PRODUCT DEVELOPMENT PROGRAMME

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PROGRAMME VISION

The Product Development Programme aims at conducting applied and appropriate research in technology improvement and innovations in processing and utilization that would contribute to food security through reduction of food losses and increase in value added products for wealth creation.

SPECIFIC OBJECTIVES

- To reduce post harvest losses of crops using improved processing technologies
- Improve and develop value-added agricultural products through enhanced indigenous processing technologies
- To assess physical, nutritional, biochemical and microbial properties of agricultural produce
- To ensure food safety through unique food systems and quality control approach
- To conduct training for local farmers, processors and other relevant stakeholders in collaboration with extension agents on new technologies for enhanced productivity

PROGRAMME MAJOR RESEARCH FOCUS

Product Development Programme research is classified under three main sub-themes:

- Sustainable maize processing and utilization for malnutrition and poverty alleviation.
- Utilization of legume and underutilized legume for improved nutrition and economic development.
- Development of ideal processing conditions and utilization for good quality kenaf products and other industrial products.

RESEARCH REPORTS

- IAR&T Food Processing Training on Cassava Technologies
- Effect of kidney bean diet on some biochemical parameters of diabetic induced

  Rats
- Nutritional Composition of a Breakfast Meal from African Yam Bean and Quality Protein Maize
- Storage of Roselle wine using *Aframomum danielli* as a preservative**.**
- Nutritional, Sensory and storage quality of soy burger and soy mayonnaise.

Project 1: IAR&T Food Processing Training on Cassava Technologies

Background

IAR&T has developed many processing technologies from cassava. Products provide good nutrition and income generating opportunities.

Overall Objectives

Empowering the populace on IAR&T food processing technologies for a sustainable livelihood.

Specific Objective

Information on the benefits of consuming the products and Training in cassava food processing technologies

Methodology

A one-day training was organized by Product Development Programme IAR&T. The training was tagged 'Innovation in Cassava Processing for Income Generation'. Participants were invited from Oyo ADPs and Ibadan environs. The groups were trained on the processing of cassava-wheat bread, cassava chinchin, cassava cookies and cassava tofu pie. The groups were also divided into four groups and were allowed to develop on their own new products from cassava, the new products they developed were- cassava flour pancake, cassava soy roll, cassava soy pie with carrot and cassava cheese roll.

A Pre-test was conducted to assess the participants on their previous knowledge and a Post-test was also used to assess the current knowledge of the participants after the training.

Result

Forty-three (43) participants were in attendance including thirty one (31) female and twelve (12) male. The participants include trainer of trainers from Oyo ADPs, students, industrialists and unemployed men and women. Pre test shows that a number of the participants (33) had previous food processing knowledge. Eleven (11) had previous training in cassava processing. Many of the participants were able to identify cassava products and only a few had used their food processing knowledge in generating income. Post test showed that participants had better understanding in food processing, cassava processing and showed interest in generating income from the training.

Conclusion - Participants had better understanding in cassava processing and they showed interest in generating income from the training.

Project 2 Effect of kidney bean diet on some biochemical parameters of diabetic induced rats

Introduction:

Diabetes is a disease in which the body does not produce enough insulin or becomes insulin resistant, it can occur as a result of an underlying disease, or it can develop over time because of genetics or poor diet. Untreated diabetes can cause serious long-term complications like heart disease, kidney failure, and damage to the eyes.

Histopathology is the microscopic examination of tissues in order to study the manifestations of diseases.

Justification

Nigeria has the highest number of people living with diabetes in Africa, with 3.9 million cases and 4.9 per cent nation prevalence rate (IDF, 2015). Grain legumes are a valuable source of dietary protein and fibre, these properties of legumes makes them veritable tools in the management of diabetes. Evidence is emerging that plant based foods play a beneficial role in the regulation of diabetes and its associated complications (Rotimi*et al*, 2010). Despite the fact that Nigeria is blessed with variety of legumes, only few are known and utilized at home level. Information on the nutritional and health benefits of other legumes (e.g. kidney

bean) will go a long way in improving its utilization and the nutritional wellbeing of consumers especially diabetics; hence the need for this work.

Where we were before: Effect of kidney bean diet on growth performance of diabetic induced rats have been studied and reported**.**

Current objective:

- To investigate the modulatory effect of kidney bean diet on oxidative stress in diabetic induced rats.
- To investigate the effect of kidney bean diet consumption on liver, kidney and pancreas of experimental animals.

Methodology:

Housing of rats **-** Twenty four healthy male Wistar albino rats, with average weight of (200-220) g were used. The experimental animals were housed in the rat house of Institute of Agricultural Research and Training (IAR&T), they were grouped in 4 standard cages, A to D (n=6), and kept under standard environmental condition. The cages are designed for the separate collection of faeces and urine; as well as monitoring of food intake. The rats were acclimatized and fed on commercial pelletized diet for seven days.

Induction of diabetes **-** Diabetes mellitus was induced in overnight-fasted rats by a single intra-peritoneal injection of alloxan monohydrate (150 mg/kg BW) dissolved in ice cold 0.9% NaCl solution. Animals to be used as control received injection water and thus, were submitted to the same stress as the animals that were administered alloxan monohydrate. Hyperglycemea was confirmed by the elevated glucose levels in plasma (72 hrs after injection). Animals with blood glucose level ≥ 200mg/dl were used for this study.

