# KWARA STATE UNIVERSITY, MALETE

...the Green University for Community Development and Entrepreneurship

# The Eleventh (11th) Inaugural Lecture

## Title:

# FROM THE FIELD TO THE BOTTLES: WORKS OF THE INVISIBLE CREATURES

## By


Professor Sunday Awe

B.Sc., M.Sc., Ph.D. (Ilorin)

Professor of Industrial and Food Microbiology

Department of Microbiology

Faculty of Pure and Applied Sciences

Kwara State University, Malete, Nigeria


DATE: WEDNESDAY, 10TH MAY, 2023




# KWARA STATE UNIVERSITY, MALETE

...the Green University for Community Development and Entrepreneurship

## The Eleventh (11th)
## Inaugural Lecture

### Title:

# FROM THE FIELD TO THE BOTTLES: WORKS OF THE INVISIBLE CREATURES

### By

Professor Sunday Awe

B.Sc., M.Sc., Ph.D. (Ilorin)

Professor of Industrial and Food Microbiology

Department of Microbiology

Faculty of Pure and Applied Sciences

Kwara State University, Malete, Nigeria

DATE: WEDNESDAY, 10TH MAY, 2023

**The Eleventh (11th) Inaugural Lecture was Delivered Under the Chairmanship of**

**The Ag. Vice Chancellor**
**Professor Shaykh Luqman Jimoh**

**DATE: WEDNESDAY, 10TH MAY, 2023**

**ISBN: .....**

**Published by:**
**KWASU Press and Publishing**



PROFESSOR SUNDAY AWE
B.Sc., M.Sc., Ph.D. (Ilorin)
Professor of Industrial and Food Microbiology

Ag. Vice Chancellor,
Registrar,
Bursar,
University Librarian,
Deans of Faculties, School of Postgraduate Studies and Student Affairs,
Professors and other Members of the University Senate,
Directors of various Centres and Units,
Heads of Departments,All other Academic Colleagues and non - Teaching Staff,
My Lords, Spiritual and Temporal,
Distinguished Students of the Faculty of Pure and Applied Sciences,
Distinguished Students of the Department of Microbiology (Greatest NAMSITES), Greatest KWASITES,
Gentlemen of the Press,
Distinguished invited Guests,
Ladies and Gentlemen.

## 1. Preamble

I give glory, praise and adoration to the Almighty God, the giver of live for the grace and journey so far, and for making me reach this position in my career. I count it a divine privilege and honour to stand before you to deliver the 11th Inaugural lecture of Kwara State University. I am highly delighted to present the story of my research activities over the years to this distinguished audience of town and gown.

An Inaugural lecture provides a golden opportunity for a newly/freshly appointed Professor to give an account of his contribution to the pool of knowledge in his area of specialization. This is the first inaugural lecture to be delivered in the Department of Microbiology and second from the Faculty of Pure and Applied Sciences of this great University.

Mr. Ag. Vice Chancellor Sir, I had wanted to study Medicine at the University of Jos in 1988 but was not admitted as a result of federal government policy on admission into its universities. By providence I was offered admission to study B. Sc. Microbiology at University of Ilorin the following year, which I accepted through the wise counsel of my Biology teacher, Mr. Samuel Folorunsho Adebiyi, then of Ilesha Grammar School Ilesha, Osun State. After my first degree, I had a stint in the industry; working as a Quality Control Microbiologist at Unique Pharmaceuticals Nigeria Plc., Sango Ota, from 1996 to 2000. I left the Industry for University of Ilorin to pursue my M. Sc. degree programme in Microbiology between 2000 and 2002. Shortly after completion of my M. Sc. Programme, I was offered appointment as a Part time lecturer under the Science Laboratory Technology Training Programme at the University of Ilorin, and Department of Biology, Kwara State Polytechnic, Ilorin for a period of four years. Thereafter, I joined Joseph Ayo Babalola University, Ikeji Arakeji as one of the foundation staff in 2006, where I lectured for a year before moving to Ajayi Crowther University, Oyo due its proximity to University of Ilorin to enable me complete my PhD programme on time. On completion of my PhD programme in 2009, I was invited to join in the development of Salem University, Lokoja in 2010 where by the grace of God, I rose to the position of a Reader before joining the Department of Microbiology here in KWASU in January 2016, again to help in the development of the Postgraduate programme of the Department and by the grace of God, I was promoted Professor of

Microbiology in 2021, which was back dated to 2019 during the tenure of the late Vice Chancellor Professor Muhammed Mustapha Akanbi, SAN. May his soul rest in peace.

Mr. Ag. Vice Chancellor Sir, this lecture is coming two years after my promotion to the post of a Professor of Microbiology of this great University. I feel highly honoured and elated today to stand before you and pay my dues by presenting this lecture, which I have titled "From the field to the bottles: Works of the Invisible Creatures".

**Unfolding of the Microbial World**

Microbiology is a specialized area of biology which is concerned with the study of organisms and agents that are too small to be seen clearly with the unaided eye. Such organisms and agents are termed microorganisms (or microbes) that include bacteria, archaea, algae, fungi, protozoa, and viruses. The field is concerned with the structure, function, and classification of such organisms and with ways of both exploiting and controlling their activities. The person that study Microbiology is called a *MICROBIOLOGIST.*

The 17th-century discovery of living forms existing *invisible* to the naked eye was a significant milestone in the history of science. From the 13th century, it had been postulated that "invisible" entities were responsible for decay and disease. The word *microbe* was coined in the last quarter of the 19th century to describe these organisms, all of which were thought to be related. As microbiology eventually developed into a specialized field of science, it was found that microbes are a very large group of extremely diverse organisms.

Daily life is interwoven inseparably with microorganisms. In addition to populating both the inner and outer surfaces of the human body, microbes abound in the soil, in the seas, and in the

air. Abundant, although usually unnoticed, microorganisms provide ample evidence of their presence—sometimes unfavourably, as when they cause decay of materials or spread diseases, and sometimes favourably, as when they ferment sugar to wine and beer, cause bread to rise, flavour cheeses, and produce valued products such as antibiotics and insulin. Microorganisms are of incalculable value to Earth's ecology, disintegrating animal and plant remains and converting them to simpler substances that can be recycled in other organisms.

## Historical background

Microbiology essentially began with the development of the microscope. Although others may have seen microbes before him, it was Antonie van Leeuwenhoek (1632–1723), a Dutch draper whose hobby was lens grinding and making of microscopes, he was the first to provide proper documentation of his observations. His descriptions and drawings included protozoans from the guts of animals and bacteria from teeth scrapings. His records were excellent because he produced magnifying lenses of exceptional quality. Leeuwenhoek conveyed his findings in a series of letters to the British Royal Society during the mid-1670s. Although his observations stimulated much interest, no one made a serious attempt either to repeat or to extend them. Leeuwenhoek's "animalcules," (as he called them), thus remained mere peculiarities of nature to the scientists of his day, and enthusiasm for the study of microbes grew slowly. Before Van Leeuwenhoek's discovery of microorganisms in 1675, it had been a mystery why grapes could be turned into wine, milk into cheese, or why food would spoil. It was only later, during the 18th-century revival of a long-standing controversy about whether life could develop out of non-living material, that the significance of microorganisms in the scheme of nature and in health and welfare of humans became evident.

## Progress of Microbiology in the 20th century

Not until the early 1900s did microbiology become established in America. Many microbiologists who worked in America at this time had studied either under Koch or at the Pasteur Institute in Paris. Once established in America, microbiology flourished, especially with regard to such related disciplines as biochemistry and genetics.

Since the 1940s, microbiology has experienced an extremely productive period during which many disease-causing microbes have been identified and methods to control them developed. Microorganisms have also been effectively utilized in industry; their activities have been channeled to the extent that valuable products are now both vital and common.

Microbes are easy to work with and thus provide a simple vehicle for studying the complex processes of life; as such, they have become a powerful tool for studies in genetics and metabolism at the molecular level. This intensive probing into the functions of microbes has resulted in numerous and often unexpected dividends.

Today, in addition to studying the natural history of microbes, Microbiology also deals with every aspect of microbe-human and microbe-environment interactions, genetics, metabolism, infection, disease, drug therapy, immunology, genetic engineering, industry, agriculture and ecology (Figure 1), among others.

