Let them eat cake: Food quality and acceptance in Africa

Professor Keith Tomlins
Structure of my presentation

• Introduction
• Use of sensors ‘electronic sweet potato’ to monitor handling during transport
• Sensory testing and consumer acceptance of foods in developing countries
• Impact on development?
• The future
• Overall conclusions
Introduction

• Let them eat cake – who said this and why?
• Was she right?
• A different interpretation?
• Challenges are enormous
  – Population growth (9.3 billion by 2050)
  – Growth of urban populations
  – Need for systems to support this
Why is acceptance and quality important?

• Survival depends mainly on access to nutritious food that is safe to eat.
• Food not eaten because of poor quality & acceptability, has zero nutritional value.
• Focus of research in developing countries rightly directed on ensuring there is enough food to eat.
• Food acceptability for poor people with minimal education has been largely neglected.
Does acceptance matter?

• Not all new food products are a success.
• Challenge for developing countries is resources / funding are scarce. Better information about quality and acceptance can improve success.
• Better access to new markets, more nutritious food products and improved incomes and livelihoods
• Promotion and price may get people to buy a new nutritious food but acceptance drives repeat consumption
Electronic sweet potato: Helping to reduce losses during transport from farms to markets

• Sweet potato is a traditional crop for subsistence farmers in Tanzania, but is now increasingly being marketed.

• The marketing system poorly developed with significant losses (10 to 30%).

• Transported in sacks weighing between 100 and 250kg up to 300km (200 miles) overnight.

• No easy way to monitor handling.
Farm

Transport

Handling

Market

Electronic sweet potato
Shock chart

- Sack loaded onto truck at farm
- Journey to Dar es Salaam by truck
- Sack arrives at market
- Overnight storage at market
- Handling of sack at market

Transportation time (hr)

Impact (g)

Drop height (mm)
Sensor measurements and damage to sweet potato

- Can track consignments over long distances
- Develop a model
- Reduced sack weight to 100kg
Sensory evaluation & Consumer Acceptance

Sensory Evaluation  Consumer acceptance
Some music

1. Raise you arm if you like this music
2. Raise your arm if you would purchase this music for £5

Jason Tomlins – ‘Addiction’
What do we mean by sensory evaluation and consumer acceptance?

- Sensory evaluation and consumer acceptance of food relies upon evaluation by our senses (odour, taste, colour, tactile, temperature, pain etc.). Only by applying exact scientific testing or analytical methods can reproducible results be obtained and analysed statistically.
- I work by comparing several products at the same time.
Things to consider

• Factors to consider - food/drink product, the people, the testing environment and the methods

• Applications - new product development, product improvement, storage stability and relating to instrumental methods
Challenges using consumer testing methods in developing countries

• Many consumers have minimal education and many only speak local languages
• Existing methods were based on English language.
• Could we use simpler methods?
• Can we find ways of using complex methods?
Consumer test methods

- Simple ‘First Choice’ method. Consumers were presented with several samples and pick the sample they preferred the most.
- Ranking. Consumers ranked the samples in order of increasing acceptance.
- 9-point hedonic scale. Consumers rate acceptance on a scale of 1 to 9 from ‘dislike extremely’ to ‘like extremely’
Simple methods and ranking compared

Hedonic scale using smiling faces

- Hedonic good if enumerators explain it on one to one basis
Outline for consumer acceptance

FARM

Processing

Location and gender differences

Socio-economic factors

MARKETS

Better nutrition

Location

Mothers & children

CONSUMER

Cross cultural

Varietal selection
Varietal selection – location and seasonal effects

• New varieties of sweet potato higher yields, better disease resistance, better nutritional and health benefits, etc..

• Taste is important.

• We gave consumers range of varieties and asked them to the pick the one they liked the most (first choice method).

• Tested varieties over range of locations and over two seasons
Results

- Sensory panel found wide variations in appearance, odour, taste and texture of sweet potato varieties
- Consumers reported wide variation in acceptance
- Developed models to map acceptance by location and year
• Developed a rapid way for sensory panel to screen for acceptance
• Why are some cultivars consistently preferred and others less preferred?
• Trials conducted over several seasons?
Biofortified sweet potato – alleviating Vitamin A deficiency

• Traditional sweet potato varieties in Africa contain little or no pro-vitamin A (β-carotene) but newer biofortified orange sweet potato varieties do.