Experimental diet - The rats were kept on experimental diet as in Table 1 for 4 weeks

Table 1: Experimental diet of rat groups

Ingredients	Group A	Group B	Group C	Group D
Corn starch (%)	81	81	71	91
Salt/Mineral mixture (%)	4	4	4	4
Fat (%)	5	5	5	5
Fish meal (%)	10	10	10	-
KBSF (%)	-	-	10	-

GROUP A: Non diabetic rats, normal diet. GROUP B: Diabetic rats, normal diet.
GROUP C: Diabetic rats fed on 10% of Kidney bean seed flour. GROUP D: Diabetic rats fed on nitrogen free diet.
KBSF= Kidney bean seed flour

Collection of tissues/organs

After 4 weeks of feeding, rats were sacrificed; superoxide dismutase (SOD), glutathione peroxidise (GSHPx), alkaline phosphatase (ALP), alanine amino transferase (ALT), and aspartate transaminase (AST) were monitored in the plasma by colorimetric methods using commercial kits. Liver, Kidney and Pancreas were also excised and examined under a digital photographic microscope to ascertain its wholeness or otherwise.

Highlight of results

- The highest levels of SOD and GSHPER were found in rat group C, indicating that this group of rats exhibited the least oxidative stress, while the rats in group B had the highest oxidative stress. (Table 2)
- AST, ALT, and ALP were elevated in diabetic induced rats; but, treatment with kidney bean diet reversed the parameters close to control. (Table 2)
- Diabetic untreated rats showed aberrations in the kidney. (Fig. 1b) This suggests that untreated diabetes has negative effect on the kidney (polyurea (excessive urination), is a common symptom of diabetes)
- No pathological alteration was observed in the kidney of rats in other groups (Figs 1a, 1c, 1d)
- No pathological alteration was observed in the liver of rats in all the groups (Figs 2a, 2b, 2c, 2d)

Conclusion

- Kidney bean diet modulated the oxidative stress in diabetic rats, this may be due to their high antioxidant capacity

- Consumption of kidney bean diet ameliorated the damaging effect of diabetes on liver function
- Kidney bean diet can be used to ameliorate oxidative stress in humans.

Table 2: Effect of kidney bean diet on biomarkers of oxidative stress

Plasma samples	**ALT (U/L)**	**AST (U/L)**	**ALP (U/L)**	**SOD (U/L)**	**GSHPER (µmol/ L)**
A	13.80 ±0.30^{c}	10.05± 0.25^{b}	24.2±0 0.60^{b}	809.20±0.50^{b}	14.30± 0.90^{a}
B	16.05±0.25^{a}	10.95± 0.25^{ab}	26.10± 0.40^{a}	790.10± 0.40^{c}	13.30± 0.80^{b}
C	14.3±00.60^{bc}	10.05± 0.45^{b}	24.50± 0.90^{b}	811.05±0.25^{a}	15.15± 0.55^{a}
D	15.85±0.55^{a}	11.85± 0.25^{a}	27.00± 0.20^{a}	806.45± 1.05^{b}	11.95 ± 0.45^{c}

Values are mean of three determinations. Means with different superscript within the same column are significantly different at ($p<0.05$)

A = Plasma sample of rat group A, B = Plasma sample of rat group B
C = Plasma sample of rat group C, D = Plasma sample of rat group D

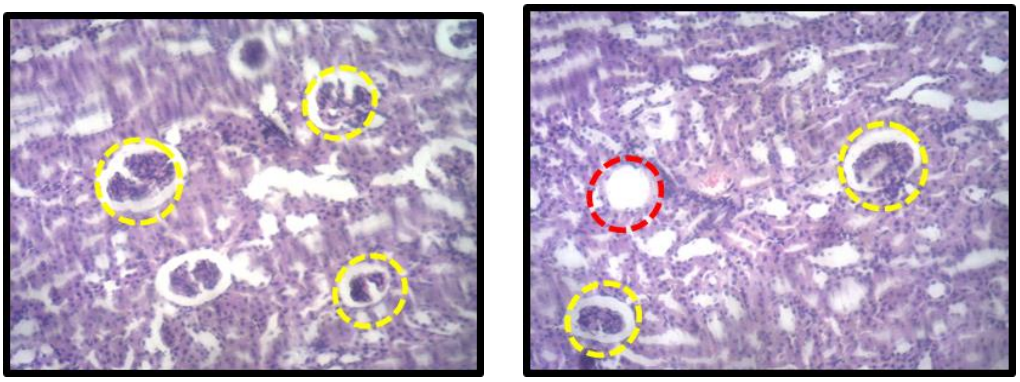


Fig 1a: Representative photomicrographs of kidney (group A) of experimental animals at x100 magnification as demonstrated by hematoxylin and eosin. Fig 1b: Representative photomicrographs of kidney (group B) of experimental animals at x100 magnification as demonstrated by hematoxylin and eosin.

Kidney A: Showing the kidney with characteristic normal disposition of renal corpuscles (yellow circle) with respective Bowman's capsule and glomerulus. The adjoining convoluted tubules appear normal. There are no pathological alterations.