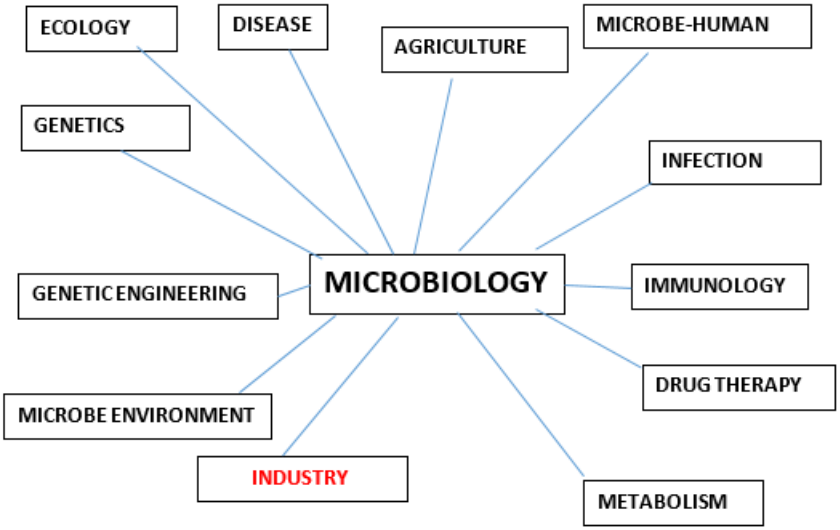



Figure 1. Various Aspects of Microbiology

There are various specialized areas of Microbiology. These include:

**Medical Microbiology:** Concerned with the study of the immune system that protects against infections and attempts to understand the many phenomena that is responsible for both acquired and innate immunity, in addition to the study of antibody-antigen reactions in the laboratory.

**Food and Dairy Microbiology:** The study of interaction of microorganisms and food in relation to food bioprocessing, food spoilage, food borne diseases and their prevention.

**Public Health Microbiology:** Monitoring and control the spread of diseases in communities.

**Industrial Microbiology:** The study of industrial uses of microbes in the production of alcoholic beverages, vitamins, amino acids, enzymes, antibiotics and other drugs.

**Agricultural Microbiology:** Study of relationships of microbes and crops with an emphasis on control of plant diseases and improvement of yields.

**Marine and Fresh Water Microbiology:** Study of microorganisms and their activity concerning human and animal health in fresh, estuarine and marine waters.

**Diagnostic Microbiology:** Fundamental principles and techniques involved in the study of pathogenic organisms as well as their application in the diagnosis of infectious diseases

**Biotechnology:** The scientific manipulation of living organisms, especially at the molecular and genetic level to produce useful products.

**Environmental Microbiology:** Applied area of environmental related study such as Pollution Management in various Industrial areas e.g Petroleum Industries, Oil Exploitation and Exploration Technology, EIA.




Figure 2. Careers in Microbiology

Mr. Ag. Vice Chancellor Sir, in the very rich and wide field of Microbiology, my area of interest is Industrial and Food Microbiology, with special focus on Enology.

**Enology, Enologist?**

The word enology is derived from two Greek words: ***oinos*** and ***logia*** which mean 'wine' and 'study of' respectively. Enology therefore refers to the science that deals with wine making or the art of wine making. An Enologist is therefore someone who is responsible for everything having to do with the science (Biology, Chemistry and Physics) of wine. The responsibility of the Enologist is usually to run a laboratory and analyze the wine or juice. The results of which are then used to make decisions on how to treat the wine or juice. The Enologist manages the different stages of wine production, including fermentation, ageing and bottling (Madeline and Justin, 2015). Mr. Ag. Vice Chancellor sir, distinguished audience, I make bold to tell you today that standing before you is an Enologist from the Department of Microbiology of this great University. I shall be giving you some insight into my work as an Enologist in Academics.

**2.2 My voyage in Enology**

Wine is an alcoholic beverage produced by alcoholic fermentation of juice of ripe grapes by the natural yeasts found on the skin of the fruit or by using selected yeast such as Saccharomyces cerevisiae (Okafor, 1978). Grapes, which are used in wine production, are naturally chemically balanced to normally ferment completely without requiring addition of (extra) sugar, acid, enzymes or other nutrients. Apples, berries and blackcurrants are sometime also fermented for wine production. Non-grape wines are called fruit wine or country wine (Batmanglij, 2006); examples are "apple wine" or "elderberry wine".

Wine has been produced and enjoyed by many; from peasants to kings. Egyptians Pharaohs were especially fond of wine; some of them were even buried with bottles of wine, "to make their journey to the underworld more tolerable" (Michael, 2000). Wine was a very social drink in Ancient Egypt and great importance was given to its production and consumption. Although the Egyptians were not the first to brew wine; they were the first to record the process of wine making and celebrate its values (Michael, 2000). France, Italy and Germany produced over half the total world output of wine, major countries in other parts of the world that are also involved in wine production are shown in Figure 3 (Fessler, 1988; Smith, 1996; Lau and Jaworski, 2003).




Figure 3: Wine making regions of the world (Fessler, 1988)

The wine industry experienced a brief decline in the 17th century; during which politics and religious propaganda did little to promote the drinking of wine for pleasure. Although the 19th century is considered the golden age of wines, it was not without tragedy; around 1863 many of the French grapevines began to suffer from a mysterious disease. `

Shortly after Louis Pasteur, a Professor of Chemistry, a crystalogist (a person who studies crystals), arrived in Lille, the father of one of his students consulted him on the difficulties that he was experiencing with the alcoholic fermentation of beet sugar in his distillery. As at that time (1850s), it was still viewed that the process where organic solution would be converted to wine was an entirely chemical one requiring a catalyst. The makeup of the catalyst was mysterious but thought to be chemical in nature, and specific to the type of fermentation. The view that fermentation was purely chemical began to change in 1835 when Cagniard de la Tour in France and Theodor Schwan in Germany independently suggested that yeasts involved in the process were living cellular organisms. Although, Justus von Liebig proposed that if the yeasts contributed to alcoholic fermentation, it was not as living beings.

Pasteur was contemplating the problem that the father of the pupil presented to him and realized the need to re-examine the nature of fermentation. He carefully designed experiments to refute the long-held belief in the solely chemical nature of the process and found that wine production was accompanied by growth of many spherical shaped organisms **invisible to the human eyes.** He used the microscope, the instrument that helped him with his crystal experiments, to examine the disease of fermentation (Robert, 2011). Pasteur showed by a simple superbly designed experiment that alcoholic fermentation is an act correlated with the life, and with the organization of these globules (yeasts) and not with their death or putrefaction. He went on to show that the problem of the wine merchant was that putrefaction was occurring in the distillery rather than alcoholic fermentation. Pasteur realized that foreign organisms competing with the yeast in the ferment caused the disease of fermentation. The leaps that Pasteur had made in his work on fermentation radically changed thinking about the nature of fermentation; and also provided foundation for understanding infectious diseases.

Solving the problem presented to him by his student's father, Pasteur set out to find a way to remove the contaminating microorganism by adding a variety of compounds, which were ineffective. He therefore turned to heat and discovered that the heat would not affect the wine marking process if applied after all the oxygen originally present in the bottle had become exhausted. This technique discovered by him is known as Pasteurization. With this development, the French Government invited him to help resolve the challenge of wine spoilage at the national level.

**Wine Making with Fruits**

The scientific background of wine making has developed greatly, allowing for many things that were once thought impossible to be accomplished. Mr. Ag. Vice Chancellor Sir, ladies and gentlemen my voyage into Enology started from a course during my M.Sc Degree programme in the year 2000: Advance Industrial Microbiology taught by Prof. J. A. Akinyanju. We were given a group assignment to produce wine (referred to as fruit wine) from guava fruits. I came to realize that Nigeria is not listed among African Countries that produce any kind of wine. I was fascinated considering the varieties and quantity of fruits that are wasted in Nigeria every year. This exposure made me to know and realize that apart from grapes, wines, called fruit wines, can be produced from other types of fruits.

Fruit wine making is not significantly different from making wines from grapes. The process is basically the same and consideration is given to the same aspects as when preparing grape wine. To produce wine from fruits other than grapes, the following must be considered:

i. the quantity of fruit to be used,

ii. the amount of available fermentable sugars, and

iii. the fruit juice's acidity.

Once these are determined, necessary adjustment can be made depending on the quantity of alcohol wanted in the wine. This makes it possible to take just about any fruit you can imagine and produce a notable wine. Fruits with good proportion of sugar may be used including but not limited to oranges, apples, cashews, pineapples, watermelons, blackberries, pawpaw, banana, guava etc. However, careful attention should be given to the quality of the fruit; doing so will repay many times over in the form of consistently superior wine (Berry, 2000).

Mr. Ag. Vice Chancellor Sir, Nigeria is undoubtedly blessed with a vast array of seasonal fruits, which are rich in sugars. The fruits are produced yearly in quantities that are more than their consumption. Large quantities of those fruits are wasted yearly due to non-availability of, or poor storage facilities. This results in loss of the vital nutrients (Vitamins) that are associated with them and loss of potential revenue source. Also, the nutrients that are so lost due to fruit spoilage can be harnessed and made available all year round, if fruit wine are produced from the fruits.

