

COMMENTARY

WHEN SCIENCE AND ART MEET: SENSORY FLAVOUR EXPERIENCE FROM LOCAL GHANAIA DISHES

Agyei-Amponsah J^{1*} and MYB Adjei²



Joyce Agyei-Amponsah

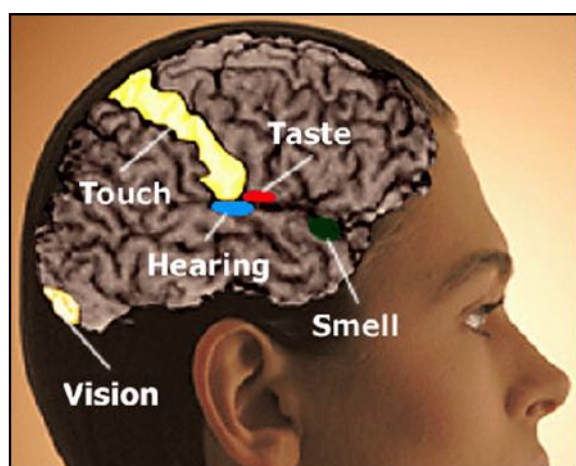
*Corresponding author email: ampjoyce@gmail.com

¹Biotechnology and Nuclear Agriculture Research Institute, GAEC (Senior research scientist - Sensory and Consumer)

 <https://orcid.org/0000-0001-6576-3736>

²Department of Nutrition and Food Science, UG (Senior lecturer, PI – Sensory Evaluation Laboratory)

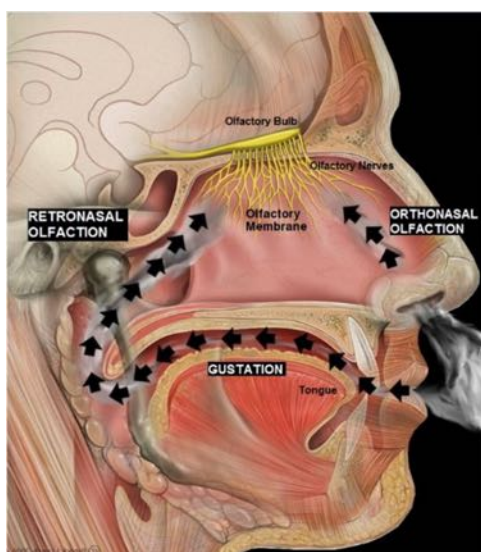
Although many of us will agree that we “eat to live”, we also agree that the food we eat (to live), should bring us happiness and contribute positively to our wellbeing. Simply put, food should be nutritious, healthy and enjoyable. It, therefore, comes as no surprise that humans will use all their five (5) senses to assess the quality of food before and during consumption. The five basic senses are the sense of sight, smell, touch, taste and hearing (Fig 1).



From: <http://research.yale.edu/ysm/images/177.4/articles-synesthesia-brain.jpg>

Fig 1: The five basic senses

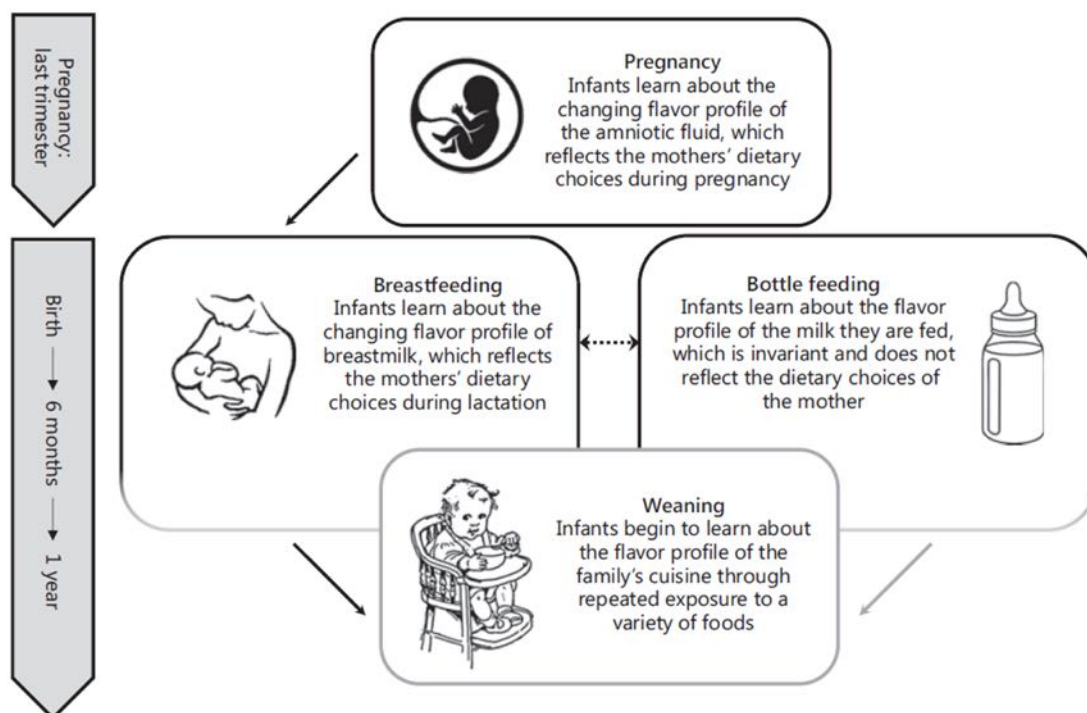
Our first judgement of the value of food is based on its appearance and sometimes the smell. It is only after this that we accept to take the food into our mouth (oral cavity). In the mouth, taste receptor cells detect the chemical compounds in the foodstuff and transmit their signals to gustatory nerve fibres [1]. The sense of taste that is developed results from the perception of the non-volatile portion of the chemical compounds from the food which dissolves in water, oil or saliva in the taste buds located on the surface of the tongue and other areas of the mouth or throat [1]. The resulting sensation is what has widely been divided into the five basic tastes – salty, sweet, sour, bitter and umami. On the other hand, the volatile molecules present in the food that has entered the mouth are sensed by olfactory receptors on the millions of hair-like cilia that cover the nasal epithelium, located in the roof of the nasal cavity [2]. The nasal cavity is accessible through the mouth in a process described as retro-nasal perception or simply put, smelling through your mouth (Fig 2). This enables us to perceive the aroma of the food. These complex interactions between the taste and aroma of foods give rise to what is appropriately referred to as the flavour of food.



