



# Impact of inclusion of cassava flour in bread formulations in West Africa; **lessons learnt and recommendations for scaling OFSP puree bread**



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# Background

- Different recipes have been tried for development of the cassava-wheat composite bread
  - However, trials were under laboratory conditions and acceptance limited to small sections along the bread value chain (Eriksson et al. 2014; Eddy et al. 2007; Shittu et al. 2007; Nwosu et al. 2014)
- Thus, the need for recipe standardization with bread stakeholders for optimum bread quality



# Summary of Methodology

## Recipe collection

- Obtained and verified on-site from 29 Bakers
  - Eastern Region (Koforidua)
  - Ashanti region (Kwadaso)

**Moving away from  
laboratory based  
recipe development**

## Recipe standardization process

From survey data,

Averages of **each basic ingredient** was determined and used as the test recipe

**Easy acceptance and  
adaptability by  
commercial bakers**

*“Learning to learn”*

*Create/ Generate Knowledge  
with the **bakers***

*Transfer  
Ownership*



# Summary of Methodology

## Recipe standardization process ...

- Two bakers tried the test recipe
- Two bakers modified the test recipe to obtain standard recipe
- Four bakers (3 regions) tested the standard recipe

Using commercial bakers with their own setup





# Impact of HQCF Inclusion on Breads Produced

**Some comments from bakers and  
distributors**

# Impact ...

## Comments: Dough

**Baker1:** “Slight differences observed in dough characteristics... Not sure whether this will have an impact on bread quality though”

**Baker2:** “No difference observed in dough characteristics”



# Impact ...

Comments:  
Tea bread

“Tastes cassava in bread but love it”

“A1 slightly lighter, hard and fibrous. However taste not bad”

“A2 quite heavy and may be well appreciated by the older generation who grew up with heavier loaves”



A = 0% HQCF; A1 = 10% HQCF and A2 = 20% HQCF

# Impact ...

Comments:  
Sugar bread

“Size of sugar bread may have resulted from the high yeast”

“Prefer A: tastes like it has more margarine. Texture also good”

“Like A2 best on the whole”

- ✓ 2 preferred 20% HQCF
- ✓ 1 preferred 10% HQCF
- ✓ 1 preferred 0% HQCF

“Like A1 best on the whole”

“Like A2 best. Loaf volume too Ok. However, appearance not appetizing: colour looks pale”



A = 0% HQCF; A1 = 10% HQCF and A2 = 20% HQCF



## Impact ...

**Table 1. Physical properties of tea bread samples**

	TA	TA1	TA2
Dough weight	309.42(0.22) <sup>a</sup>	309.42(0.20) <sup>a</sup>	309.56(0.29) <sup>a</sup>
Bread weight	298.18(3.98) <sup>a</sup>	281.56(1.85) <sup>a</sup>	280.21(2.79) <sup>a</sup>
Bread volume	1597.00 <sup>a</sup>	1371.00 <sup>b</sup>	1308.33 <sup>c</sup>
Specific volume	5.74(0.08) <sup>a</sup>	4.87(0.08) <sup>b</sup>	4.64(0.07) <sup>c</sup>
Specific density	0.17(0.00) <sup>a</sup>	0.21(0.00) <sup>b</sup>	0.21(0.00) <sup>b</sup>

Value represented as mean (standard deviation)

Values in the same row with different superscripts are significantly different at  $p < 0.05$

TA – Tea bread 0%HQCF, TA1 – Tea bread 10%HQCF and TA2 – Tea bread 20%HQCF



# Impact ...

## Implication of physical characteristics of bread samples

- Substituting wheat flour with HQCF in tea bread significantly increased ( $p < 0.05$ ) its density
  - It will be more filling per unit bread
  - This may be preferred by the Ghanaian consumer who looks out for heavy bread loaf
- Specific volume of tea bread samples significantly decreased ( $p < 0.05$ ) with increasing substitution of HQCF
  - The Ghanaian consumer also prefers bigger loaves, thus the need to create the balance between the specific volume and density