Kidney B: representative photomicrograph of kidney of experimental animal showing the renal with characteristic normal disposition of renal corpuscles (yellow circle) with respective Bowman's capsule and glomerulus. There is a halo spaced renal corpuscle (red circle) suggesting pathologic perturbation of the histomorphology of the kidney

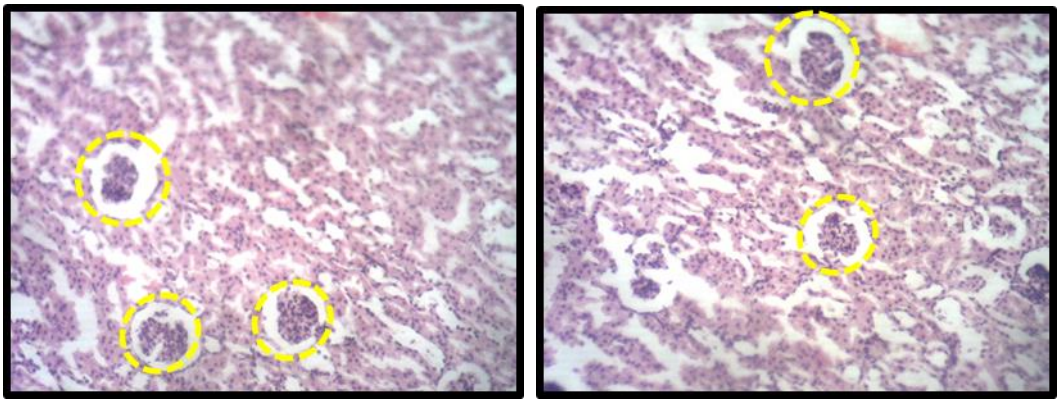


Fig 1c: Representative photomicrographs of kidney (group C) of experimental animals at x100 magnification as demonstrated by hematoxylin and eosin. Fig 1d: Representative photomicrographs of kidney (group D) of experimental animals at x100 magnification as demonstrated by hematoxylin and eosin.

Kidney C: representative photomicrograph of kidney of experimental animal showing the renal with characteristic normal disposition of renal corpuscles (yellow circle) with respective Bowman's capsule and glomerulus. The adjoining convoluted tubules appear normal. There are no pathological alterations.

Kidney d: representative photomicrograph of kidney of experimental animal showing the renal with characteristic normal disposition of renal corpuscles (yellow circle) with respective Bowman's capsule and glomerulus. The adjoining convoluted tubules appear normal. There are no pathological alterations.

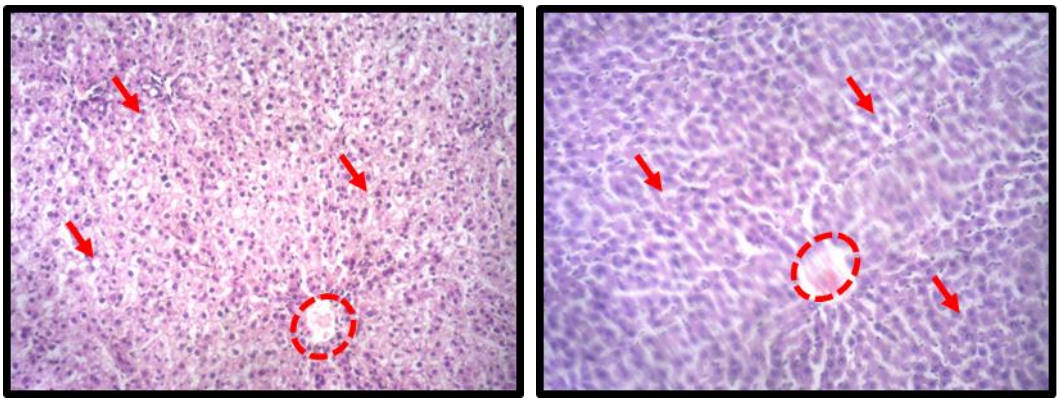


Fig 2a: Representative photomicrographs of liver (group A) of experimental animals at x100 magnification as demonstrated by hematoxylin and eosin. Fig 2b: Representative photomicrographs of liver (group B) of experimental animals at x100 magnification as demonstrated by hematoxylin and eosin.

Liver A: Representative photomicrograph of the liver of experimental animal showing habitual distribution and characteristic density of the hepatocytes (red arrows) tightly packed and evenly distributed around the central vein (red circle). There are no apparent pathological alterations.

Liver B: Representative photomicrograph of experimental animals showing the central veins (red circle) and surrounding hepatocytes (red arrow). The hepatocytes are evenly distributed and densely packed with no signs of pathological alterations.

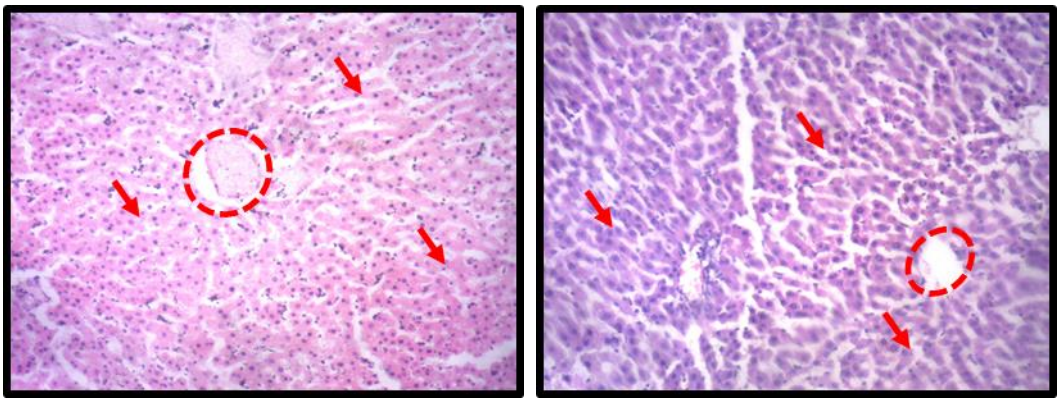


Fig 2c: Representative photomicrographs of Liver (group C) of experimental animals at x100 magnification as demonstrated by hematoxylin and eosin. Fig 2d: Representative photomicrographs of liver (group D) of experimental animals at x100 magnification as demonstrated by hematoxylin and eosin.