www.aromadecuba.be

Fig 2: Diagram showing the interactions between taste and aroma

Flavour is one of the most important characteristics of any food product and plays a critical role in consumers' assessment of food quality and their resulting behaviour in food choice, consumption, amount of food intake and repeat purchase behaviour of any food product [3,4]. Perception of flavour is believed to start very early in life. The taste buds of a foetus are able to detect and transmit information to the central nervous system by the last trimester [3,5]. At that early stage of prenatal development, the fetus perceives the rich flavours of the intrauterine environment. Flavour perception continues to develop and change during breastfeeding as the maternal diet changes, through weaning foods until adult food (Fig 3). This change continues throughout the lifecycle of all humans.



Forestell, 2017

Fig 3: Development of flavour perception

Food flavours from Ghana come in diverse forms. A typical Ghanaian dish is made up of a starchy staple (main) as the source of carbohydrates. This is typically consumed with a sauce or soup as a source of protein (meat, fish, legumes), fat (cooking oils), and vitamins & minerals (legumes, vegetables, spices, salt). Throughout the different consumption stages during the eating process, the combination of the ingredients in the meal releases a flavourful medley of tastes, aromas and sensations that uniquely characterizes Ghanaian cuisine.

The ever-popular Ghanaian jollof rice is made basically from rice and tomato sauce or stew as it is popularly called in Ghana. The tomato stew contains tomatoes as the name suggests, pepper, meat (example beef, mutton, chicken) or fish, onion, herbs, spices and salt. The ingredients are cooked methodologically in cooking oil. In the process of cooking the rice in the tomato stew, the rice absorbs all the aromas from the different ingredients, giving it that characteristic jollof rice flavour. Although there are robust scientific methods available to fully and accurately describe all of the perceivable flavours in jollof rice using a trained descriptive sensory panel, the ordinary consumer when enjoying this meal and attempting to describe it will come up with several terms reflecting the basic tastes emanating from the main ingredients in the meal. These could include, descriptors such as umami taste, commonly associated with cooked tomato, spices, and stock from the cooked meat. The breakdown of flavonoids and the carotenoid pigments (Lycopene) in tomatoes could also yield a “cooked tomato” flavour to the jollof. It is also possible that tastes such as sweet and salty may be perceived from ingredients such as the onion and the added salt. There are scientific

ways to accurately determine which ingredients contribute to which flavours although we do not discuss that in this commentary.



<https://www.ggmixblog.com/ghanaian-jollof-rice/>

Waakye, a popular Northern Ghana dish that can be found in almost every part of Ghana now, is a dish of rice and beans (cowpea). The rice and beans are cooked (boiled) together with sorghum bicolor leaf sheaths, a natural food colourant. The colourant gives waakye a unique reddish-brown colour [6]. The rich waakye flavour emanates from the flavonoids present in the sorghum sheaths [6] as well as the primary aromatic compound, 2-acetyl-1-pyrroline [7] in the rice. The black eye peas (cowpea) that are normally used present a savoury starchy and beany taste and a rich earthy flavour.



