; 3. Psychological continuum of affective (pleasantness/ unpleasantness) upon which such choices are based (Amerine et al., 1965).

May include the choice of one sample over another

A ranked order of liking, or an expression of opinion on a hedonic (like/dislike) scale.

Measures the appeal of one food or food product over another (Stone and Sidel, 1993)

8.10.1 Reasons for Consumer Acceptance Testing

- Product maintenance
- Development of new products
- Give estimate of products acceptance in different areas around the country (composed of 100-500 consumers in 3 or 4 cities)
- Will not guarantee success in the marketplace
- Not a substitute for a large-scale market tests
- Product improvement or optimization
- Product improvement
- Product optimization
- Assessment of market potential

Methods used in Acceptance and Preference Tests

Paired Preference

Ranking

Rating tests

The 3 Most Frequently Used Methods

Paired comparison

9-point hedonic scale

Ranking

Paired Comparison

In a paired comparison test, a pair of coded samples that represent the standard or control and an experimental treatment are presented to the panelist, who is asked to indicate which sample has the greater or lesser degree of intensity of a specified characteristic, such as sweetness and hardness. If more than two treatments are being considered, each treatment is compared with every other in the series.

Advantages

- Easy to organize and to implement
- Only two orders of presentation: A-B and B-A.
- Panelists usually evaluate only one pair of products in a test.

Disadvantages

- Less informative because magnitude of preference is not asked.
- Less efficient.
- There is only one response per product pair as opposed to one
- Response per product.

9-point hedonic scale

The 9-point hedonic scale due to its suitability in measurement of product acceptance and preference has gained special consideration. The scale is easily understood by panelists and is easy to use. In these scales, there are no numbers or labels associated with intermediate categories. These scales should carry verbal end labels to anchor the scale to common frame of reference (Lawless and Heyman, 1997). The reliability and validity of the 9-point hedonic scale in the assessment of several hundred-food items has been confirmed (Peryam et al., 1960 Meiselman et al., 1974).

Consumer responses from use of a hedonic scale can likewise be converted to ranks or paired preference data. To convert to paired-preference data, it is necessary to count the number of subjects who scored one product higher and analyze the result using p=1/2, or binomial distribution. The 9-point hedonic scale has yielded results that are reliable and valid. Efforts to improve the scale have been unsuccessful, and it should continue to be used with confidence (Stones and Sidel, 1993)

Example of the Hedonic Scale is shown in the appendix

Ranking

The panelist is asked to rank several coded samples according to the intensity of some particular characteristic. It is generally used to screen one or two of the best samples from group of samples. This implies that samples are evaluated in relation to each other. Example of the Ranking Test is shown in the appendix.

8.11 Other Consumer Test Methods

- Laboratory Tests
- Central Location Tests
- Home-use Test

8.11.1 Laboratory Tests (Research Guidance Tests)

- Most frequently used test
- Responses per product: 25-50
- Product number per sitting: 2-5

Advantages

- Convenient location
- Control conditions
- Rapid feedback
- "Test wise" subjects

Disadvantages

- Familiarity with product
- Limited information

8.11.2 Central Location Test (CLT)

- Usually conducted in a shopping mall, or location accessible to public
- Respondents pre-recruited or intercepted
- Responses per product: 100 or more
- Product number: 4

Advantages

- Large numbers of respondents
- No employees used; "real" consumers

Disadvantages

- Large numbers of respondents
- Limited resources
- Limited control
- Limited tasks to be performed
- Limited food preparation facilities

OTHER TYPES OF CLT

- Mobile laboratory
- Mobile cart

8.11.3 Home Use Test (HUT)

- Use employees or consumers
- Responses per product: depends on product
- Test preference, acceptance or performance

Advantages

- Actual use conditions
- Responses of entire household
- Marketing information can be obtained

Disadvantages

- Little or no control
- Expensive
- Non-response rates are greater
- Time consuming

8.11.4 Differences between Qualitative and Quantitative Test Methods

Qualitative	*Vs.* *Quantitative*
Small group	Large group
Dynamic interviewing	Same mode of interviewing used
May vary from group to group	Vary with each respondent
Non-independent responses	Individual answers
Data never projectable	Data are projectable
Data cannot be aggregated	Responses can be aggregated
Multiple biases	Limited biases
Reports are subjective; based on opinions and observations	Reports are more objective; data collected in a scientific manner

Several qualitative methods exist, and these include one-on-one, in-depth interviews, group interviews, and focus groups. The most commonly used qualitative research method is the focus groups.