As at the time this research commenced, little or no attention was paid to the investigation of suitability of our fruits for wine production. As my contribution to the race toward self-reliance and local sourcing for raw materials for food and drink production in Nigeria, I decided to focus on production of fruit wine from locally available fruits, and assessment of their suitability for human consumption. I have assessed the potentials of some locally available fruits for wine production.

Ag. Vice Chancellor Sir, I followed up my foray into Enology by undertaking research into Production, Quality Assessment and Toxicology of Wines from Selected Fruits in Nigeria for my PhD Degree programme. For the study I selected Cashew (Anacardium occidentale L.), Banana (Musa sapientum),

Pawpaw (Carica papaya) and Pineapple (Ananas comonsus (L.) Merr, Syn); common fruits around North Central and South Western Nigeria. Fruit wines were successfully produced from the four fruits (Plate 1 and 2) .

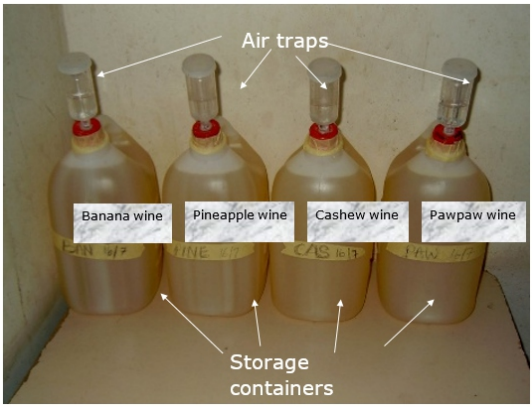



Plate 1. Fruits wines undergoing aging




Plate 2. Different types of Bottled fruit wine

The yield from the fruits in volume/gram varied in the order: Cashew > Pawpaw >Pineapple > Banana. In terms of alcohol yield the fruit wines were in the order: Banana, Cashew, Pawpaw and Pine apple (Fig. 4). The toxicological assessment showed that indicator enzymes, Aspartate amino transferase (AST), Alanine amino transferase (ALT), Gama–glutamyl transferase (GGT) and Lactate dehydrogenate (LDH) activities obtained for the fruit-wines were not significantly different from those of Red wine ($p > 0.05$) (Fig. 5 - 12). Haematological parameters evaluated were also not significantly different ($P > 0.05$) (Table 1 and 2) (Awe and Okorie, 2014). Histological assessment revealed that there was damage to the liver at 7.5% alcohol level and above (Plate 3, 4a 4b, 4c, 4d and 4e). (Awe et al., 2011; Awe and Madueke, 2012; Awe et al., 2013)

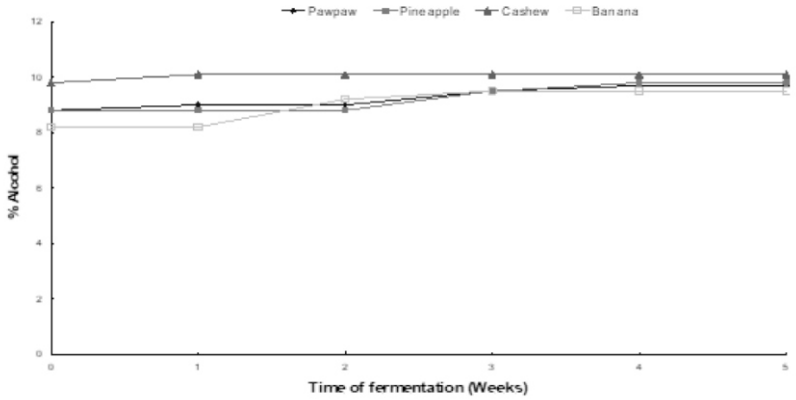



Figure 4. Alcohol production during aerobic fermentation of must

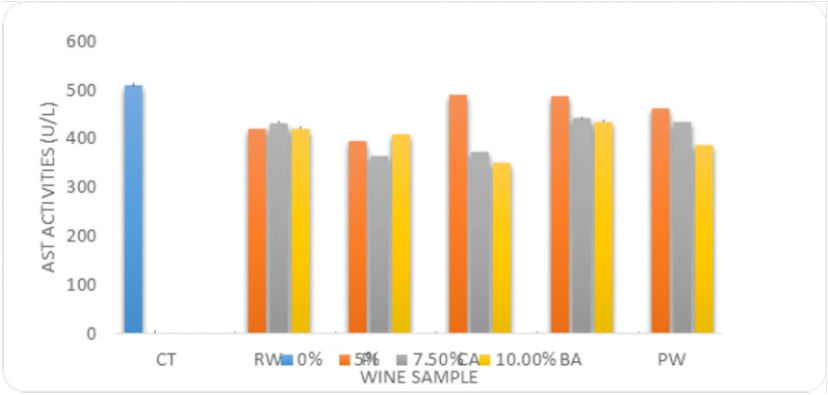



Figure 5. Effect of different wines with different alcohol contents on Aspartate amino transferase (AST) activities in the liver

Key: CT – Control (Water) RW- Red wine, PI- Pineapple wine, CA- Cashew wine,

BA- Banana wine, PW- Pawpaw wine

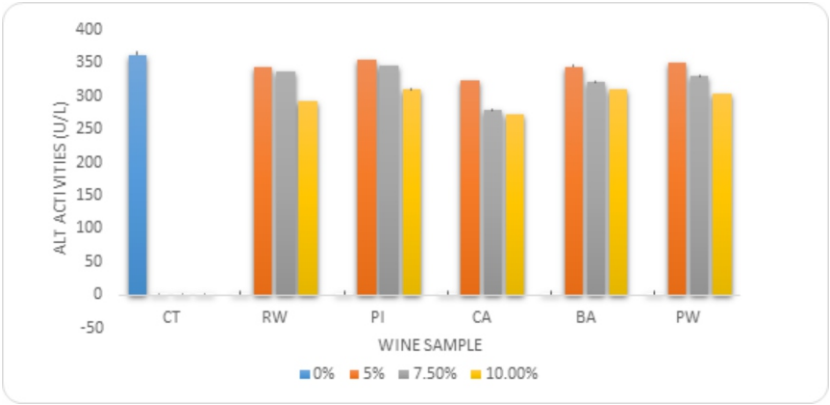



Figure 6. Effect of different wines with different alcohol contents on Alanine amino transferase (ALT) activities in the liver

Key: CT – Control (Water), RW- Red wine, PI- Pineapple wine, CA- Cashew wine,

BA- Banana wine, PW- Pawpaw wine

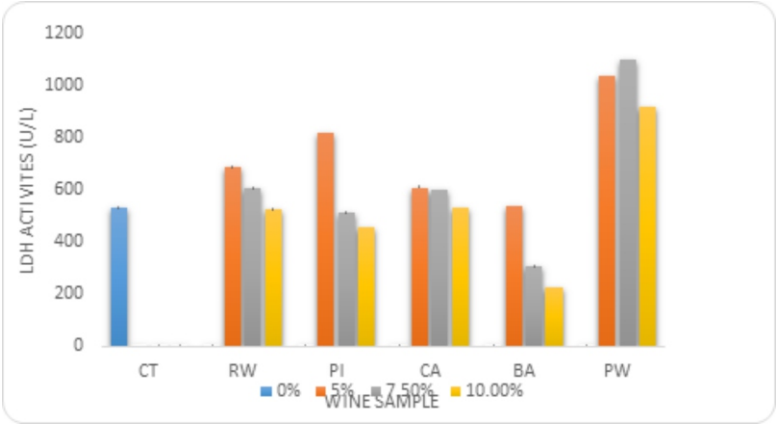



Figure 7. Effect of different wines with different alcohol contents on Lactate dehydrogenate (LDH) activities in the liver

Key: CT – Control (Water), RW- Red wine, PI- Pineapple wine, CA- Cashew wine,

BA- Banana wine, PW- Pawpaw wine

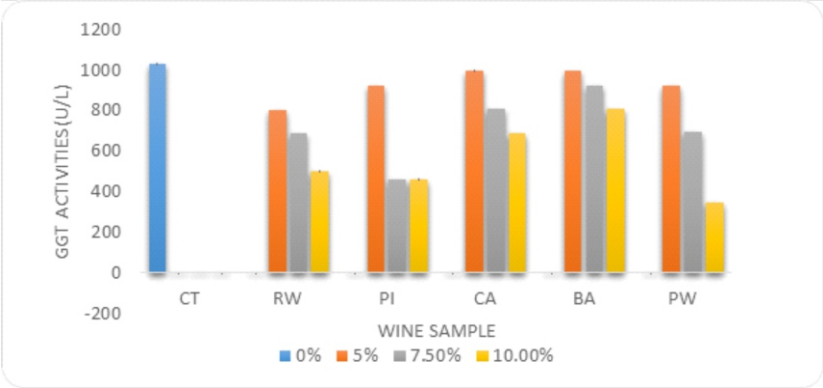



Figure 8. Effect of different wines with different alcohol contents on Gama–glutamyl transferase (GGT) activities in the liver