<https://biscuitsandladles.com/waakye/#.YaStfdDP1PY>

Boiled yam or plantain and Kontomire (green leafy vegetable) stew are one of the common everyday dishes in Ghana. The yam or plantain is boiled and served as a main dish. The kontomire stew is prepared from cocoyam leaves (kontomire), onions, pepper, salted fish (koobi), smoked fish or meat, egushi seeds (pumpkin seeds) and palm oil. The aroma from a dish of yam served with kontomire stew is tasty. One would most likely experience all the five basic tastes when consuming a dish of yam and kontomire. Most Ghanaian yams have a sweet taste, and the kontomire brings in some bitterness and sourness. The koobi adds a salty and fermented (discussed later) taste. In addition, the spices and the stock from the meat add a unique umami taste. The combination of the basic tastes and the aromas from the perceived volatiles makes yam /plantain with kontomire very flavourful and tasty.



Awuni Tours Ghana

The flavour uniqueness of Ghanaian soups is much liked. A typical Ghanaian soup contains different blends of ingredients all in one pot. Commonly used ingredients include vegetables (example tomatoes, onions, pepper, palm nut, groundnut, eggplant), meat (bush meat/game, beef, pork, mutton, lamb, chicken, smoked turkey, tripe, fresh/dried snails, pig's trotters, crab, shrimp, guinea fowl), fish (smoked fish, fermented fish, dried fish, salted fish, fried fish), mushroom, and snails (optional). The most common soups are light soup (eggplant soup), palm nut soup, groundnut soup, kontomire soup (ebunabune), and okra soup. A trained descriptive sensory panel would definitely have an interesting time identifying the sensory attributes of a typical Ghanaian soup, especially when it comes to the flavour.



<https://aftradvillagekitchen.blogspot.com/2015/09/abe-nkwan-palmnut-soup.html>

<https://m.scooper.news/ghana/2020/09/11/prepare-delicious-groundnut-soup-at-home-by-using-this-simple-recipe/11553355>

<https://myrecipejoint.com/how-to-prepare-ebunuebunu-soup/>

Apart from the commonly known spices [thyme, garlic, onions, ginger, peppers, curry, basil, nutmeg, negro pepper (hwentee), rosemary, fennel seeds (nkitsenkitse) and bay leaf], Ghanaians have special local spices such as dawa dawa (*Parkia biglobosa*), also known as the African locust bean tree, and *Tetrapleura tetraptera* (prekese) that are included in most of the Ghanaian dishes giving it some unique flavour. The dawa dawa spice is obtained by fermenting African locust beans. The dawa dawa spice has a strong pungent and umami flavour highly recommended in most Ghanaian soups, stews, and some rice dishes. Prekese, on the other hand, has a sweet fragrance earning it its popular nickname “Soup Perfume”. Prekese is added as an ingredient when cooking palm nut soups to infuse the sweet aroma into the soup together with the other basic ingredients. The major constituents in prekese are tannins, flavonoids and starch [8].

One flavour that cuts across most Ghanaian dishes, which unfortunately has little to no sensory evaluation attention, is the exceptional fermented food flavour. Fermented foods are very important in Ghanaian dishes and constitute about 40 % of food consumed in Ghana [9]. Ghanaians mainly use spontaneous fermentation (when the food product is left for any available yeast and bacteria in the air or on the food to naturally cause the fermentation) in most food fermentation processes. The presence of the lactic acid bacteria give fermented foods unique aromas. The major aroma compounds are lactic acid, acetic, butyric and propionic acids.

The process of fermentation gives food a pungent, and sometimes unpleasant taste, which could wrongly be perceived as an off-flavour. However, fermentation enriches food with essential fatty acids and amino acids and added on flavours that Ghanaians so much look forward to in their dishes. In Ghanaian cuisine, fermentation of both carbohydrates and proteins are typical. Fermented fish and meats are delicacies in soups and stews and add authenticity to the final meal which few cuisines can compare with. Typical examples of fermented and salted fish/meat are “momoni”, “Kako”, “Koobi” and “Ewurefua”. Some common examples of fermented carbohydrate-based foods in Ghana include kenkey (sourdough dumpling), banku (a smooth, whitish paste cooked from a mixture of fermented corn and cassava dough), kokonte (dry cassava dumpling), gari (powdery food flour made from the tuberous roots of cassava plant), koko (fermented corn dough porridge), Fura (millet dough balls), foroforo (fermented

millet drink), pito (beer made from fermented millet or sorghum), asana (caramelized corn drink made from fermented corn and caramelized sugar) and dawa dawa (a spice made from fermenting African locust bean).

There are many rich flavour profiles in Ghanaian cuisine that have not yet been tapped into. Sensory science can help elucidate many of these flavour profiles from the local foods and thus give the food industry an excellent array of unique flavours to work with to bring quality products to consumers.

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