8.12 Focus Groups

The focus group is a method by which small groups of consumers are used to obtain information about their reaction to products and concepts, and to obtain information about their reactions to products and concepts, and to investigate various other aspects of respondents' perceptions and reactions.

This method is used to determine product attributes that consumers think are important and should be maximized in the product and characteristics that consumers do not like and think should be minimized or eliminated from the product. The distinguishing feature of this method is the unstructured approach. This method is qualitative and determines critical attributes of a product.

8.13 Reasons For Conducting Focus Groups

- To determine the critical attributes of a product.
- To investigate a wide range of issues and obtain detailed information about consumer attitudes, opinions, perceptions, behaviours, habits, and practices (Chambers and Smith, 1991).
- It is useful in gaining insight into consumer's preferences and defining critical attributes of a product (Galvez and Resurreccion, 1992).
- They may also be used in studying consumer habits or attitudes, which may be predictive of future behaviour.

8.13.1 Advantages of Focus Group

- Flexibility
- Provides observation of real consumers in an interactive setting
- Involves fewer participants compared to quantitative methods.
- Can be arranged on short notice and at a lower cost.
- Statistical analysis is unnecessary.

8.13.2 Disadvantages of Focus Group

- Non-independent responses (i.e. panelists influencing each other)
- Small numbers of panelists than in quantitative research
- Qualitative data
- Interview style may affect quality of data collected
- Lines of questioning vary markedly from group and respondent to respondent

8.14 CONCLUSIONS

- Panelists are qualified on the basis of attitudes towards products
- Objectives of the test should determine the sample size
- Product preparation, handling and coding adhere to accepted laboratory practices
- Measure acceptance-preference; not descriptive measures

- Does not replace large scale market tests
- Can be used to minimize testing of products that do not warrant further consideration

CHAPTER 9
STATISTICAL ANALYSIS METHODS

Consumer sensory evaluation uses statistics to determine whether responses from a group of consumers are sufficiently similar or represent a random occurrence. Know ledge that results are not a random occurrence enables the project leader to make a decision about the products being-tested with some measure of confidence.

9.1 HYPOTHESIS TESTING

Hypothesis testing is "an approach for drawing conclusions about a population, as a whole, based on the information contained in a sample of items from that population" (ASTM, 1996). Hypothesis testing involves the development of a null hypothesis and an alternative hypothesis. The null hypothesis states the conditions that are assumed to exist before the study is run (ASTM, 1996). In comparing means of two samples, the null hypothesis is

$$H_o: \mu_1=\mu_2$$

This means that there is no difference between the samples on the average. The alternative hypothesis states the conditions that are of interest to the investigator if the null hypothesis is not true (ATSM, 1996). In comparing two samples, 1 and 2, the alternative hypothesis is that

$$H_a: \mu_1\neq\mu_2.$$

9.2 GRAGHIC REPRESENTATIONS OF THE DATA

In many cases, it is advisable as a first step to plot the data. Graphing independent and dependent variables is a simple and direct way to visualize the nature of the relationship between variables. Scatter plots, bar graphs, and histograms are especially helpful in this task. Graphs show whether a relationship exists, or whether the relationship is a linear or curvilinear one. Outliners can likewise be detected by graphical representations of the data.

9.3 T-TEST

The Student's t-test is one of the most commonly used statistical procedures for determining the significance of the difference between means of two samples. The t-statistics is the ratio of the difference to the standard error of that difference (ASTM,1996). It is a useful test if only two products are being tested and when analyzing responses from a small number ($N \leq 30$) of consumers.

One characteristics of the t-statistic is that it provides information on the direction of the difference. This information is often important in the interpretation of the results (ASTM, 1996). Tables of the t-distribution give the appropriate t-statistic for the given probabilities and degrees of freedom. Variations of t-test include; Two-sample tests with related samples, Two- sample tests with unrelated samples, and one sample test.