• In sub-Saharan Africa, vitamin A deficiency is a leading cause of tens of thousands of childhood deaths each year and a major risk factor for pregnant and lactating women.

• Introducing new high β-carotene varieties could benefit an estimated 50 million children under age 6 who are currently at risk.
Approach

• Sensory evaluation of 12 cultivars found that varying carotenoid contents altered not only the colour but also aroma, taste and texture.
• Relationship between orange colour and carotenoid content was logarithmic.
• This time we used a 9-point hedonic scale and four cultivars.
Ways to analyse results?

• Have four varieties of varying carotenoid content (white, yellow, orange and deep orange) tested by 475 consumers from rural and urban locations.
• Want to know if they find the orange varieties acceptable
• Want to know how many prefer orange to the other varieties
• Are there rural and urban differences?
• What influences acceptance?
A look at the overall mean values

Does not tell us anything about individual consumers
How many find the orange varieties acceptable?

- Can count how many find the orange varieties acceptable. We find 82% of consumers – is good
What about those who prefer Orange to yellow and white?

Cluster analysis (groups consumers into those with similar preferences)

59% consumers liked all varieties
23% preferred orange
11% disliked orange

Neutral to adopting orange varieties
Likely to adopt orange varieties
Not likely to adopt orange varieties

7% disliked deep orange
Acceptance and β-carotene (provitamin A)?

23% prefer orange

Likely to adopt orange varieties

Consumer acceptance vs. Log10 carotenoid content (µg/g fresh wt)
Consume sweet potato the most, farmers, less affluent, least likely to purchase sweet potato at a market.

More affluent, buy from markets

Rural / urban differences
Conclusions

• The acceptance of sweet potato containing pro-vitamin A in Uganda was more complex than previously indicated.
• Overall the acceptance of OFSP was high (82%)
• Where a direct relationship was identified between provitamin A content and acceptance the proportion of consumers (23%; orange-likers) was small
• A minority (18%) of consumers did not like the orange varieties (either orange or deep orange fleshed) and may not benefit from a nutrition intervention to alleviate vitamin A deficiency.
Differences in acceptance between mothers and children

- Acceptance of orange sweet potato compared by mothers of preschool children and school children.
- Mothers influence the diets of children in early childhood and later in life.
- Schools are a good way of introducing new nutritious foods.
- Acceptance of four varieties of varying provitamin A content
- 94 children
- 59 mothers and young children
Conclusions

• Orange sweet potato more acceptable to both mothers and children.
• The mothers, however generally gave slightly higher acceptance scores than the children.
• Worth further studies to explore acceptance of children?
Does location and ethnic group affect acceptance?

- Ghana - Parboiled rice (local v imported). 300 consumers interviewed. Three cities.
- Imported most preferred. Acceptability not affected by ethnic group, age and gender.
- Varied by location with consumers preferring rice sold at their own location.
- Segmentation indicated differing perceptions - most all likers, smaller groups were more discriminatory.
Location effect for fermented cassava products (fufu)

S3 = All Fufu likers
S2 = Like trad flour and dislike mod paste
S1 = paste likers
Conclusions

• Acceptability did not differ with location.
• Did vary with age, gender and frequency of eating.
• Acceptability of fufu, however, was not uniform within the population but was segmented and these segments had differing socio-economic profiles.
• Relationship between acceptance and intensity of certain sensory attributes was non-linear.
Cross cultural differences: Acceptance of foods by African and non-African consumers

• Research so far has only involved consumers in Africa. Does acceptance of other cultures differ more widely and how?
Why traditional foods and the EU?

• Traditional African foods target high value international markets in Europe for income generation.

• Possible gap because few indigenous African foods have been sold in any volume outside their countries of origin.

• Consumer acceptance is important in marketing strategies and in product development in both the EU and Africa.
Test Products

Hibiscus drink from Senegal. Made from the flower (juice or syrup)

Kenkey from Ghana – stiff fermented paste made from maize

Akpan from Benin - yoghurt-like product prepared from a partially fermented maize. Often mixed with condensed milk, ice & sugar.
Experimental Methodology

1. Sensory testing of products
2. Consumer acceptance testing using African and non-African consumers (hedonic scale)

<table>
<thead>
<tr>
<th>Country</th>
<th>Product</th>
<th>African</th>
<th>Non-African</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senegal</td>
<td>Hibiscus</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>Ghana</td>
<td>Kenkey</td>
<td>110</td>
<td>90</td>
</tr>
<tr>
<td>Benin</td>
<td>Akpan</td>
<td>103</td>
<td>74</td>
</tr>
</tbody>
</table>
Hibiscus drinks (Bissap) tested were either infusions or syrups.
Analysis