Key: CT – Control (Water), RW- Red wine, PI- Pineapple wine, CA- Cashew wine,

BA- Banana wine, PW- Pawpaw wine




Figure 9. Effect of different wines with different alcohol contents on Aspartate amino transferase (AST) activities in the serum

Key: CT – Control (Water) , RW- Red wine, PI- Pineapple wine, CA- Cashew wine, BA- Banana wine , PW- Pawpaw wine

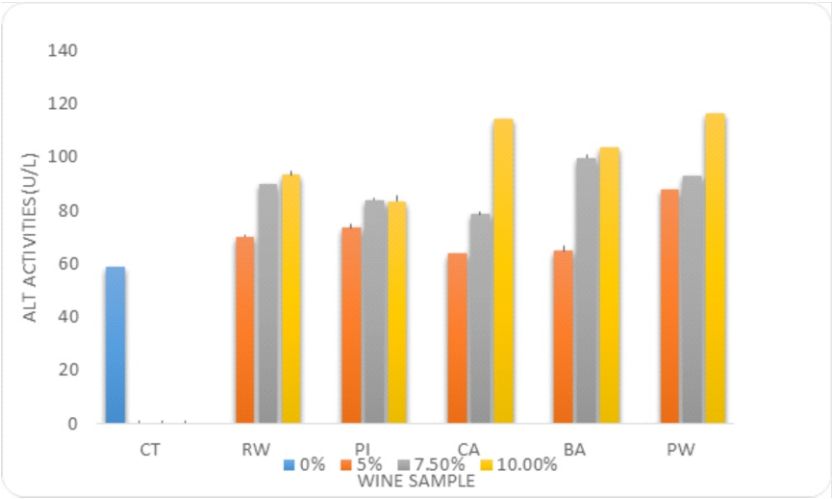



Figure 10 . Effect of different wines with different alcohol contents on Alanine amino transferase (ALT) activities in the serum

Key: CT – Control (Water), RW- Red wine, PI- Pineapple wine, CA- Cashew wine,

BA- Banana wine, PW- Pawpaw wine

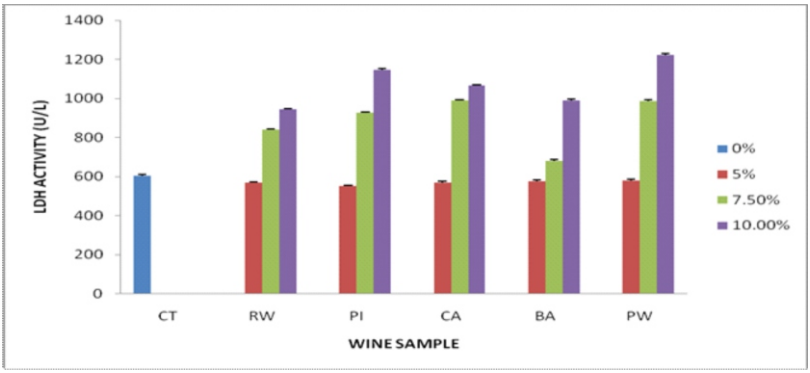



Figure 11. Effect of fruit wines on Lactate dehydrogenate (LDH) activities in the serum

Key: CT – Control (Water), RW- Red wine, PI- Pineapple wine, CA- Cashew wine,

BA- Banana wine, PW- Pawpaw wine

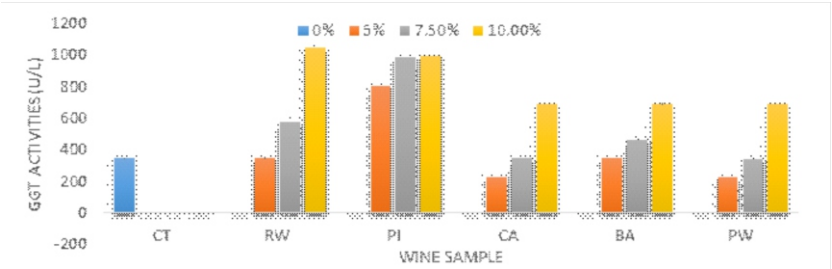



Figure 12. Effect of fruit wines on Gama–glutamyl transferase ( GGT) activities in the serum

Key: CT – Control (Water), RW- Red wine, PI- Pineapple wine, CA- Cashew wine,

BA- Banana wine, PW- Pawpaw

Table 1. Effects of wine samples on Red Blood Cell indices

| Red Blood Cell indices | % alcohol | Wine sample | | | | |
|---|---|---|---|---|---|---|
| | | Red wine | Pineapple wine | Cashew Wine | Banana Wine | Pawpaw Wine |
| PCV (%) | CT | 39.00 ± 0.70 | 39.00 ± 0.70 | 39.00 ± 0.70 | 39.00 ± 0.70 | 39.00 ± 0.70 |
| | 5 | 36.30 ± 0.47 | 35.00 ± 1.41 | 34.66 ± 2.35 | 39.00 ± 070 | 38.33 ± 0.94 |
| | 7.5 | 37.00 ± 0.07 | 35.33 ± 0.23 | 31.00 ± 2.82 | 40.00 ±1.41 | 38.66 ± 0.23 |
| | 10.0 | 37.00 ± 2.12 | 32.66 ± 0.23 | 33.30 ± 3.29 | 38.38 ± 0.23 | 39.33 ±1.17 |
| RBC ($X10^{12}$/L) | CT | 4.94 ± 0.10 | 4.94 ± 0.10 | 4.94 ± 0.10 | 4.94 ± 0.10 | 4.94 ± 0.10 |
| | 5 | 4.57 ± 0.06 | 4.43 ± 0.11 | 4.42 ± 0.20 | 4.99 ± 0.02 | 4.75 ± 0.14 |
| | 7.5 | 4.69 ± 0.07 | 4.48 ± 0.01 | 3.78 ± 0.98 | 5.05 ± 0.24 | 4.85 ± 0.02 |
| | 10.0 | 4.67 ± 0.22 | 4.19 ± 0.01 | 4.80 ± 0.96 | 4.88 ± 0.04 | 4.93 ± 0.11 |
| HB (g/dl) | CT | 13.46 ± 0.25 | 13.46 ± 0.25 | 13.46 ± 0.25 | 13.46 ± 0.25 | 13.46 ± 0.25 |
| | 5 | 12.53 ± 0.18 | 12.06 ± 0.51 | 11.93 ± 0.82 | 13.46 ± 0.25 | 13.23 ± 0.30 |
| | 7.5 | 12.76 ± 0.25 | 12.16 ± 0.04 | 10.70 ± 0.98 | 13.80 ± 0.49 | 13.33 ± 0.04 |
| | 10.0 | 12.76 ± 0.73 | 11.26 ± 0.09 | 11.46 ±1.15 | 13.23 ± 0.09 | 13.56 ± 0.37 |
| MCH(pg) | CT | 27.33 ± 0.25 | 27.33 ± 0.25 | 27.33 ± 0.25 | 27.33 ± 0.25 | 27.33 ± 0.25 |
| | 5 | 27.33 ± 0.23 | 27.00 ± 0.70 | 27.00 ± 0.70 | 26.66 ± 0.94 | 27.66 ± 0.23 |
| | 7.5 | 27.33 ± 0.23 | 27.33 ± 0.23 | 28.66 ±1.17 | 27.66 ± 0.23 | 27.23 ± 0.23 |
| | 10.0 | 27.33 ± 0.47 | 26.66 ± 0.23 | 27.66 ± 0.47 | 27.00 ± 0.00 | 27.66 ± 0.23 |
| MCV (fl) | CT | 79.00 ± 0.00 | 79.00 ± 0.00 | 79.00 ± 0.00 | 79.00 ± 0.00 | 79.00 ± 0.00 |
| | 5 | 79.00 ± 0.00 | 78.66 ± 0.94 | 78.33 ±1.85 | 78.20 ± 2.12 | 80.00 ± 0.70 |
| | 7.5 | 78.66 ± 0.47 | 79.00 ± 0.70 | 83.33 ± 3.77 | 79.66 ± 0.94 | 79.66 ± 0.23 |
| | 10.0 | 79.00 ± 0.70 | 77.66 ± 0.94 | 80.66 ±1.17 | 78.66 ± 0.47 | 80.00 ± 0.70 |
| MCHC(g/dl) | CT | 34.66 ± 0.47 | 34.66 ± 0.47 | 34.66 ± 0.47 | 34.66 ± 0.47 | 34.66 ± 0.47 |
| | 5 | 34.66 ± 0.23 | 34.33 ± 0.47 | 34.00 ± 0.00 | 34.66 ± 0.47 | 35.33 ± 1.17 |
| | 7.5 | 34.66 ± 0.47 | 34.33 ± 0.47 | 34.66 ± 0.23 | 34.33 ± 0.23 | 35.33 ± 0.94 |
| | 10.0 | 34.66 ± 0.23 | 34.33 ± 0.47 | 34.00 ± 0.00 | 34.66 ± 0.47 | 34.66 ± 0.47 |