9.4 TWO-SAMPLE TESTS WITH RELATED SAMPLES

This is also called the paired or dependent t-test and tests for a significant difference between the means of two related samples. This test is appropriate in tests involving two samples when the same consumer panelists evaluate both samples. When the effect of serving order of samples is important, the order of presentation of both samples is balanced such that the number of times one sample is presented as the first is equal to the number of times it is presented as the second.

9.5 TWO-SAMPLES TESTS WITH INDEPENDENT SAMPLES

This is also called the unpaired, independent t-test (O'Mahony, 1986). This test is for a significant difference between means of two unrelated samples, such as those responses obtained from different judges under different conditions, and results in two independent groups of data. The data sets may or may not have an equal number of observations in each group, but they are assumed to have normal distributions and the same variances.

9.6 One-Sample Test

This test is used to compare the average set of results against some fixed value, such as a target or specification. The calculations are similar to those for the generalized t-test.

The selection of the appropriate t-statistic and degrees of freedom will depend on a number of factors, including paired or unpaired varieties, equal or unequal numbers of judgments per cell, and equality or inequality of variances.

9.7 Chi-Square Test

This is a method to test hypothesis about frequency of occurrence or to determine whether the distribution of observed frequencies of a categorical variable (either nominal or ordinal) differs significantly from the distribution of frequencies that are expected according to some hypothesis. The chi-square test is a nonparametric test, because it uses nominal data.

9.8 Analysis Of Variance (ANOVA)

The analysis of variance often referred to as ANOVA or AOV, is probably the most frequently used method for data analysis of consumer sensory data from multiproduct tests. The method is used for testing for significant differences in means of a variable across groups of observations. While "analysis of means" appears to be more appropriate name, the methods employ ratios of variances to determine whether the means differ- thus, the name analysis of variance.

The total amount of variation in a test can be split into different sources of variability, such as product-to-product variation, subject-to-subject variation, and within-subject variation. Some of these components represent planned differences and are called fixed effects (treatments, factors), and others are random effects such as measurement error (ASTM, 1996). ANOVA is a statistical procedure designed to partition all the sources of variability in a test, thus providing a more

precise estimate of the variable being studied (Stone and Sidel, 1993). If the variance among fixed effects exceeds the variation within such effects, the fixed effects are said to be statistically different

There are a number of ANOVA procedures that can be used. The selection of the procedure depends on the nature of the problem. The specific test procedure to use depends on whether the variable is expected to have more than a single effect, whether the subject might be expected to respond differently to the different

products, whether the subjects evaluate each products on more than a single occasion, or whether different subjects evaluate each product at different time.

ANOVA involves a series of computations to yield total sums of squares, treatment sums of squares, and error sums of squares of the experimental observations. When the data set is not balanced, as when there are unequal numbers of subjects and therefore missing observations need to be accounted for. In such cases, the general linear model (GLM) procedure may be used.

9.9 Mean Comparison Tests

ANOVA provides evidence that a significant difference exists, but does not give an indication of how treatments differ. To determine which treatments are significant, a mean comparison test is needed. Several test are used for this purpose. These are the Fisher's LSD (Least significant difference), Duncan's multiple range, and the Newman –Keuls, Tukey, Scheffe, and Bonferroni tests. It is important to remember that these tests are not interchangeable and apply only when a significant F value was found. O'Mahony(1986) wrote an excellent discussion on multiple comparisons

In conclusion, to carry a out statistical analysis, one must first of all collect data, calculate mean value for each sample; use t-test for comparison of two samples; use

ANOVA and Turkey's HSD test for analysis of variance and multiple comparisons respectively for multiple samples.

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APPENDIX

WORSHEET FOR TRIANGLE TEST

Name:

Panelist Code: _ Name:_____ _____Date:

Type of Sample:

Instruction: Taste the samples on the tray from left to right.Two samples are idental; one is different. Select the odd/different sample and indicate by placing an X next to the code of the odd sample.