Liver C: Representative photomicrograph of the liver of experimental animal showing habitual distribution and characteristic density of the hepatocytes (red arrows) tightly packed and evenly distributed around the central vein (red circle). There are no apparent pathological alterations.

Liver D: Representative photomicrograph of the liver of experimental animal showing habitual distribution and characteristic density of the hepatocytes (red arrows) tightly packed and evenly distributed around the central vein (red circle). There are no apparent pathological alterations. The cracks in the slides are mere tissue tearing that must have occurred during processing of thin sections of the liver,

Project 3 Nutritional Composition of a Breakfast Meal from African Yam Bean and Quality Protein Maize

Introduction

Quality Protein Maize produces 70-100% more of lysine and tryptophan than the most traditional varieties of tropical maize. Grain legumes constitute the main source of protein in the diets of average Nigerian. The legumes are a good source of dietary protein. They are cheaper than animal products such as meat, fish, poultry, and egg; therefore they are consumed as a major source of cheap protein in developing or poor countries like Nigeria. The need therefore arises for the fortification of QPM with underutilized legumes like African yam bean in order to increase the protein content.

Justification

Most rural communities cannot afford animal proteins which can lead to retarded growth for the growing children. Diversifying African yam

bean utilization in the production of breakfast meal will improve the utilization of the otherwise underutilized legume, increase farmer's willingness to cultivate, and improve income generation of farmers and their households. Quality protein maize contains lysine and tryptophan and when fortified with AYB in the production of breakfast meal, it will lead to increase in the protein content of the meal, leading to improved nutritional status of consumers.

Where we were before - Pasting characteristics and sensory properties were reported in the 2017 In-House Review Exercise.

Current Objective

Assessment of the shelf life studies, physicochemical, and sensory properties of a breakfast meal developed from QPM and AYB.

Methodology

African yam bean and QPM varieties were obtained from Grain legume Improvement programme and Maize Improvement programme for Southern Ecologies of the Institute. The QPM used was sorted and grinded into powder, AYB was sorted, rinsed and roasted for about five minutes and was grinded into powder. Composite mixture of the QPM and AYB flour was made at different ratios: 10% AYB +90% QPM, 20% AYB +80% QPM, 30% AYB + 70% QPM, 40% AYB + 60% QPM, 50% AYB + 50% QPM and 100% QPM served as control. Each composite mixture was kept inside clean transparent polythene bag and stored under ambient temperature. Chemical composition, functional, shelf life, microbial quality and sensory properties of these composite flour were evaluated.

Highlight of the Result

The composite mixtures of QPM and AYB made at different ratios and the control were stored for six months. The total viable count increased gradually with increase in storage period. There was no growth in total coliform at day one, thereafter the growth increased gradually with storage time.

No growth was recorded for total *E-coli* and total staphylococcal in all the samples up to the 6^{th} months. There was no growth for total mould count from the first day till third month while there was scanty growth on the fourth month which ranges from $0.3x10^1$cfu/g to $1.0x10^1$cfu/g and on sixth month the growth ranges from $0.6x10^1$ cfu/g to $4.3x10^1$.cfu/g

Conclusion - It can be deduced that the microbial load of samples at sixth month were within the safe levels and can be adjudged as safe for consumption. Although the viable count increased this may be due to the growth of resident organisms in the flour.

TABLE 1: Average Total Bacterial Count

Sample Code	1st Day cfu/g	1st Month cfu/g	2nd Month cfu/g	3rd Month cfu/g	4th Month cfu/g	5th Month cfu/g	6th Month cfu/g
10%	$1.0x10^1$	$1.7x10^1$	$13.3 x10^1$	$5.3x10^2$	$6.7 x10^2$	$8.0 x10^2$	$9.7 x10^2$
20%	$0.6x10^1$	$2.3 x10^1$	$12.3 x10^1$	$7.0 x10^2$	$7.7 x10^2$	$8.0 x10^2$	$10.7 x10^2$
30%	$1.0 x10^1$	$3.0 x10^1$	$13.1 x10^1$	$5.3 x10^2$	$7.0 x10^2$	$8.7 x10^2$	$11 x10^2$
40%	$0 x10^1$	$1.3 x10^1$	$13.3 x10^1$	$8.3 x10^2$	$9.3 x10^2$	$10.7 x10^2$	$13 x10^2$
50%	$0.6 x10^1$	$2.3 x10^1$	$12.7 x10^1$	$6.7 x10^2$	$8.3 x10^2$	$9.7 x10^2$	$11.7 x10^2$
100%AYB	$0.6 x10^1$	$2.3 x10^1$	$15.0 x10^1$	$9.0 x10^2$	$10.7 x10^2$	$11.3 x10^2$	$11.3 x10^2$
100%QPM	$1.0 x10^1$	$1.0 x10^1$	$18.3 x10^1$	$7.7 x10^2$	$9.7 x10^2$	$10.7 x10^2$	$12.7 x10^2$

Key

100% QPM: 100% of Quality protein maize, 90% QPM: 90% of Quality protein maize + 10% of Africa yam bean 80% QPM: 80% of Quality protein maize + 20% of Africa yam bean 70% QPM: 70% of Quality protein maize + 30% of Africa yam bean 60% QPM: 60% of Quality protein maize + 40% of Africa yam bean 50% QPM: 50% of Quality protein maize + 50% of Africa yam bean 100% AYB: 100% of African yam bean

