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Fermented and malted products in Africa: Expedition from traditional foods to industrial value added products

Why Millet?

- 6th most important cereal
- Food and nutrition Security
- Potential source of nutraceuticals and functional foods/ingredients
- Drought resistance

- ✓ 7 of 10 top millet producing countries are African (Niger, Nigeria, Mali, Sudan, Ethiopia, Chad and Burkina Faso)
- ✓ Africa home to 1.2 Billion people- it is projected that by 2050 the number will increase to 2.4 Billion = Food demand
- ✓ Nutrition disorders in Africa- A triple burden (Under & Over Nutrition co-existing with the infectious diseases)
- ✓ Climate change – Recent devastating droughts in SSA

Malting and Fermentation: Relevance

- **Fermentation**: Involves biochemical modification of primary food matrix brought about by microorganisms and their enzymes.
- Food preservation through lactic acid, alcoholic, acetic acid and alkaline fermentations-Increased shelf-life
- Detoxification during food (e.g. cassava)
- Nutritionally enhancing the quality of food (bioavailability of some essential amino acids and mineral)
- Facilitates development of a wide diversity of flavours, aromas and textures in food.

❖ **Malting**: Involves germination of grain in moist air under controlled conditions to promote the development of hydrolytic enzymes which were inactive in the raw grain.

❖ Improves protein/lipids/carbohydrates starch bioavailabity- hydrolytic enzymes structurally modify and solubilize the grain structure, causes the breakdown of carbohydrates, lipids and proteins to simple sugars, lipids and amino acids respectively

❖ Decreases phytic acid and increases the extractability of calcium, iron and zinc in millet and derived products

❖ Enhances flavours in millet products

Effects of Malting and Fermentation on Nutritional quality of millet flour

Parameters	Pearl millet flour		
	Native Flour	Fermented	Malted
Crude protein	5.47	5.80 (+6%)	6.69 (+22%)
Essential Amino acids			
Histidine	0.23	0.31	0.81 (*2)
Isoleucine	0.35	0.39	0.42
Leucine	0.78[c]	0.86	0.84
Lysine	0.22	0.31 (+40%)	0.43 (95%)
Methionine	0.16	0.17	0.20
Phenylalanine	0.38	0.42	0.45
Threonine	0.29	0.33	0.39
Valine	0.52	0.57	0.69
Selected mineral			
Calcium	295.58	324.59	506.38[a]
Iron	89.38	136.64 (+53%)	131.27 (+47%)
Zinc	17.45	19.85 (+14%)	26.08 (+49%)
Phosphorous	9.42	18.12	14.40

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Effect of fermentation and malting on the microstructure and selected physicochemical properties of pearl millet (*Pennisetum glaucum*) flour and biscuit

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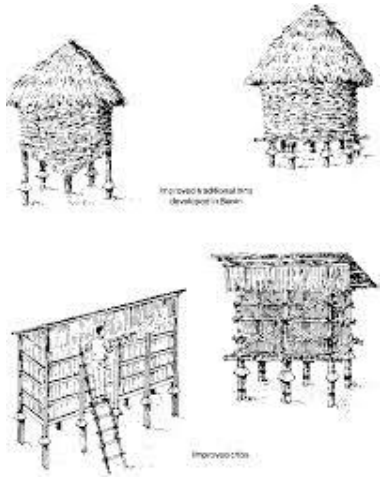
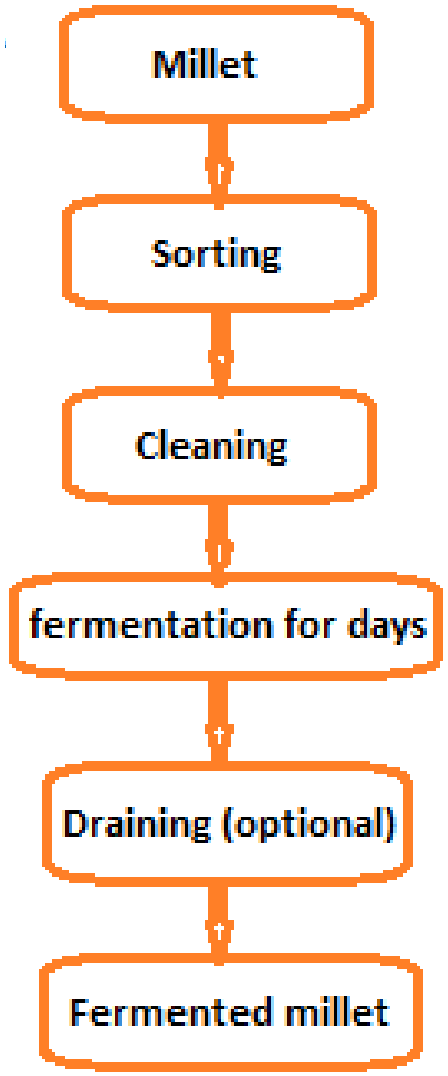
Source: (http://www.jdfoods.co.za