Each Value is A Mean of Three Determinations ± SEM

KEY: PCV- Pack cell volume, MCH - Mean cell haemoglobin, HB –Haemoglobin, RBC- Red blood cell, MCV – Mean cell volume, MCHC- Mean cell haemoglobin concentration

## Table 2. Effects of wine samples on Differential White Blood Cell Count

| Differential White blood cell cont. | % Alcohol | Wine sample | | | | |
|---|---|---|---|---|---|---|
| | | Red wine | Pineapple wine | Cashew Wine | Banana Wine | Pawpaw Wine |
| TWBC | CT | 8.50 ± 0.56 | 8.50 ± 0.56 | 8.50 ± 0.56 | 8.50 ± 0.56 | 8.50 ± 0.56 |
| (x $10^9$/l) | 5 | 10.95 ± 2.16 | 7.03 ± 0.02 | 8.83 ± 0.40 | 7.60 ± 0.91 | 7.20 ± 0.21 |
| | 7.5 | 10.23 ± 1.17 | 7.66 ± 0.65 | 7.76 ± 01.39 | 8.50 ± 0.56 | 7.56 ± 0.54 |
| | 10 | 10.6 ± 0.84 | 8.10 ± 2.40 | 10.66 ± 2.35 | 7.43 ± 0.75 | 7.76 ± 0.37 |
| NEU (%) | CT | 29.66 ± 1.03 | 29.66 ± 1.03 | 29.66 ± 1.03 | 29.66 ± 1.03 | 29.66 ± 1.03 |
| | 5 | 27.33 ± 2.35 | 23.33 ± 3.77 | 33.33 ± 1.17 | 39.00 ± 3.53 | 34.33 ± 2.59 |
| | 7.5 | 28.66 ± 0.47 | 26.60 ± 3.29 | 24.44 ± 1.24 | 43.33 ± 4.70 | 32.33 ± 1.64 |
| | 10.0 | 27.33 ± 4.00 | 28.66 ± 3.54 | 30.66 ± 1.59 | 39.33 ± 4.00 | 46.33 ± 2.59 |
| EOS (%) | CT | 3.66 ± 3.06 | 3.66 ± 3.06 | 3.66 ± 3.06 | 3.66 ± 3.06 | 3.66 ± 3.06 |
| | 5 | 2.33 ± 1.64 | 1.30 ± 0.47 | 2.33 ± 1.88 | 8.66 ± 1.88 | 0.33 ± 0.23 |
| | 7.5 | 1.33 ± 0.47 | 7.00 ± 0.07 | 2.00 ± 2.12 | 4.00 ± 0.07 | 5.00 ± 2.12 |
| | 10.0 | 2.66 ± 1.64 | 3.00 ± 0.70 | 3.66 ± 0.47 | 2.33 ± 1.88 | 0.33 ± 0.23 |
| | CT | 66.66 ± 1.07 | 66.66 ± 1.07 | 66.66 ± 1.07 | 66.66 ± 1.07 | 66.66 ± 1.07 |
| LYM (%) | 5 | 78.33 ± 2.24 | 75.33 ± 3.29 | 64.33 ± 3.60 | 52.33 ± 5.42 | 65.33 ± 2.35 |
| | 7.5 | 73.33 ± 4.71 | 66.33 ± 2.59 | 74.00 ± 3.36 | 52.66 ± 5.42 | 62.66 ± 3.77 |
| | 10.0 | 82.00 ± 2.82 | 68.33 ± 8.24 | 65.66 ± 3.12 | 58.33 ± 5.89 | 53.33 ± 2.35 |

Each Value is a Mean of Three Determinations ± SEM

Values along the same row are not significantly different (P>0.05)

KEY: LYM – Lymphocyte EOS – Eosinophil NEU – Neutrophil

TWBC – Total white blood cell




**Plate 3.** Photomicrograph (X120) showing effect of administration of Distilled Water (CONTROL) on Architecture of liver of Rats. (XH stain)

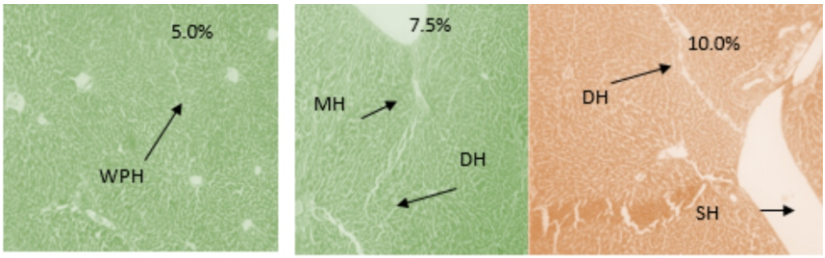



**Plate 4a.** Photomicrograph (X120) showing effect of administration of Red wine at different alcohol levels (5, 7.5 and 10%) on Architecture of liver of Rats. (XH stain)

WPH- Well preserved Hepatocyte, SH- Sever Hyperplasia,

MH-Mild Hyperplasia Central Vein, DH- Distorted Hepatocyte

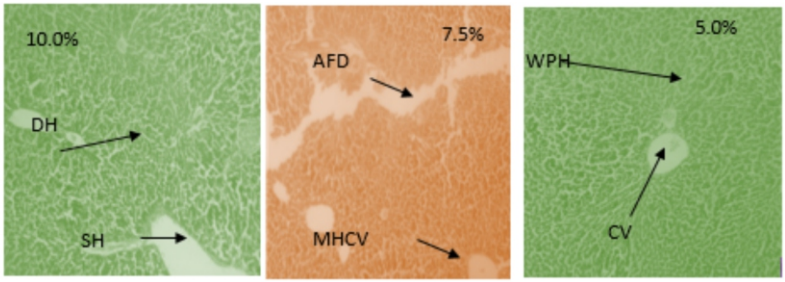



**Plate 4b.** Photomicrograph (X120) showing effect of administration of Banana wine at different alcohol levels (5, 7.5 and 10%) on Architecture of liver of Rats. (XH stain)

WPH- Well preserved Hepatocyte, CV- Central Vein, - WPH- Well Preserved Hepatocytes

SH- Sever Hyperplasia, CV-Central Vein, DH- Distorted Hepatocyte

AFD- Area of fatty acid degeneration

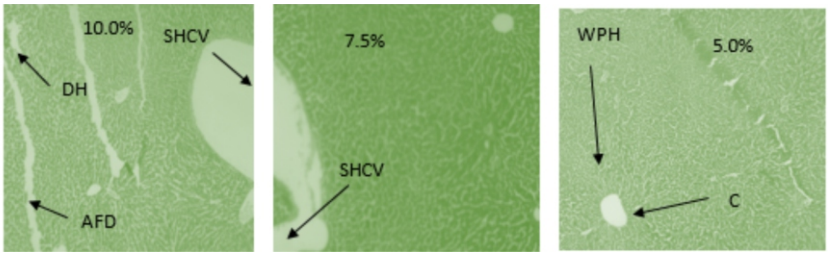



**Plate 4c.** Effect of Cashew wine (5, 7.5 and 10% alcohol) on Architecture of liver of Rats (XH stain)

WPH- Well preserved Hepatocyte, SHCV- Sever Hyperplasia Central Vein,
MH-Mild Hyperplasia Central Vein, DH- Distorted Hepatocyte
AFD- Area of fatty acid degeneration CV- Central Vein