TABLE 2: Average Total Coliform Count

Sample Code	1st Day cfu/g	1st Month cfu/g	2nd Month cfu/g	3rd Month cfu/g	4th Month cfu/g	5th Month cfu/g	6th Month cfu/g
10%	-	-	$11x10^1$	$4 x10^1$	$4 x10^1$	$5.3 x10^1$	$6.7 x10^1$
20%	-	$0.6 x10^1$	$7 x10^1$	$4.3 x10^1$	$3.7 x10^1$	$4.3 x10^1$	$5.3 x10^1$
30%	-	$0.6 x10^1$	$10.7 x10^1$	$3.3 x10^1$	$3.7 x10^1$	$6.7 x10^1$	$7.0 x10^1$
40%	-	$1.3 x10^1$	$8 x10^1$	$2.3 x10^1$	$2.3 x10^1$	$3.7 x10^1$	$4.7 x10^1$
50%	-	$0.3 x10^1$	$9.7 x10^1$	$4.7 x10^1$	$3.7 x10^1$	$5.3 x10^1$	$5.7 x10^1$
100%AYB	-	$1.7 x10^1$	$5.7 x10^1$	$4.7 x10^1$	$4.3 x10^1$	$3.7 x10^1$	$5.3 x10^1$
100%QPM	-	-	$6.7 x10^1$	$3.7 x10^1$	$4.3 x10^1$	$3.3 x10^1$	$4.7 x10^1$

TABLE 3: Average Total Mould Count

Sample Code	1st Day cfu/g	1st Month cfu/g	2nd Month cfu/g	3rd Month cfu/g	4th Month cfu/g	5th Month cfu/g	6th Month cfu/g
10%	-	-	-	-	0.6	2.6	4.3
20%	-	-	-	-	-	-	0.6
30%	-	-	-	-	1.0	1.3	3.3
40%	-	-	-	-	-	-	1.3
50%	-	-	-	-	0.3	1.0	3.3
100%AYB	-	-	-	-	0.6	0.6	2.3
100%QPM	-	-	-	-	0.6	1.0	3.0

Project 4: Storage of Roselle wine using *Aframomum danielli* as a preservative.

Introduction - Roselle plant (*Hibiscus sabdariffa*) belongs to the family Malvaceae. The use of roselle extract in the production of wine is not popular. Roselle extract is rich in vitamins and minerals. It also contain anthocyanins which has antioxidative, anti-inflammatory, antibacterial and antiallegenic capacities. *Aframomum danielli* (*A. danielli*) popularly known as Atere Obiro by Yorubas and Urioma by the Igbos, belongs to the genius Aframomum of the family *Zingiberaccae*. *A. danielli* spice has an excellent antioxidant property.

Justification

In Nigeria the use of roselle calyces in the production of zobo is well known but a dearth of information on the production and storage properties of roselle wine using *A danielli* as a preservative. The use of *A danielli* spice that is affordable and available in the preservation of roselle wine will serve as a good alternative to chemical preservatives which are expensive with grave health consequences. Training of entrepreneurs on preservation of roselle wine would contribute to the gross domestic product of the country

Where we were before: Report of some phytochemicals and sensory properties up to 6 months of storage was reported in 2017 Annual In House Review.

Current Objectives.

- Develop preservation technology for wine processed from roselle calyces by using *A danielli* spice.

- Evaluate changes in the phytochemicals, chemical and sensory properties of the stored roselle wine

Methodology:

Preliminary operations such as cleaning, sorting were carried out to remove extraneous materials from the Roselle calyx. Aqueous extract of roselle calyces was obtained at 10% concentrations and boiled at a temperature of 100°C for 20min. The juices were sieved using a clean muslin cloth and 200g of sugar was added to the juices. Roselle wine was processed using standard approved methods. However 0.3% of sodium metabisulphite, 0.8% , 1.0% and 1.2% of Aframomum danielli powder were added to the wine as preservatives. Also plain roselle wine (RW) was prepared and were all compared with commercial wine. The wine samples were filled into glass bottles and stored at ambient temperature.

Results

- Flavonoids content of roselle based wine samples are higher than commercial wine
- Alcohol content of the wine samples are negligible
- In roselle wine samples, the saponin content of roselle wine with 1.2% A. danielli (RWA3) was the highest at 12 months of storage.
- Roselle wine with 0.3% sodium metabisulphite and 1.2% *A danielli* were acceptable with reference to taste and general acceptability at 12 months of storage.