Traditional fermentation and malting processes-Shortcoming

- ✓ **Uncontrolled systems and consequently that may result in undesirable species of bacteria, yeasts and fungi contributing to food spoilage and pathogenicity-Food Safety issues**
- ✓ **Poor yield and quality**
- ✓ **Consumer perception & the effect of Rural-Urban migration/Modernitsation/increase of the middle class**



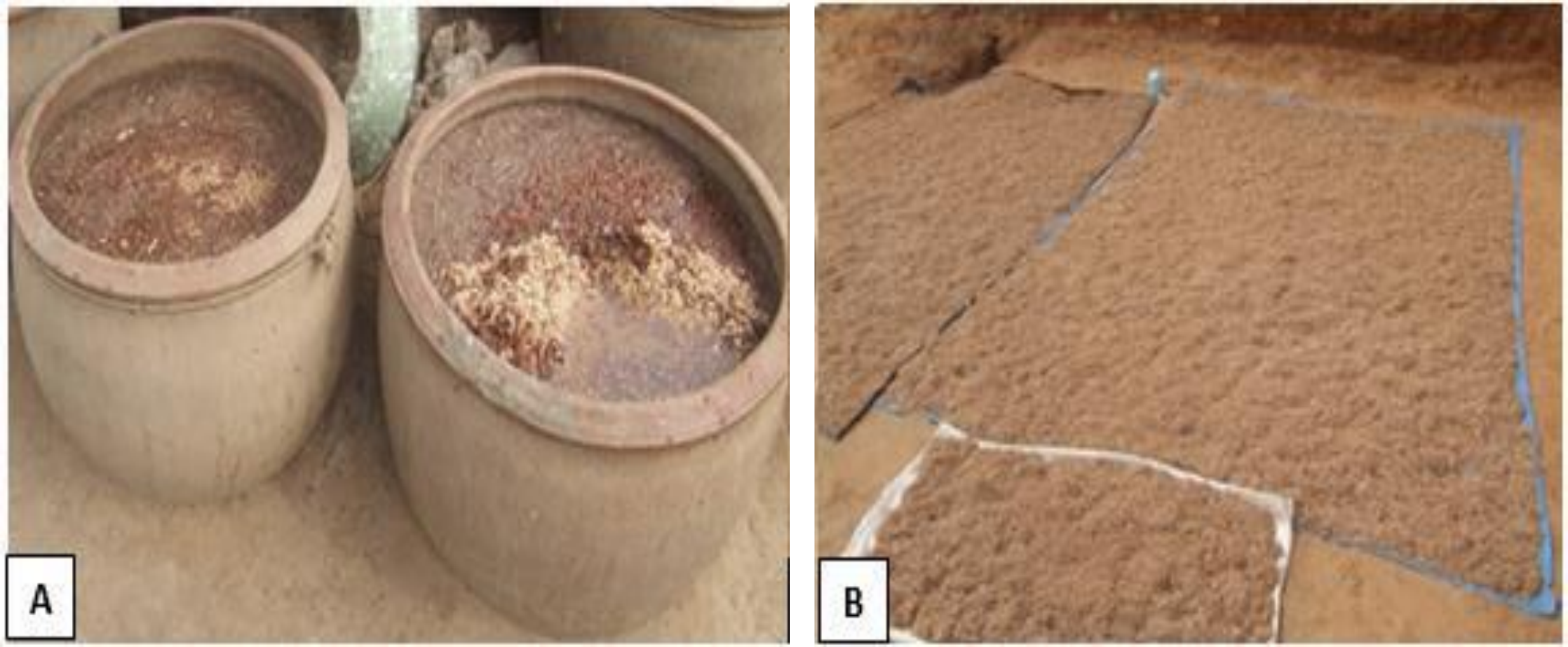
Traditional fermentation: Common practices



Spontaneous fermentation (SF) process for millet

- ✓ Most African fermented foods are produced through SF
- ✓ Process is mostly managed by women in households or at a commercial small scale level
- ✓ In most cases millet grains are winnowed, cleaned and soaked into water for days
- ✓ Back-slopping also commonly practiced