# Impact ...

**Table 2. Physical properties of sugar bread samples**

	SA	SA1	SA2
Dough weight	309.46(0.18) <sup>a</sup>	309.50(0.30) <sup>a</sup>	309.41(0.32) <sup>a</sup>
Bread weight	287.80(1.79) <sup>a</sup>	284.45(2.02) <sup>a</sup>	285.87(2.26) <sup>a</sup>
Bread volume	1348.33 <sup>a</sup>	1324.00 <sup>a</sup>	1298.33 <sup>a</sup>
Specific volume	4.69(0.30) <sup>a</sup>	4.65(0.37) <sup>a</sup>	4.54(0.35) <sup>a</sup>
Specific density	0.21(0.01) <sup>a</sup>	0.22(0.02) <sup>a</sup>	0.22(0.02) <sup>a</sup>

Value represented as mean (standard deviation)

Values in the same row with different superscripts are significantly different at  $p < 0.05$

SA – Sugar bread 0%HQCF, SA1 – Sugar bread 10%HQCF and SA2 – Sugar bread 20%HQCF



# Impact ...

## Implication of physical characteristics of bread samples

- Substituting wheat flour with HQCF in sugar bread was not significantly different ( $p > 0.05$ ) for specific volume and density
  - Thus, when the composite flours are used in sugar bread, there may not be any observable difference in the physical characteristics.



## Impact ...

### Influence of bread type and ingredients on specific volume and density

- A significant difference was observed between tea and sugar bread with respect to specific volume and density
  - This may be due to the variation in quantity of ingredients used



# Impact ...



Plate 1. A cross-section of sugar bread samples

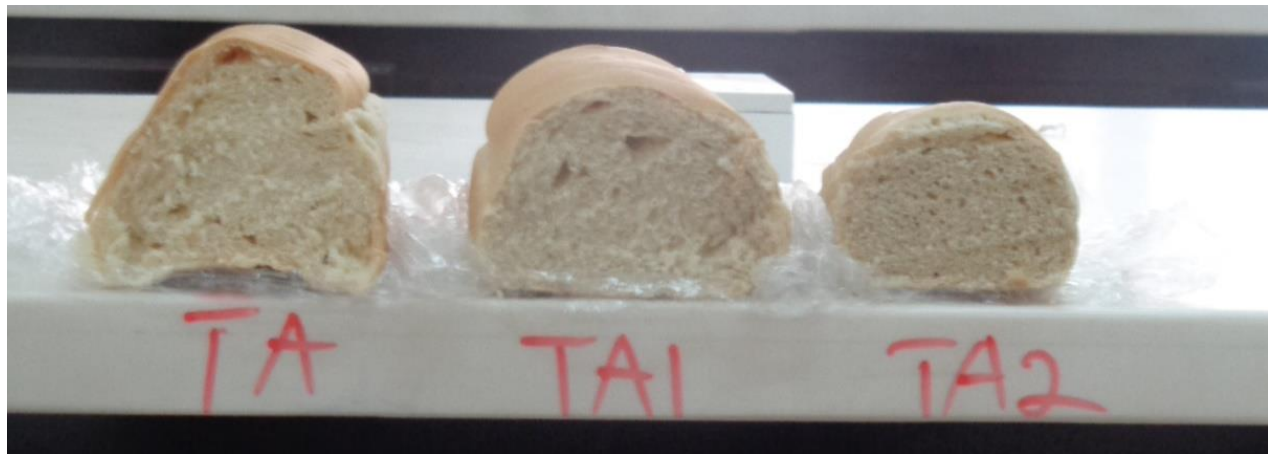


Plate 2. A cross-section of tea bread samples

**SA – Sugar bread 0%HQCF, SA1 – Sugar bread 10%HQCF and SA2 – Sugar bread 20%HQCF**  
**TA – Tea bread 0%HQCF, TA1 – Tea bread 10%HQCF and TA2 – Tea bread 20%HQCF**

# Impact ...

TA – 0% HQCF tea bread, TA1 – 10% HQCF tea bread,

TA2 – 20% HQCF tea bread

1 = dislike very much, 2 = Dislike moderately, 3 = neither like nor dislike, 4 = Like moderately and 5 = Like very much