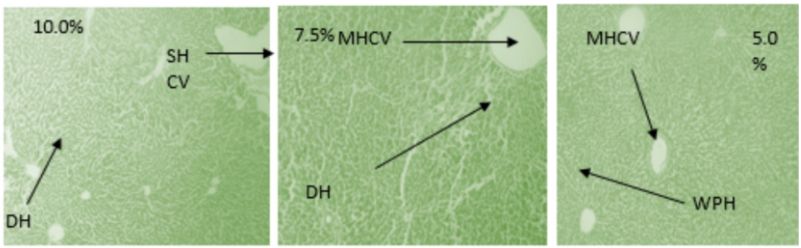



**Plate 4d.** Effect of Pineapple wine (5, 7.5 and 10% alcohol) on Architecture of liver of Rats (XH stain)

WPH- Well preserved Hepatocyte, SHCV- Sever Hyperplasia Central Vein,
MHCV-Mild Hyperplasia Central Vein, DH- Distorted Hepatocyte

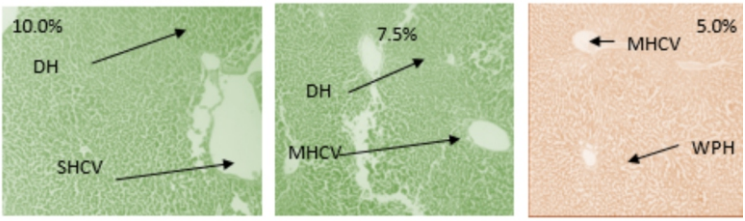



**Plate 4f.** Effect of Pawpaw wine (5, 7.5 and 10% alcohol) on Architecture of liver of Rats (XH stain).

WPH- Well preserved Hepatocyte, SHCV- Sever Hyperplasia Central Vein,
MHCV-Mild Hyperplasia Central Vein, DH- Distorted Hepatocyte

## Clarifying Agent and Clarifiers

Clarifying agent or fining is a product that alters the clarity of wine, when added to it (Berry, 2000). Bentonite, gelatin, casein, albumin and kaolin are used in wines as clarifiers. The effects of clarifying agents on the clarity of the wines were investigated with gelatin and kaolin. The result revealed that Gelatin was a better clarifying agent for the fruit wines I produced (Fig. 13a – d) (Awe, 2018).

## Acceptability of wines

In terms of acceptability the order was: Banana, Pine apple, Pawpaw and Cashew. Figure 14 shows acceptability of the fruit wines produced to human volunteers. Banana wine was the most acceptable (79%) while Cashew was the least acceptable (64%). There was no significant difference between the fruit wines produced and the Red wine (P>0.05).

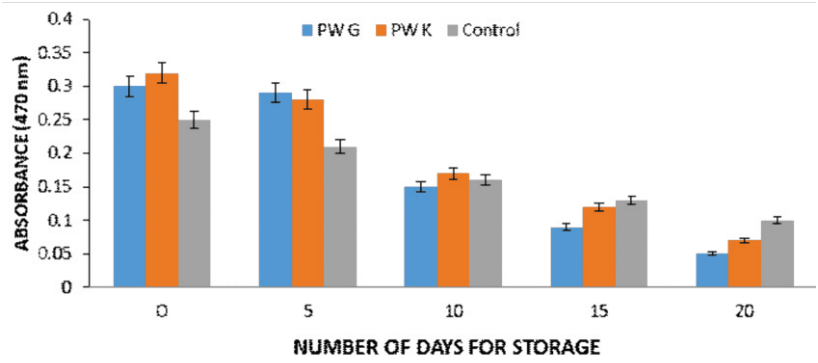



Figure 13a. Effect of clarifying agents on Pawpaw wine

Key: PWG=Pawpaw wine + Gelatin, PWK= Pawpaw wine + Kaolin

The values are the Means ± SD (range) for three readings.

Significantly different from the control, $p<0.05$

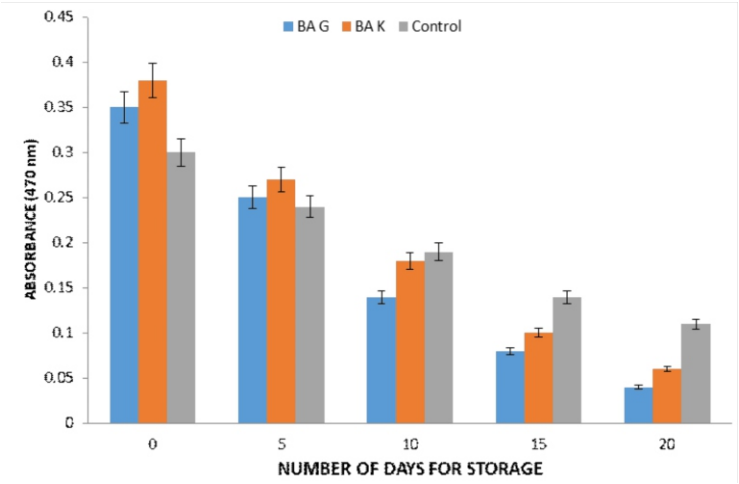



Figure 13b. Effect of clarifying agents on Banana wine

Key: BAG= Banana wine + Gelatin, BAK= Banana wine + Kaolin

The values are the Means ± SD (range) for three readings.

Significantly different from the control, $p<0.05$

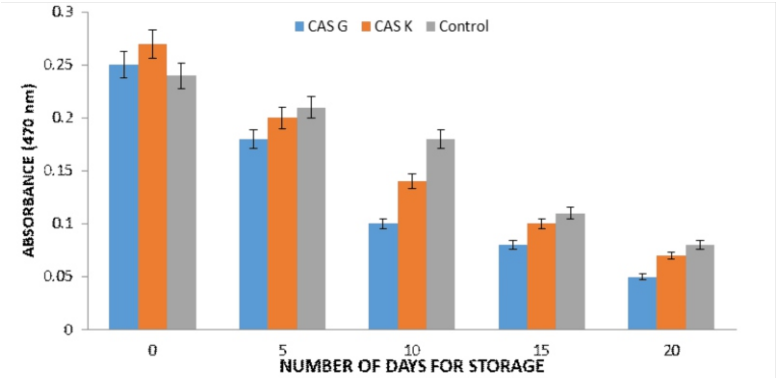



Figure 13c. Effect of clarifying agents on Cashew wine

Key: CASG= Cashew wine + Gelatin, CASK= Cashew wine + Kaolin

The values are the Means ± SD (range) for three readings.

Significantly different from the control, $p<0.05$)

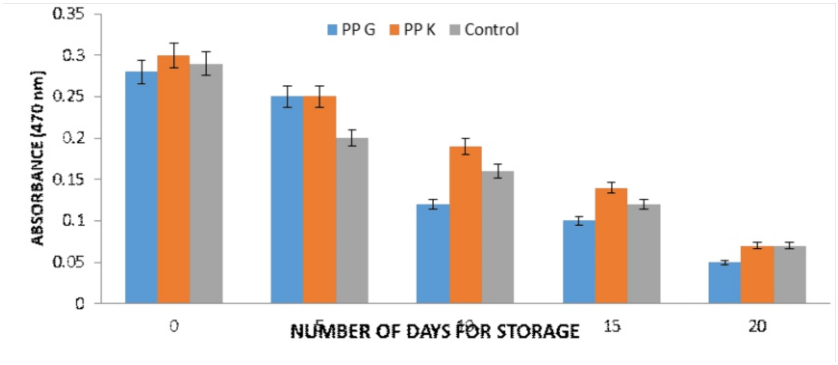



Figure 13d. Effect of clarifying agents on Pineapple wine

Key: PPG= Pineapple wine + Gelatin, PPK= Pineapple wine + Kaolin

The values are the Means ± SD (range) for three readings.

Significantly different from the control, $p<0.05$)

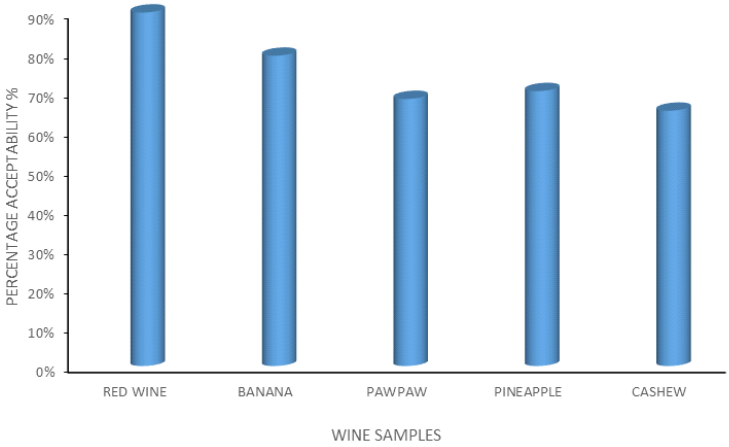



Figure 14. Acceptability of Fruits wines produced compared to Red wine

Following the completion of the PhD programme, I have, along with colleagues, worked on production of fruit wines from Dates Palm (Phoenix dactylifera L.) (Awe and Nadozie, 2015), dietary inclusion of locally made sweet potato wine to protect against biochemical alterations in high cholesterol fed rats potatoes (Ajani *et al*., 2020), and currently work is ongoing on production of Tomato wine. Mr. Ag. Vice Chancellor sir, I am delighted to remind us that these fruit wines were showcased at the exhibition during the 2021 Convocation ceremony. The quality and toxicological assessment results were similar to those of the other fruit wines.