Tradition Malting process-Common Practices



Traditional millet malting process; soaking (sprouting) in pots (A), germination on jute bags (B)

Value addition through Improved processing-An opportunity

Optimization of traditional M&F processes results in:

- ✓ **Processes that are more controlled: Reducing the risk of contamination and creates opportunity for product commercialization**
- ✓ **Increased shelf-life and economic value of products**
- ✓ **Improved packaging that attracts African urban and middle class consumers**
  - ✓ **New-market thus improving the livelihood of farmers & small scale/medium scale enterprises**
  - ✓ **Women empowerment**

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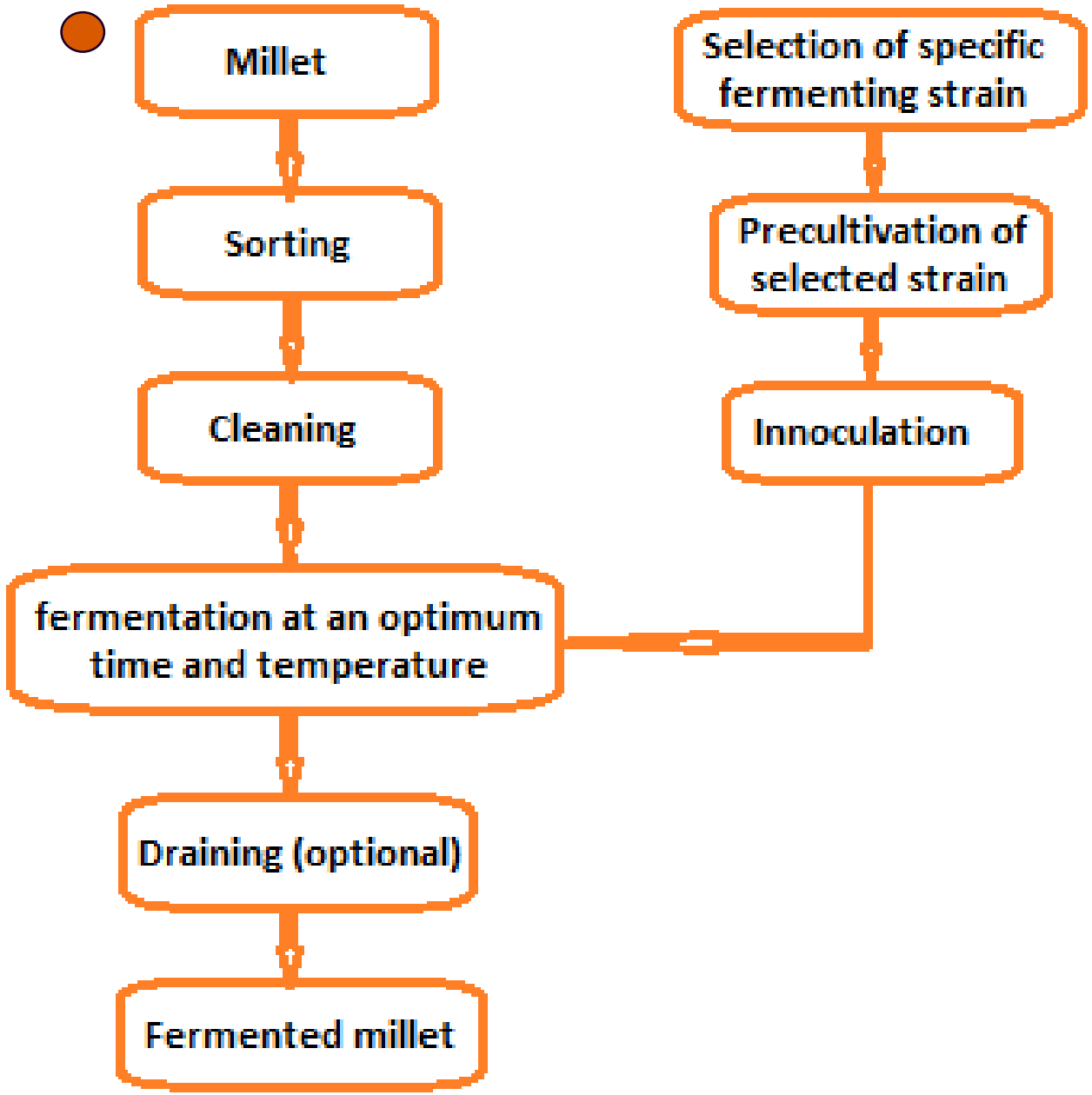