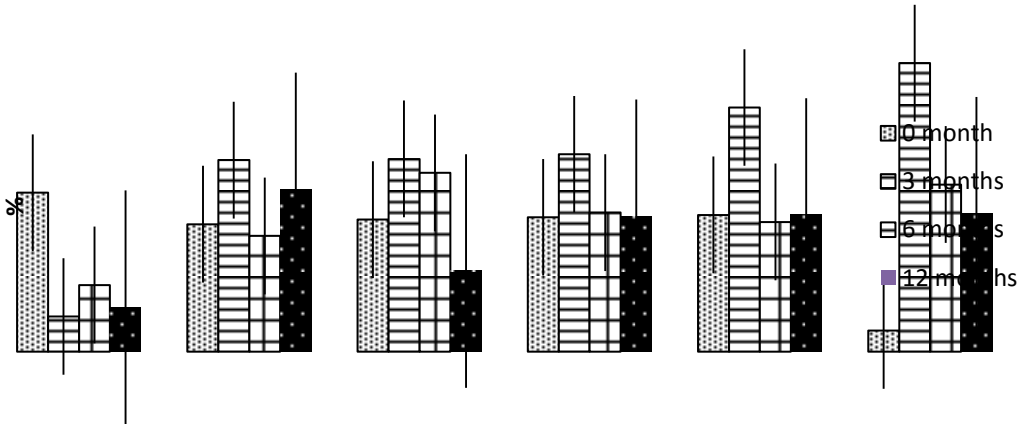


Fig 1 Flavonoid content of stored Roselle wine

Key

CW Commercial wine RW Roselle wine

RWS Roselle wine + 0.3% sodium metabisulphite RWA1 Roselle wine+ 0.8% Aframomum danielli spice RWA2 Roselle wine+ 1% Aframomum danielli spice RWA3 Roselle wine+ 1.2% Aframomum danielli spice

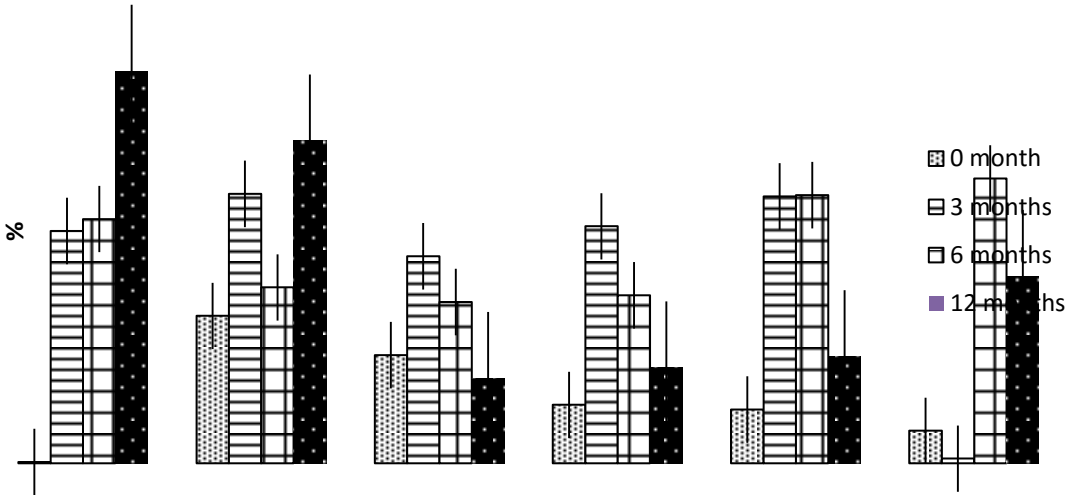


Fig 2 Saponin content of stored Roselle wine

Key

CW *Commercial wine* *RW* *Roselle wine*

RWS *Roselle wine + 0.3% sodium metabisulphite* *RWA1* *Roselle wine+ 0.8% Aframomum danielli spice* *RWA2* *Roselle wine+ 1% Aframomum danielli spice* *RWA3* *Roselle wine+ 1.2% Aframomum danielli spice*

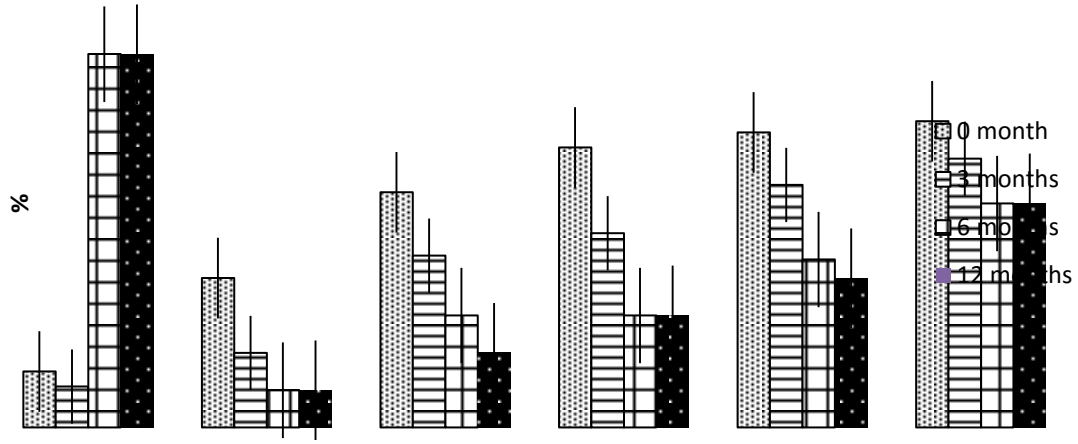


Fig 3 Alcohol content of stored Roselle wine

Key

CW *Commercial wine* *RW* *Roselle wine*

RWS *Roselle wine + 0.3% sodium metabisulphite* *RWA1* *Roselle wine+ 0.8% Aframomum danielli spice* *RWA2* *Roselle wine+ 1% Aframomum danielli spice*

RWA3 *Roselle wine+ 1.2% Aframomum danielli spice*

Table 1 Sensory evaluation of wine samples at 0 month of storage at ambient temperature

Sample	Colour	Taste	Mouth Feel	Flavour	General Acceptability
CW	6.7[a]	7.4[a]	6.7[a]	7.5[a]	7.7[a]
RW	6.9[a]	6.5[ab]	6.5[a]	6.7[ab]	7.4[ab]
RWS	6.7[a]	5.8[bc]	4.5[b]	6.5[ab]	5.8[c]
RWA1	6.4[a]	5.6[bc]	5.2[ab]	5.9[b]	6.1[bc]
RWA2	6.8[a]	5.0[c]	5.6[ab]	5.5[b]	6.0[bc]
RWA3	6.6[a]	5.6[bc]	5.2[ab]	6.2[b]	6.2[bc]