## FOOD QUALITY AND THE INVISIBLE CREATURES

Ag. Vice Chancellor Sir, distinguished guests, as part of my training as an Industrial Microbiologist, I have devoted part of my research work to food quality assessment. These include: Effect of microbial fermentation on the nutritional and anti-nutritional composition of fermented Mung Bean (Vigna radiata) (Lawal and Awe, 2020; Lawal *et al.*, 2021). Bacteriological quality of Sobo drinks (Olowe et al., 2003), Effect of preservatives on Zobo Drink (Awe and Abdulmumin, 2019), Microbial quality of smoked Frog (Rana esculanta) and Heavy Metal Composition (Awe and Oshomah, 2019), Bacteriological assessment of selected fruits and vegetables (Awe et al., 2018), Microorganisms associated with selected fresh fishes from river Niger (Awe and Adejo 2018), Parasitological assessment of fresh vegetables and Fruits (Awe *et al.*, 2015), Microbiological analysis of street foods (Madueke *et al.*, 2014) and Microbiological quality of some selected spices (Thymus vulgaris, Murraya koenigi and Piper nigrium) (Awe et al., 2009).

Ag. Vice Chancellor Sir, animal protein in developing countries has over the years been in shorts supply, and has been attributed to

inadequate products and high cost of conventional sources of animal protein - poultry, goat meat, beef, mutton and pork. This has led to the sourcing of alternatives to provide a solution to the problem of protein deficiency in this regard. Frogs are consumed in some part of the world as source of protein.

In our study, we examined the microbial quality, proximate composition and heavy metal content of smoked frog retailed in some markets in Ilorin, Nigeria.

We observed that smoked frog was nutritionally rich but harbor pathogenic microorganisms and heavy metals which can pose serious health hazard to consumers; hence they are not totally safe for human consumption (Awe and Oshomah, 2019).

Our study on zobo examined effect of different preservation techniques to increase the shelf life of Zobo drink. This study revealed that the synergistic effect of pasteurization and lime, pasteurization and sodium benzoate introduced into zobo drinks, minimize bacterial load to acceptable limit. The microbial load obtained for all the samples is within the limit of 103 cfu/ml for ready-to-drink soft drink for at least six days after production (Awe and Abdulmumin, 2019).

Adequate nutrition is a prerequisite for active and healthy living. However, getting the required nutrients from foods that are free from potential toxic constituents and readily available for human consumption are among the major concerns. Our study investigated the effect of microbial fermentation on the nutritional and anti-nutritional composition of fermented mug bean (Vigna radiata). Legumes are probably the second most important source of food next to cereal grains and are consumed worldwide as a major source of protein especially in developing countries. Thus, legumes are good supplements in areas where the staple food is high in carbohydrates but low in protein (Mensah and Olukoya, 2007).

Our study established the effect of fermentation on the microbial and nutrient compositions of mug bean (Vigna radiata). The microbial analysis showed that some of the isolated bacteria were beneficial and their pure strains were confirmed using sequencing analysis. Further work revealed that fermenting mung beans led to an increase in protein and lipid contents coupled with decrease in antinutrient composition which will make more nutrients available from the seed.

These findings indicate:

1. that fermenting mung beans (Vigna radiata) led to an increase in protein and lipid contents coupled with decrease in antinutrient composition. This is of importance in solving protein energy malnutrition;
2. that fresh vegetables and fruits in our major markets harbor high number of parasitic and pathogenic contaminants. Hence consumption of unwashed raw fruits and vegetables from these markets is highly hazardous to human health. However, there is a need to educate people about the need for proper washing of fruits and vegetables using salt water to avoid microbial and parasitic infections before consumption;
3. that the synergistic effect of preservatives: lime, pasteurization and sodium benzoate introduction into zobo sample can be used to minimize bacterial load to acceptable limit for at least six days after production (Awe and Abdulmumin, 2019).

Ag. Vice Chancellor Sir, in recent years, increasing attention has been drawn to plants and foods rich in natural antioxidants, particularly fruits and vegetables, which have been linked with reduced risks of several chronic diseases in human such as diabetes, cancer and so on (Olsson et al., 2014; Yi et al., 2016). Sorghum (Sorghum bicolour) ranks the fifth most staple crop all

over the world in terms of world grain production (FAOUN, 2015) Among the cereals, sorghum contains the highest phytochemical contents (6 % w/w) including anthocyanins, carotenoids, phenolic acids, and condensed tannins, and so on. (Doka et al., 2004; Dicko et al., 2005).

Anthocyanins are reported to have some therapeutic benefits including vaso- protective and anti-inflammatory properties, anti-cancer and chemo-protective properties, as well as anti-neoplastic properties. In a series of collaborative studies that I led, we focused on increasing the anthocyanin production in sorghum by fermentation using the ***invisible creatures*** as starter culture since the use of plant tissue culture proposed as a means of large-scale anthocyanin production to date has not been able to produce anthocyanins at levels sufficient to meet current industrial demand (Moore, 2006).

Our study showed array of ***invisible creatures*** during fermentation that could result in a significant increase in anthocyanin content of sorghum bicolor R-960 particularly Pantoea dispersa LMG 2603 and Cronobacter sakazakii NBRC 102416 which produced a significant amount of anthocyanin after 5 days fermentation.

## WATER QUALITY ASSESSMENT USING THE INVISIBLE CREATURES

Ag. Vice Chancellor Sir, one of the inputs to my research is water. Along with colleagues, I have devoted some time to assess the importance of the ***invisible creatures*** in water quality. According to statistics from the United Nations, more than 1.1 billion people do not have access to any form of source of potable water and about 1.6 million deaths result annually as a direct consequence of lack of access to potable water and basic sanitation (WHO, 2016).

Ag. Vice Chancellor Sir, ladies and gentlemen, it is common knowledge that since the late 1980s water storage has become a popular practice in many homes, hence, the question: what happens to the invisible creatures in water that are stored for days or perhaps weeks?

Realizing the widespread lack of awareness of groundwater contamination, my team and I carried out studies which included assessing the qualities of water from hand pump well (Plate 5) (Awe and Faloye, 2020), risk assessment of drinking well water using Portable Microbiology Laboratory (PML) Kit (Plate 6 and Table 3) (Olawale et al., 2019), bacteriological examination of springs water (Awe et al., 2012), effect of storage of water in containers (Eniola et al., 2007) and solar disinfection of water from stream and wells (Plate 7) (Eniola et al., 2011). In our studies we found potential health risk of some of the water sources in different communities in Malete, Ilorin and Offa, Kwara State, considering the EPA's recommendation for acceptable distance (minimum safe distance- MSA) between a water well and a septic tank; there is need for interventions to guarantee safe drinking water in those communities.

We observed that storing water in containers improved the quality of the water after 12 to 14 days of storage. The factors responsible were gravitation sedimentation, inter and intra specific interactions and nutrient depletion (Eniola et al., 2007) Also, we found that the population of invisible creatures was depreciating overtime and disinfection was also taking place upon exposure of water to sunlight. The initial invisibles creatures count of the water samples were high (1.8 to $2.4\times10^6$ cf/ml and 2.2 to $2.4\times10$

for well and stream water respectively). They were reduced by between 78.7 to 86.3% for well water and between 77.4 to 81.2% for stream water. The rates of killing of invisible creatures varied in the water samples and also hourly (8.5 to 56.5%/hour and 8.2 to

50.0%/hour for the well water and stream water respectively). The rate of disinfection was influenced by the intensity of solar radiation, aerosol optical depth and relative humility. We found that exposing water to radiation from sun using pet bottles from 6 to 8 hours (depending on the location) improved the water quality. In the course of our study, we realized that this method had been used to reduce incidence of water borne diseases in rural communities of East Africa and Asia known as Solar Disinfection (SODIS). This is not yet known in Nigeria and we are still studying its adaptability and acceptability to our politico economic and cultural setting.