Controlled fermentation process

- Involves monitoring of dominant fermentation microorganisms and the analysis of the respective microbial biodiversity of fermented millet foods
- Specific strains and starter cultures are identified and selected for better fermentation
- Fermentation is done under an optimal condition required by the strain, to yield a desired product characteristics

CEREALS (MILLET/SORGHUM/SOYBEANS)

↓

SORTING AND WASHING

↓

STEPING (18 HOUR) water changed at intervals

↓

DRAINING

↓

MALTING (2 days at ambient temperature 25°C - 30°C)

↓

KLINING (60°C - 65°C)

↓

REMOVAL OF THE ROOTLET

↓

MALTED CEREAL

Optimized process for production of malted cereals

African Fermented and Malted Millet products

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Selected African Fermented and Malted Millet products: Porridges

Traditional Millet based gruel and porridges; *Ogi/Koko/Ugali/pap* (A), *ben saalga* (B)

Value added millet products; packaged *Ogi* (A&B), packaged *Koko* (C&D).

Success story of selected F&M products: Non-alcoholic beverages-

KUNU

Selected African Fermented and Malted Millet products: Non-alcoholic beverages-BUSHERA

"Popular in Uganda and Rwanda"

Selected African Fermented and Malted Millet products: Non-alcoholic beverages-MAHEWU/MAGEU

Mageu **of different flavours displayed in the shelf of supermarkets of Johannesburg, South Africa.**

Selected African Fermented and Malted Millet products: Alcoholic

Traditional millet based alcoholic beverages; *Pombe* from Mozambique (A), opaque beer from Zambia (B), millet beer from Cameroon (C), *Pito* from Nigeria (D).