Means in the same column having the same letter are not significantly different from each other at p<0.05

Key

CW Commercial wine RW Roselle wine

RWS Roselle wine + 0.3% sodium metabisulphite RWA1 Roselle wine+ 0.8% Aframomum danielli spice RWA2 Roselle wine+ 1% Aframomum danielli spice

RWA3 Roselle wine+ 1.2% Aframomum danielli spice

Table 2 Sensory evaluation of wine samples at 3 months of storage at ambient temperature

Sample	Colour	Taste	Mouth Feel	Flavour	General Acceptability
CW	7.0[a]	6.8[a]	8.2[a]	7.4[a]	7.6[a]
RW	7.4[a]	5.4[a]	6.2[b]	6.6[a]	6.4[a]
RWS	7.2[a]	6.2[a]	7.2[ab]	6.8[a]	7.0[a]
RWA1	7.2[a]	6.8[a]	6.8[ab]	7.4[a]	7.2[a]
RWA2	7.0[a]	6.4[a]	6.6[ab]	5.6[a]	6.0[a]
RWA3	6.4[a]	6.8[a]	6.4[b]	5.8[a]	6.2[a]

Means in the same column having the same letter are not significantly different from each other at p<0.05

Key

CW Commercial wine RW Roselle wine

RWS Roselle wine + 0.3% sodium metabisulphite RWA1 Roselle wine+ 0.8% Aframomum danielli spice RWA2 Roselle wine+ 1% Aframomum danielli spice

RWA3 Roselle wine+ 1.2% Aframomum danielli spice

Table 3 Sensory evaluation of wine samples at 6 months of storage at ambient temperature

Sample	Colour	Taste	Mouth Feel	Flavour	General Acceptability
CW	8.4[a]	8.0[a]	8.2[a]	8.2[a]	8.8[a]
RW	6.6[ab]	6.2[ab]	5.2[b]	5.2[ab]	5.4[bc]
RWS	6.2[ab]	5.6[b]	4.8[b]	4.4[b]	6.0[b]
RWA1	6.0[ab]	6.0[ab]	5.6[b]	3.8[b]	3.6[c]
RWA2	5.2[b]	5.0[b]	4.6[b]	4.2[b]	3.4[c]
RWA3	5.8[b]	4.8[b]	4.4[b]	5.8[ab]	5.2[bc]

Means in the same column having the same letter are not significantly different from each other at p<0.05

Key

CW Commercial wine RW Roselle wine

RWS Roselle wine + 0.3% sodium metabisulphite RWA1 Roselle wine+ 0.8% Aframomum danielli spice RWA2 Roselle wine+ 1% Aframomum danielli spice

RWA3 Roselle wine+ 1.2% Aframomum danielli spice

Table 4 Sensory evaluation of wine samples at 12 months of storage at ambient temperature

Sample	Colour	Taste	Mouth Feel	Flavour	General Acceptability
CW	5.6[c]	7.4[a]	8.0[a]	7.0[a]	7.0[a]
RW	7.6[a]	6.0[ab]	5.8[ab]	6.2[ab]	6.6[ab]
RWS	6.2[b]	4.8[c]	4.4[c]	5.2[c]	6.0[bc]
RWA1	6.8[ab]	5.2[b]	3.8[cd]	5.0[c]	5.0[cd]
RWA2	7.0[a]	6.0[ab]	4.4[c]	5.6[b]	5.4[c]
RWA3	7.8[a]	7.2[a]	6.8[b]	5.6[b]	6.4[b]

Means in the same column having the same letter are not significantly different from each other at p<0.05

Key

CW Commercial wine RW Roselle wine

RWS Roselle wine + 0.3% sodium metabisulphite RWA1 Roselle wine+ 0.8% Aframomum danielli spice RWA2 Roselle wine+ 1% Aframomum danielli spice

RWA3 Roselle wine+ 1.2% Aframomum danielli spice

Project 6: Nutritional, sensory and storage quality of soy burger and soy mayonnaise

Introduction - Due to the unrivalled nutritional and phytochemical composition of soybeans and the labour-intensive and skill requirement for its processing into meals, hence, it is necessary that soybean is made available in convenience forms so as to encourage its consumption.

Last year we were able to conclude that soy burger can compete favourably with beef and chicken burgers in proximate (protein, fat, ash, crude fibre) and vitamins (thiamine, riboflavin and niacin) composition as well as in sensory properties. Similarly the proximate (except fat) and vitamin composition of soy mayonnaise was significantly higher than that of a commercial mayonnaise brand. It is therefore a pertinent approach to compare the storage quality of soy mayonnaise with that of a commercial mayonnaise brand.

Objectives

- To compare the chemical composition of soy mayonnaise with that of a commercial mayonnaise brand periodically for a year;
- To compare the microbial status of soy mayonnaise with that of a commercial mayonnaise brand;
- To compare the sensory properties of soy mayonnaise with that of a commercial mayonnaise brand periodically for a year.