Samples on tray	Indicate odd sample	Remarks
_____	( )	
_____	( )	
_____	( )	

Comments:.....

.....

.....

SCORESHEET FOR TWO-OUT-OF-FIVE TEST

Name:.....Date:.....

Sample Code:

Of the five samples, two are the same and the other three are different. Please taste the samples in the order given and determine the two groups, one of the two samples is the same, the other of the three samples are the same.

Which two are similar?_____

Please describe any differences:

.....

.....

.....

QUESTIONNAIRE FOR DUO –TRIO TEST

Name:..... Date:.....

Product: .....

On your tray you have a control sample (R) and two coded samples. One sample is identical with (R) and the other is different. Which of the coded samples is different from R? Circle the coded sample which tastes different to the control.

Please describe any difference:

.....

.....

SCORESHEET OF 3-AFC TEST

Name:.....Date:.....

Sample Code:.....

Instructions:

Taste the samples on the tray from left to right. Two samples are identical; one is different. Select the stronger sample and indicate by placing an X next to the code of the odd sample.

Samples on tray	Indicate "Stronger" sample	Remarks
_____	( )	_____
_____	( )	_____
_____	( )	_____

If you wish to comment on the reasons for your choice or if you wish to comment on the product characteristics, you may do so under remarks.

SCORESHEET OF "A"-"NOT A" TEST

Name:.....Date.....

Sample code.....

Instructions

1. Before taking this test familiarize yourself with the flavour of the samples "A" and "Not A" which are available from the attendant.
2. Taste the test samples from left to right. After each sample, record your response below, rinse your palate with water, and wait one full minute between samples.

Note: You have received equal numbers of "A" and "Not A" samples.

Sample No.	Code	The sample is: "A"	"Not A"	Sample No.	Code	The sample is: "A"	"Not A"
1	____	( )	( )	6		( )	( )
2	____	( )	( )	7		( )	( )
3	____	( )	( )	8		( )	( )
4	____	( )	( )	9		( )	( )
5	____	( )	( )	10		( )	( )

Comments:

.....

.....

SCORESHEET OF SIMPLE DIFFERENCE TEST

Name: .....Date.....

Sample code.....

Instructions

Taste the two samples from left to right.

Determine if samples are the same/identical or different.

Mark your response below.

Note: Some of the pairs of samples consist of two identical samples.

---------- Products are the same

---------- Products are different

Comments:.....

.....

.....

DESCRIPTIVE PROFILING OF SHITO SAUCE

Name.....Date:.....

Sample Code.....

Please evaluate the shito sauce samples from left to right. Identify the attribute below and judge their intensity. Place a clean vertical line on each line at the appropriate position.

APPEARANCE INTENSITY

Brown Colour _____ Very dark brown/ Burnt
none

TEXTURE

Fine Fineness _____ Course Texture
none

Chewiness _____ Chewiness
none

Fibrousness _____ Courseness
fine

TASTE

Saltiness _____ absent
Strong

MOUTHFEEL

Mouthfeel _____ Strong Oiliness
oiliness
none

Off-flavour _____ Strong off-flavour
none

Hotness _____ Strong Hotness
none

Overall Acceptability _____ Extremely acceptable

SCORESHEET FOR PAIRED COMPARISON TEST

Name:.....Date: .....

Product: .....

In front of you are two samples. These may be the same or different. Evaluate the sweetness of these two samples of cocoa beverages. Taste the sample on the left first. Indicate which sample is sweeter

9-POINT HEDONIC SCALE

Please evaluate Sample _____ and check on the space that best reflects your feeling about feeling about the sample.

Overall, how would you rate this sample?

How would you rate the FLAVOUR of this sample?

like extremely ( )

like very much ( )

like moderately ( )

like slightly ( )

neither like nor dislike ( )

dislike slightly ( )

dislike moderately ( )

dislike very much ( )

Dislike Extremely ( )

QUESTIONAIRE FOR RANKING

Name:.....Date:.....
.....

Product:.....

Please rank these samples for preference. Rank the sample you like best as first and the sample you like least as forth.

Taste the samples in the following order: 817 462 149 535

First
Second
Third
Fourth
Comments:

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