Selected African Fermented and Malted Millet products: Alcoholic beverages

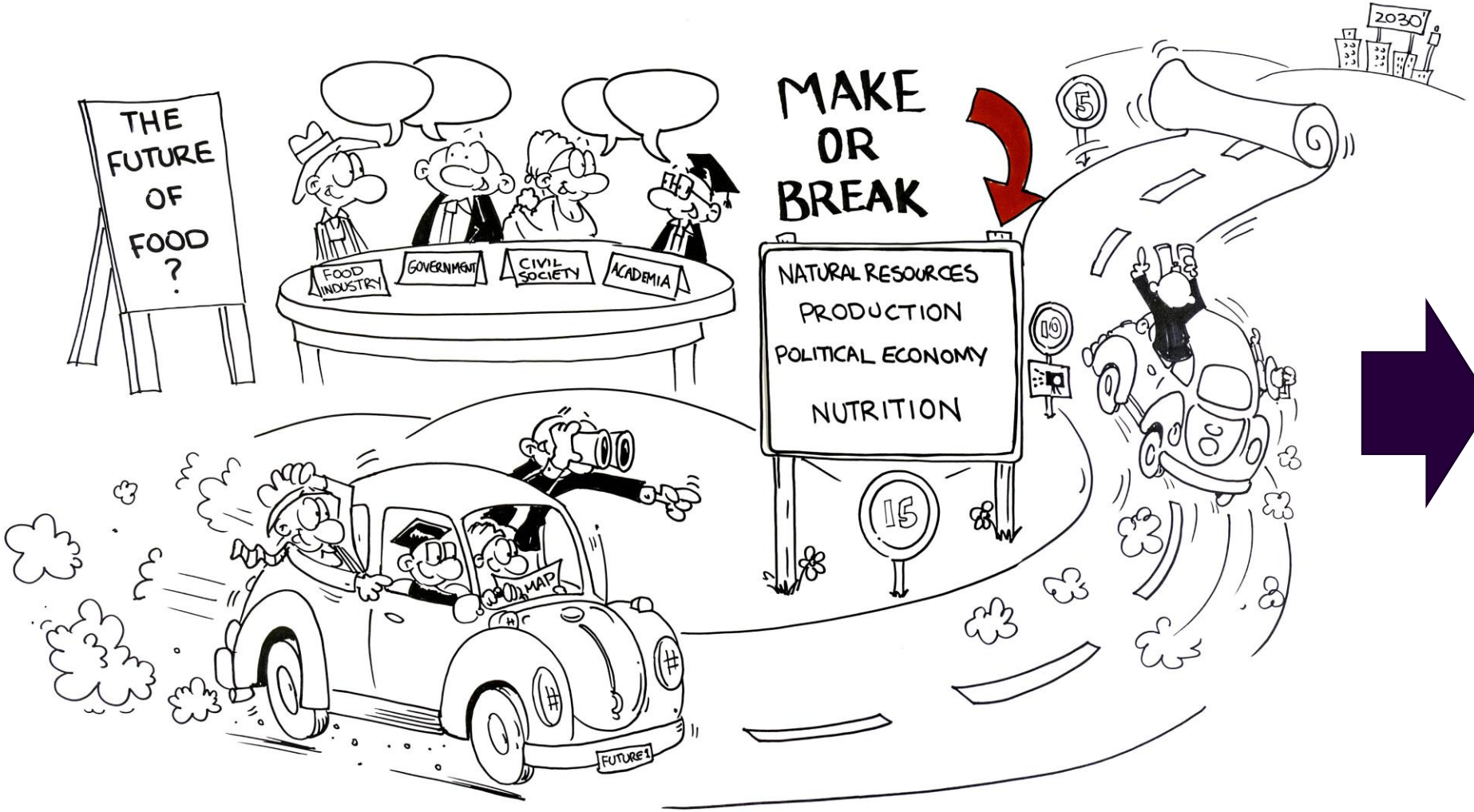
Zambian Opaque beer

Selected African Fermented and Malted Millet products: Alcoholic beverages

Selected African Fermented and Malted Millet products: Millet based flatbreads/pancakes

Injera (Ethiopia)

Kisra (Sudan)



Member Voices

?

the Consumers Mind

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Current Model (Source : FoodLab-SA**)**

Consumer involvement the case of "Bushera Sensory lexicon by Mukisa *et al*., 2009 (Makerere University-Uganda"

Descriptor	Definition	Reference
TASTE		
Sweet	**A taste sensation that is related to sugar or honey**	**1% Sucrose solution**
Sour	**A taste sensation characteristic of lemon juice**	**0.04% citric acid**
Aftertaste Sour	**An after taste sensation characteristic of lemon juice**	**0.04% citric acid**
Bitter	**A taste sensation related to quinine**	**0.02% quinine solution**
MOUTH FEEL		
Coarse	**Consisting of large particles felt in the**	**suspension of sorghum flour particles that are larger than 1 mm**
Astringency	**A sensation that leaves a dry feeling in the mouth**	**Half ripe apple bananas (Ndiizi)**
Thickness	**Related to the ease of flow in the mouth**	**Sorghum porridge(1:3 sorghum : water (v/v)**
AROMA		
Buttery	**Aroma characteristic of butter**	**Salted Butter**
Alcoholic	**Aroma typical of fermented alcoholic products**	**10% Ethanol solution**
Fruity	**A characteristic sweet smell of fruits**	**Banana juice (Omubisi)**
Musty	**Smell characteristic of damp wood or something mouldy**	**Mouldy maize grain**
Stale porridge	**Typical smell of spoilt porridge**	**Stale porridge**
Honey	**Typical aroma of honey**	**Honey**
Pungent	**A sharp stinging sensation in the throat or nose**	**Vinegar**
Cereal	**An aroma related to sorghum or millet flour**	**Ashed sorghum malt**
APPEARANCE		
Dregs	**Appearance of flat particles floating**	**Malwa – Ugandan sorghum beer**
Watery	**Having a high proportion of liquid in comparison to the suspended solid matter**	**A suspension of 1 teaspoon of sorghum flour in 500 mL of water**
Soggy	**Appearance of a mass that is wet and heavy with water**	**Soft mud**
Brown colour	**Appearing brown in colour**	**Cassava flour pancakes (kabalagala)**
Fizzy	**Containing gas bubbles rising to the top**	**Stoney Tangawizi ™ soda that has just been poured in a glass**

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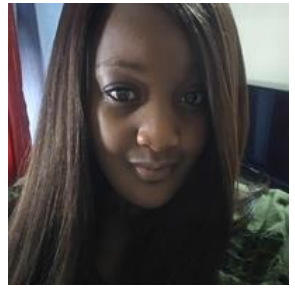

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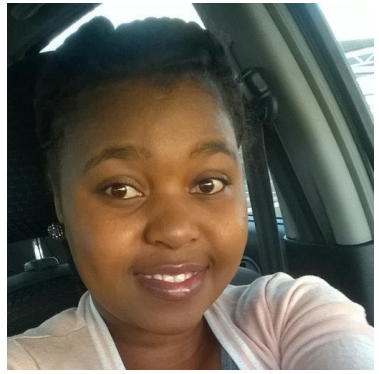
Thank You!!!



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