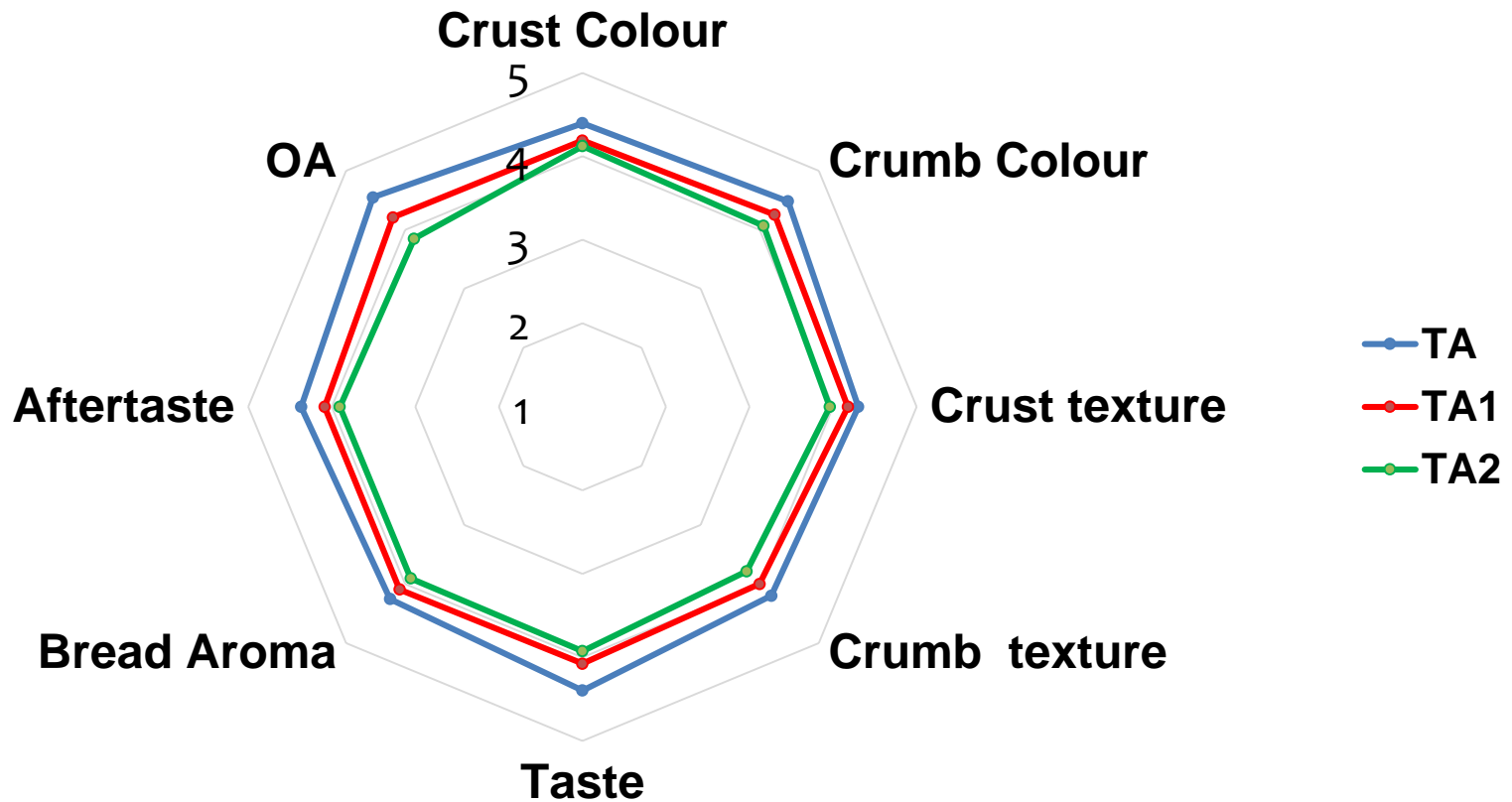


Fig. 1. Preference of tea bread samples by 105 consumers



## Impact ...

- The consumer acceptance for
  - 10% HQCF tea bread was similar to the control for all attributes except crust colour
  - All sugar bread samples were similar in crust colour and texture, and bread aroma
- Variances in recipe were in the levels of margarine, sugar and salt which reflected the bread types