Methodology

Soy mayonnaise was produced using the basic recipe for the conventional egg mayonnaise but the egg was replaced with soymilk. A sample of the soy mayonnaise was prepared with vinegar while this was replaced with lemon juice in another soy mayonnaise sample. The preservative used was 0.1% potassium sorbate and samples were designated as follows:

BM: A commercial mayonnaise brand (control);

VRM: Soy mayonnaise produced with vinegar;

VLM: Low-fat soy mayonnaise with vinegar;

LRM: Soy mayonnaise produced with lemon juice;

LLM: Low-fat soy mayonnaise with lemon juice.

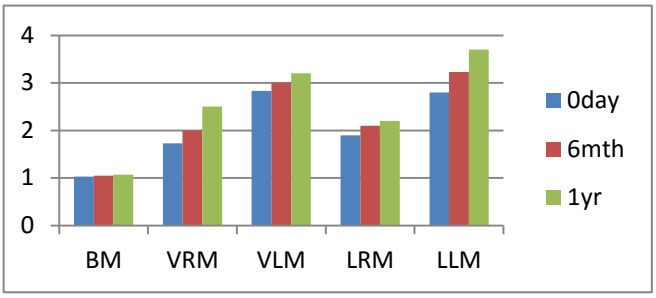
These five samples were subjected to proximate, thiamine, riboflavin, niacin, cholesterol, fatty acid, microbial, texture, colour and sensory analyses using appropriate standard analytical procedures. These were carried out on the day of production and was repeated periodically for a period of one year. Mean data were compared using ANOVA at $p \leq 0.05$.

Highlight of Result

Protein content: The protein content of all the samples increased with length of storage time but this increase was only significant ($p<0.05$) in VRM and LLM (Fig 1)

The protein content of the soy mayonnaise samples were still significantly higher than that of the commercial brand throughout the experimentation period.

Fat content: There was a slight increase in fat content of all the samples with increase in the length if storage time but this increase was not significant ($p<0.05$)



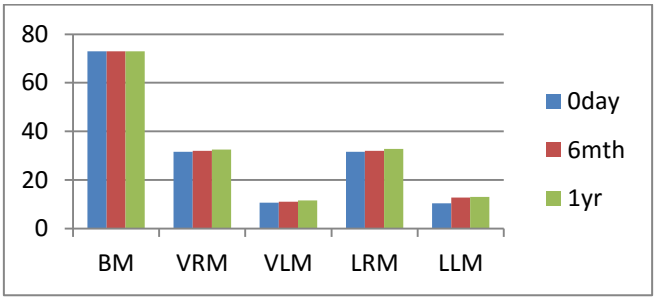


Fig 1: Protein content (%) of mayonnaise samples with storage period, Fig 2: Fat content (%) of mayonnaise samples with storage period

BM- Commercial brand; VRM-Soy mayonnaise produced with vinegar; VLM-Soy mayonnaise produced with vinegar and reduced oil; LRM- Soy mayonnaise produced with lemon juice; LLM-Soy mayonnaise produced with lemon juice and reduced oil. BM- Commercial brand; VRM-Soy mayonnaise produced with vinegar; VLM-Soy mayonnaise produced with vinegar and reduced oil; LRM- Soy mayonnaise produced with lemon juice; LLM-Soy mayonnaise produced with lemon juice and reduced oil.

Ash content: This denotes the mineral content of the samples. The ash content also slightly increased in all the samples but this increase was not significant.

Carbohydrate: This reduced with increase in period of storage in all the samples but this reduction was not significant.

Cholesterol: This was present only in the commercial mayonnaise brand and there was a slight reduction with increase in period of storage.

Vitamin content: Thiamine, riboflavin and niacin content slightly increased with increase in length of storage in all the samples but this increase was not significant. Soy mayonnaise samples were still significantly higher in these vitamins than the commercial brand.

Fatty acid: The increase in fatty acid content of the samples was not significant ($p<0.05$) in all the samples both at the sixth and twelfth months of storage at ambient temperature. Soy mayonnaise samples were still significantly higher than the commercial mayonnaise brand in unsaturated fatty acid throughout the experimentation period.

Microbial status: The commercial mayonnaise brand was free of microorganisms throughout the experimentation period (one year). Soy mayonnaise samples were free of coliform, fungi and anaerobes while the highest total aerobic count was 4.2×10^2 (at the end of the 6^{th} month) which was close to the threshold, that is, 1.5×10^3 at which the sample is considered unsafe for consumption.

Texture: Soy mayonnaise samples were significantly lower ($p<0.05$) than the commercial brand in texture parameters at the sixth and twelfth months.

Colour: In the commercial mayonnaise brand colour parameters reduced significantly at the end of the experimentation period while there was significant increase in the soy mayonnaise samples ($p<0.05$).

Sensory Evaluation: Samples were evaluated the following sensory properties; Colour, mouth-feel, flavour, texture, taste, aroma and

overall acceptability. Even though the sensory scores for the commercial mayonnaise brand were significantly higher than that of the soy mayonnaise samples, the scores for the latter was still within the likeness range. However, there is need for improvement of the sensory properties of soy mayonnaise especially flavour and texture.

Conclusion

Protein, ash, vitamins and unsaturated fatty acids were still significantly higher in the soy mayonnaise samples than the commercial brand throughout the experimentation period while the opposite was the case with the fat content. Ambient storage significantly altered both the texture and colour parameters of all the mayonnaise samples while the shelf life of the soy mayonnaise thus produced could be taken to be six months. Soy mayonnaise was acceptable by consumers though the commercial brand was more preferred, hence, there is need to improve on the sensory properties of soy mayonnaise especially the flavour and texture.

Recommendation

Household and commercial production and consumption of soy mayonnaise is hereby encouraged.