• **Hibiscus consumption of both groups high**

• **Different forms of purchase:***
  African = dried flower & in sachets, non-African = bottles & syrup

• **Different places of purchase:***
  African = street and market, non-African = market and restaurants
Correlations between acceptance and chemistry of Hibiscus drinks

Juice likers who like dark coloured drinks

Syrup likers who like sweet drinks and colour is less important
Kenkey

Consumers tested traditional kenkey, white kenkey and a similar product called banku.
Analysis

• **Consumption differs:** non-Africans do not consume Kenkey or similar products

• **Different forms of purchase:** Non-African not eat kenkey or only Ga. Ga most popular for African

• **Different places of purchase:** Africans purchase on street or eat at home. Non-African at chop bar or restaurant
Correlations between sensory and consumer acceptability

Relationship between sensory attributes and consumer acceptance is more complex – particularly for most African consumers.
Akpan

Similar results to Kenkey in Ghana

- "Akpan likers" (C4)
- "Akpan dislikers" (C3)
- "sweet & milk likers" (C2)
- "ogui likers" (C1)
Conclusions for African and non-African consumer differences

- **Similar acceptance patterns** - seems to be related to prior familiarity with products
- **Different acceptance patterns** - if non-Africans are not familiar with the product
- **Form of consumption and place of purchase** differ regardless of culture and familiarity. Good for market opportunities
- **Relationship between acceptance and sensory attributes** for fermented food by African consumers is more complex than non-African.
- Several promising **new market opportunities** identified
Consumer acceptance and what they might pay?

Willingness to pay

Sensory properties

Liking

Culture, location, habit, childhood etc.

Appearance, odour, taste, texture

Socio-economic status, availability, advertising, ethics, packaging

Contribution to overall acceptance and purchase decisions
Orange sweet potato in Uganda

• Provitamin A–rich varieties in Uganda. Compared with traditional sweet potato varieties. We also gave some nutrition information. 475 consumers.

• In the absence of nutrition information, the orange varieties given a similar price to white and yellow varieties.

• The impact of nutrition information on willingness to pay was more than expected.

• Compared hypothetical and paying with real money to explore the bias.
Orange maize in Zambia

• Explored how much consumers in rural Zambia will pay for orange maize which contains provitamin A. Will consumers confuse with yellow maize (drought food)?

• Surveyed 478 respondents in 2 provinces of rural Zambia. Explored

• a) the length of time they interacted with the product (short time in a market or longer at home)

• b) nutrition messages by different methods
Results

• With no information, amount paid for orange maize is similar to white maize.
• Nutrition information resulted in improved acceptance and willingness to pay for orange maize by consumers.
• The method of giving information (community leaders or radio) was not important.
• Did we overcome ‘novelty effect’
IMPACT ON DEVELOPMENT

• ‘electronic sweet potato’ : reduction in sack weight and size in some markets in Tanzania. Health benefit for the porters.

• Report by UK government Department for International Development on orange sweet potato stated ‘Conducting a consumer acceptability study of OFSP as a new product was essential to the project success’.

• Harvestplus reported similar for orange maize. Within two years, provitamin A maize should be released in Zambia, where it has the potential of being a life-changing crop for many.’
• Traditional African foods - based on our research, EU and African partners are using the results to work together to develop improved products for both African and EU markets.
THE FUTURE

• a) Further develop improved handling and transport to reduce food wastage and loss.
• b) Improve the capacity and skills in sensory and consumer research facilities in developing countries.
• c) Would like to do follow up research? Did consumers respond in the way we predicted?
• d) Can we alter consumer behaviour?
• e) Explore more about what influences low income consumer behaviour regarding acceptance and purchase decisions.
Overall conclusions

• Research shows the wide variety of research we carry out. Food chains are complex and I have described how acceptance and quality can be important at all stages.

• Let them eat Cake means different things to different consumers!

• Important for accessing new markets, improved nutrition and improving livelihoods.

• To improve impact we still have much more to learn.
Let them eat cake revisited

• Let them eat cake makes sense today
• However, history like science is not always straightforward
• Marie Antoinette may not have said this or rather ‘Qu'ils mangent de la brioche’
• Evidence suggests she might have been sympathetic to the plight of the poor people of France at that time.
Acknowledgements

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