# Impact on glycemic index

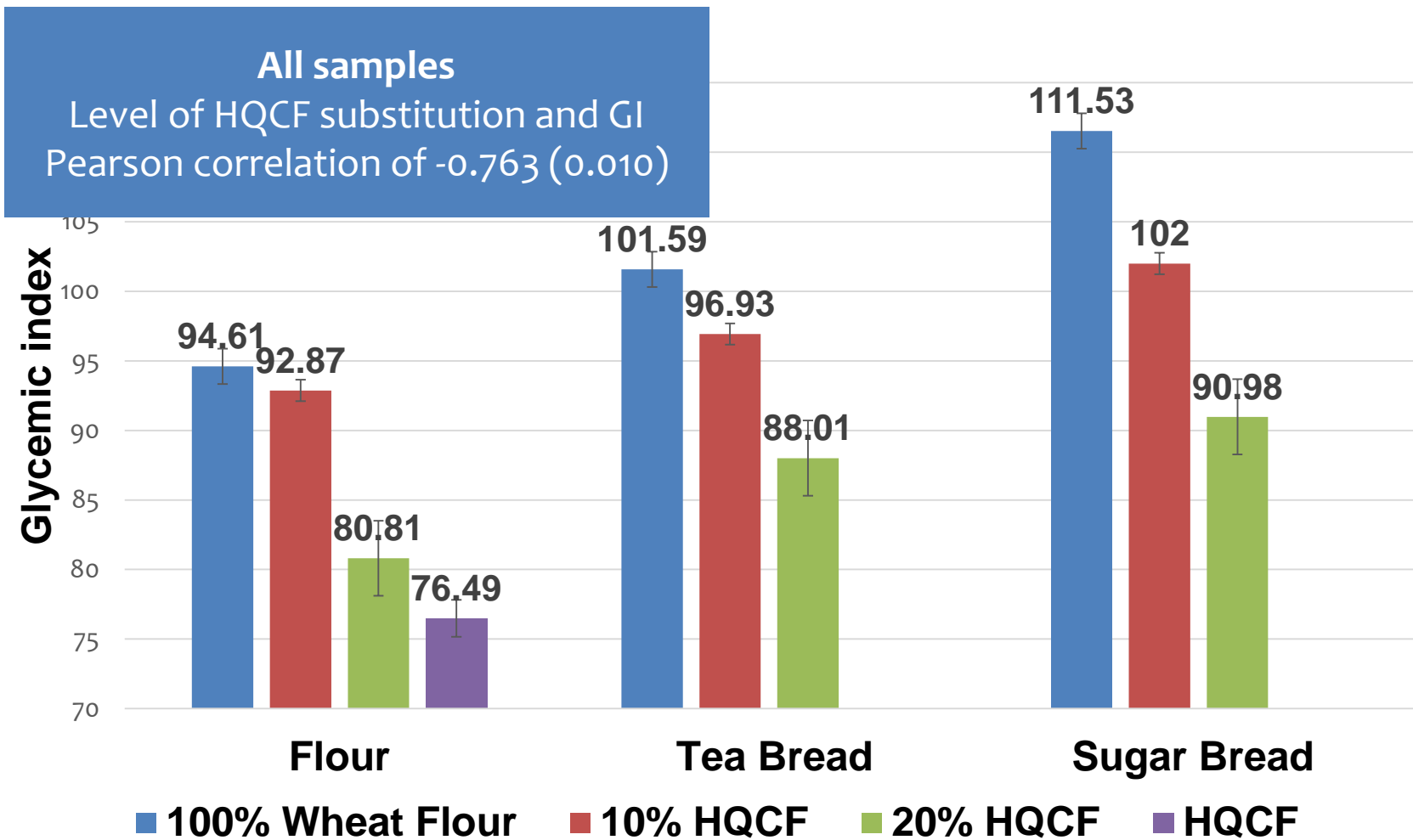


Fig. 2: Comparison of glycemic indices among flour and different bread types



# Impact on shelf life

## Shelf life of cassava composite stored under different conditions

### Sugar Bread

- Shelf life at elevated temperature (26-35°C)

