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Urban consumer preferences and sensory evaluation of locally produced and imported rice in West Africa

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Abstract

Parboiled rice produced in Ghana is of poor quality and is being overtaken by imported rice. This study sought to investigate consumer preference and relate sensory attributes with consumer acceptability of rice. The majority of consumers preferred imported raw and parboiled rice to that produced locally. Acceptability was influenced by location and gender. Individual preferences of consumers varied and four different segments of consumers with similar liking of the rice samples were identified. The largest three segments (86% of consumers) preferred the imported rice but differed in their preferences for the local rice. A niche segment (14%) mostly preferred traditional local rice. Regression models to predict consumer preference from the sensory panel scores were based on either brown colour of the cooked rice or unshelled paddy in the uncooked form. The models were suitable for three of the consumer segments representing 86% of the consumers. This suggests that while a sensory panel could be used to rapidly monitor consumer acceptability in product development, it was not valid for all consumers. The implications of these findings are discussed.

Keywords: Consumer acceptability; Sensory evaluation; Rice; Ghana; Africa

1. Introduction

Rice (*Oryza sativa* L.) is an important food for urban consumers in Ghana and West Africa and is taking over from traditional staples, mainly root crops such as yam and cassava (Asafo, 1985). The per capita consumption of rice is second only to maize among cereals in Ghana (Quaye, Greenhalgh, Manful, & Hammond, 2000). About 281,000 tons of milled rice is produced annually in Ghana (Anon, 1998) but it has been estimated that about 200,000 tons of rice is imported (Day, Oldham, Acheampong, Opoku-Apau, & Langyintuo, 1997). While most of the imported rice is in the raw form, it is estimated that 46% of locally produced rice is parboiled. As many as 120,000 women are involved in the production of parboiled rice, which is, however, of poor quality and trades at about half the price of that imported (Quaye et al., 2000).

Parboiling is a steam treatment of paddy that alleviates the effects of poor drying (cracking) and improves yield quantitatively and qualitatively since the proportion of broken grains is reduced (Diop & Wansey, 1990). The cooking quality of parboiled rice is better because the grains stay firm and do not stick together. The rice is also more nutritious because the proteins and vitamins are diffused through the centre of the grain after parboiling and it stores better thanks to its greater hardness. Only its stronger flavour and yellowish colour could be disadvantages (Garibaldi, 1985; Pillaiyar, 1990). In Ghana and Nigeria, parboiling is accomplished by soaking in hot water, steaming at ambient pressure, drying and milling the rice.

Little has been reported on the consumer preference of rice in Ghana. Priestly (1994) reported that cooked grains should be firm and non-sticky. In Brazil, Luz and Treptow (1994) found that consumers preferred parboiled to milled rice although most consumers generally ate milled rice. In Sri Lanka, factors influencing preference were percentage of head rice, shape of milled rice and aroma (Kotagama & Kapila Jayantha Kumara, 1996). In the Philippines, milled rice that had a soft texture was preferred (Del Mundo & Juliano, 1981). Schutz and Damrell (1974) reported a high correlation

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between hedonic ratings by US consumers and sensory attributes by a trained panel of six. Sensory attributes relating to palatability were dryness, stickiness, rubberiness, starchiness, rice flavour and compactness.

Ghana is a multi-ethnic society with five major ethnic groups. This presents difficulties when developing or improving a product because consumer preferences may differ widely. This study seeks to determine if consumer acceptability of rice differs with location in Ghana and how acceptability differs within these groups. The sensory factors influencing acceptability will be investigated and models that predict consumer acceptability from these sensory attributes will be determined. This will assist with the development of processing methodologies to improve the quality of parboiled rice produced by small-scale rural processors in Ghana and may help to focus marketing strategies.

2. Materials and methods

2.1. Samples

The six samples of rice selected for the study and some characteristics are as follows:

(a) US (United States) imported raw rice (US No. 5)—widely available in Ghana.
(b) US imported parboiled rice (Tilda)—premium product limited to a few supermarkets.
(c) Parboiled rice produced and purchased in the Upper East Region of Ghana-generally considered to be the best quality local product because the rice is extensively sorted and graded by market traders.
(d) Parboiled rice purchased in Accra, Ghana—average quality local product that has undergone limited sorting and clean-up.
(e) Parboiled rice purchased in Kumasi, Ghana—average quality local product that has undergone limited sorting and clean-up.
(f) Parboiled rice purchased and processed in Tamale, Ghana—average quality local product that has undergone limited sorting and clean-up.

2.2. Cooking method

Rice (300 g) was washed in water (300 ml) of water and drained for five minutes. The samples were cooked in 450 ml salted water (3 g salt in 1000 ml water) and the heat was reduced in the last 10 minutes of cooking. The cooking times (according to local cultural practices) were 30 min for the American raw, American parboiled, parboiled from Upper East and parboiled from Accra. The parboiled samples from Kumasi and Tamale were cooked for 35 min. Cooked rice was kept in a heated box (60 ± 5 °C) for up to one hour until served.

2.3. Consumer acceptability methodology

Consumers (300) were interviewed at three locations (Accra, Kumasi and Tamale) in Ghana using the method of central location testing. Consumers were selected according to gender and ages from 18 to 70 years.

During testing, cooked rice samples were freshly prepared after every hour and kept in a heated box (60 ± 5°C) until ready for serving. The rice samples served to the consumers were close to ambient which varied between 25 and 30 °C. Consumers scored the acceptability of rice using a 9-point hedonic box scale (Meilgaard, Civile, & Carr, 1987) from 'dislike extremely' to 'like extremely'. The six cooked rice samples were coded with 3-figure random numbers and presented simultaneously, but in random order, to each consumer on white paper plates.

After scoring the acceptability of the rice, consumers were interviewed. This recorded information on gender, age, occupation, how often they consumed rice, where they eat rice, which rice they prefer to purchase (local or imported), their preferred staple and who purchases rice in their household. The interview lasted about 30 min.

2.4. Sensory methodology

The same rice samples prepared for the consumers were scored by a semi-trained sensory panel using a modified version of quantitative descriptive analysis (QDA) since standards were not provided (Bainbridge, Tomlins, Wellings, & Westby, 1996; Meilgaard et al., 1987). The sensory panel (10 panellists) was conducted at the Food Research Institute (FRI), Accra, Ghana under controlled temperature (air conditioned) and lighting. The panel was comprised of staff from the Food Research Institute who had been screened for perception of the basic tastes (sweet, sour, bitter and salty), familiarity with the product and ability to determine differences between rice samples. Sensory attributes for uncooked (visual and odour) and cooked (visual, odour, taste and texture) rice were generated during a preliminary focus group session guided by the panel leader. A total of 16 uncooked and 14 cooked sensory attributes were developed for which the group had a consensus. Sensory attributes generated for the uncooked product were uniform colour, black specks, white heads, yellow colour, brown colour, cream colour, brightness, translucence, clean appearance, chalky appearance, unshelled paddy (not completed hulled), whole grain shape (as opposed to broken), long shape, oval shape, size and slender. Sensory terms for the cooked rice were brown colour, yellow colour, whitish appearance, black specks, uniform appearance, typical rice odour, sweet taste, sour taste, creamy flavour, sticky texture, grainy texture and hard texture.