Standard recipe {

- Baked Control (100% wheat) was 7 days 6 hours
- Composite bread (90%wheat: 10% HQCF) 5 days 8 hours

- Shelf life at room temperature (25-31°C)

Standard recipe {

- Baked Control (100% wheat) was 8 days 16 hours
- Composite bread (90%wheat: 10% HQCF) 6 days 9 hours



## Impact on shelf life

Shelf life of cassava composite stored under different conditions

### Tea Bread

**Bread stored at room temperature conditions tends to have a better shelf life than bread stored at elevated as done by bread retailers**





# Lessons Learnt

## Lessons Learnt

- Essential to build the confidence and personal skills of bakers in relation to the use of composite flours in baking through teamwork
- Importance of increased awareness on the use of cassava flour usage in the food industries to eliminate negative perceptions



# Identified bread types

- Wheat (bran) bread
- Honey bread
- Potato bread
- Cake bread
- Corn bread
- Banana bread
- Coconut bread
- Soya bread
- Chocolate bread

### **The Ghanaian baker**

- Compositing wheat flour and producing several composite bread

### Responses on the knowledge and potential for acceptability of bread from wheat-HQCF composites

- **52.9%** of bakers interviewed had knowledge on the inclusion of other flours as composites
- 37.5% knew of the inclusion of HQCF in baked products
  - 43.8% of these bakers had knowledge of the use of HQCF in bread making
- **81.3% of bakers were willing to use HQCF if proven to be successful**

# Common bread types in Ghana

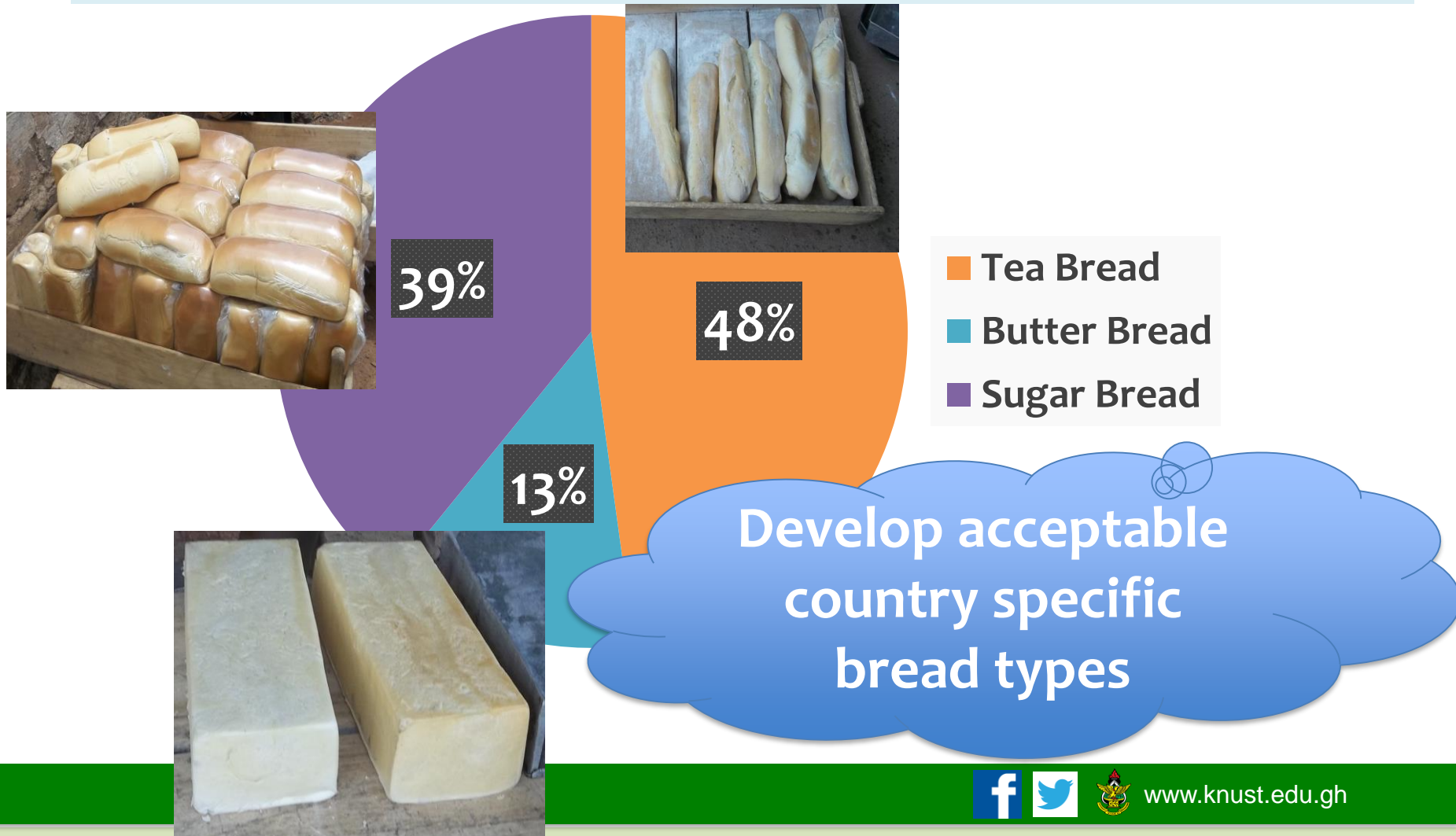


Fig. 3. Most produced bread types in the combined study areas



# Lessons Learnt

**Table 3. Overview of the weights of basic ingredients per 50kg flour for the three bread types**

Ingredient	Butter Bread (N=11)	Sugar Bread (N=11)	Tea Bread (N=16)
Sugar (kg)	0.10	0.10	0.10
Salt (kg)	0.10	0.10	0.10
Margarine (kg)	3.18	3.18	3.18
Yeast (kg)	0.10	0.10	0.10
Water (L)	10 – 30	10 – 30	15 – 40

Ratio of sugar to salt affect dough proofing and bread quality

Type and quantity of yeast affects dough proofing and bread quality

Bread types differed in recipe



# Lessons Learnt

- Identified commercial High Quality Cassava Flour Producers
  - JOSMA processing limited, Mampong
  - Food Research Institute – CSIR, Legon
  - ✓ **Involve** all relevant stakeholder to **foster uptake**
  - ✓ The need for the **production of quality flour**

## Preparation of Composite flour



Process  
adaptability



Commercial mixer at bakeries

Kitchen mixer in the  
laboratory

# Profitability of Cassava Composite Bread

- In Ghana, **61** food and bakery industries use **822 MT** of HQCF out of the **1,384.3 MT supplied** annually  
Dziedzoave & Hillocks 2012
- Currently in Ghana, a **50 kg** bag of HQCF costs **GH¢ 120.00** (**\$26.30**) whereas **wheat flour** cost **GH¢ 250.00** (**\$ 54.79**)  
(FRI, 2017)
- For every **one naira (N1)** invested into the cassava wheat composite business, there is a profit of **N3.3** if all things being equal

Mgbakor et al. 2014



## Lessons Learnt

- Difficulty in getting willing bakers to take part in the project
- Mixing was an essential unit operation that affects bread quality
- Reliable supply of High Quality Cassava Flour
- Composite bread shelf life is less than the 100% wheat



# Recommendation for scaling OFSP puree bread

- Reliable OFSP flour/ OFSP puree supply
- Involve all major bread stakeholders (Bakers, ...)
- OFSP puree bread recipe formulation
  - Country specific bread types
- Study the impact of puree on dough characteristics and quality of bread produced



# Recommendation for scaling OFSP puree bread ...

- Demonstrating the profitability of substituting wheat flour with OFSP puree
  - Conduct a feasibility survey with bakers within small region in various countries
- Conduct epidemiology studies to establish an authoritative health claim for OFSP composite bread
- Study the shelf life of composite OFSP puree/flour bread



# Recommendation for scaling OFSP puree bread ...

- Managing the mixing of puree and wheat flour
  - Can existing technology by commercial bakers be used
- Cassava as a crop is backed by policy in most West African countries
  - How about sweetpotato?







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