Plate 5. (A-F): Hand Pump well sampled

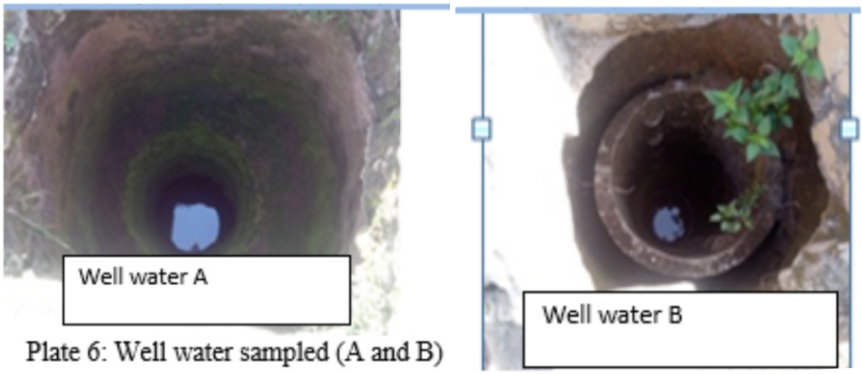



Plate 6: Well water sampled (A and B)




Plate 7. Application of Solar Disinfection of Water (SODIS)

Table 3: Water Samples Analysis using Colilert and Petrifilms

| S/N | Sample ID | Date collected | Location Collected | 24hr Colilert | | 24hr Petrifilm # Blue &Gas | Risk Level |
|---|---|---|---|---|---|---|---|
| | | | | ONPG | MUG | | |
| 1. | ALB HPB | 14-01-19 | Alenibare Hand p | + | - | 0 | Low |
| 2. | ALB W1 | 14-01-19 | umped borehole Alenibare Well 1 | + | + | 3 | **High** |
| 3. | ALB W2 | 14-01-19 | Alenibare Well 2 | + | - | 0 | Low |
| 4. | BOH HPB | 14-01-19 | Bolohunduro Hand pumped borehole | + | - | 0 | Low |
| 5. | BOH W | 14-01-19 | Bolohunduro Well | + | + | 2 | **High** |
| 6. | GB MBH | 14-01-19 | Gbosun Motorized BH | - | - | 0 | Nil |
| 7. | GB W | 14-01-19 | Gbosun Well | + | - | 0 | Low |
| 8. | ILO W1 | 04-02-19 | Ilota well 1 | + | + | 6 | **High** |
| 9. | ILO W2 | 14-01-19 | Ilota well 2 | + | + | 5 | **High** |
| 10. | ILO P | 04-02-19 | Ilota pond | + | + | 15 | **Very High** |
| 11. | Igb G HPB | 04-03-19 | Igbonna garage hand pumped borehole | + | - | 0 | Low |
| 12. | Igb G MBH | 04-03-19 | Igbonna garage motorized borehole | - | - | 0 | Nil |
| 13. | KA W1 | 04-02-19 | Kere-aje Well 1 | + | + | 13 | **Very High** |
| 14. | KA W2 | 04-02-19 | Kere-aje Well 2 | + | + | 8 | **High** |
| 15. | KA MBH | 04-02-19 | Kere-aje motorized borehole | - | - | 0 | Nil |
| 16. | Kan HPB | 04-02-19 | Kanmonu Hand pumped borehole | + | - | 0 | Low |
| 17. | Kan W | 04-02-19 | Kanmonu Well | + | - | 0 | Low |
| 18. | Ogbo W1 | 04-03-19 | Ogbondoroko Well 1 | + | + | 6 | **High** |
| 19. | Ogbo W2 | 04-03-19 | Ogbondoroko Well 2 | + | - | 0 | Low |
| 20. | Ogbo W3 | 04-03-19 | Ogbondoroko Well 3 | + | + | 5 | **High** |
| 21. | Ogbo W4 | 04-03-19 | Ogbondoroko Well 4 | + | + | 8 | **High** |
| 22. | Ogbo W5 | 04-03-19 | Ogbondoroko Well 5 | + | + | 3 | **High** |
| 23. | R.O HPB | 04-02-19 | Reke-Oja hand pumped borehole | + | - | 0 | Low |
| 24. | TE W1 | 04-03-19 | Temidire Well 1 | + | + | 14 | **Very High** |
| 25. | TE W2 | 04-03-19 | Temidire Well 2 | + | + | 2 | Low |

| Risk Level | *E. coli in sample* | Colliert MUG+ | # Blue Colonies on Petrifilm |
|---|---|---|---|
| Nil | - | - | 0 |
| Low | <1/10 ml | - | 0 |
| Moderate | 1-10/10 ml | + | 0 |
| High | 1-10/ml | + | 1-10 |
| Very High | >10/ml | + | >10 |

## Conclusion

Ag. Vice Chancellor Sir, ladies and gentlemen, Nigeria is blessed with sugar-rich fruits in different locations around the Country all the year round; the nutrients that are otherwise lost due to lack of facility to store fruits leading to loss of vital nutrients and potential revenue can be harnessed and made available all year round, with the help of the ***invisibles creatures***, fruit wine can be produced from them. This lecture has drawn our attention to the fact that Nigeria also has the potential to join the league of countries known for wine production if we make deliberate effort to maximize the potential of many fruits available in our nation. Fruit wines were successfully produced from banana, cashew, pawpaw and pineapple, sweet potatoes, date palm fruits and tomatoes using mostly locally available materials. The wine produced compared favourably with imported wine: (Red wine Carlo Rossi, vinted and bottled by Carol Rossi Vineyards, California U.S.A) in terms of toxicological effects, nutritive quality, microbiological quality, acceptability with the Cashew wine having a higher Vitamin C content than the Red wine.

Ag. Vice Chancellor sir, ladies and gentlemen, it may interest you to know that there is no non-alcoholic wine. No wine is produced without alcohol. There is only ***de-alcoholized*** wine, which is produced through a further step in which the alcohol is removed by spinning cone, vacuum distillation or reverse osmosis. Generally, ***de-alcoholized*** wines contain less than 1% alcohol and the very fine de-alcoholized wines can have as low as 0.05% but rarely 0.0%. ***De-alcoholized wines will never taste *just* like 'real wine' because they're not.***

What people parade as non-alcoholic wines in our shopping malls are actually fruit juice or sparkling drinks in wine bottles with addition of flavours, preservatives and indication of expiry dates, whereas real wine does not contain preservatives and expiry date since the alcoholic content serves as its preservative and the longer it stays the better the taste.

**Recommendations**

1. Locally available fruit should be used to produce wines that are comparable to imported ones.
2. In view of the toxicological effect of alcohol, it is recommended that the alcohol in the wine be distilled off and used for other non-consumptive purpose.
3. The nutrients that are otherwise lost due to lack of facility to store fruits can be harnessed by turning it to wine.
4. Foreign exchange can be saved/ earned by producing wines locally for export, instead of importing wines.
5. To maximize the benefits of local production of the fruit wine, it is recommended that the fruit wine is produced during its season, since the fruit are usually seasonal, and in regions of fruit abundance.
6. It is recommended that sorghum grains should be used as natural substrate for the production of anthocyanin under a five day solid state fermentation using Pantoea dispersa strain LMG 2603 as a means of increasing the yield of anthocyanin and will help in solving the problem of anthocyanin deficiency.
7. There is a need for proper washing of fruits and vegetables using salt water to avoid microbial and parasitic infections before consumption.
8. Further research should be carried out to measure the antioxidant activity of anthocyanin, exploration of the anti-cancer effect of anthocyanin and the purification of the produced anthocyanin
9. Use of solar disinfection and storage of water in containers for a period of time will help in purification of our drinking water and help to fight against water bore diseases.

**Acknowledgements**

First and foremost, I return all glory, honour, adoration, power and majesty to the ancient of days, the I am that I am, the beginning and the end, the all- knowing God, the lifter of my head, and restorer of my soul, the all wise God, for making today a reality, 'it is not of him that willeth, nor of him that runneth but of the Lord that showeth mercy', for making it possible for me to attain this position. Let HIS name be praised for ever and ever.

I am forever grateful to my Guardian and mother, Retired Chief Matron Bolaji Hanna Fagbemi sitting here today, and her late husband who took me up at early age of my life as her first son after the demise of my biological mother in 1973. Indeed, you are a mother, may the good Lord spare your life more to enjoy the fruits of your labour.

I am eternally grateful to my father, Pa. Moses Olounda Awe (Ajinti), my Aunties (Mrs Omolara Ojo, Mrs Janet Adeniyi, Mrs Margret Adeniyi, Mrs Aina Olajugba and her husband). What do I say of My siblings: Mr Kayode Julius (BODA), Late Femi Awe, Mr Babatunde Olabode Awe, Babalola Wande Awelewa and their wives? I thank you all for your supports and encouragements. May Almighty God reward you abundantly.

Special thanks to all my teachers from primary to tertiary levels for laying the solid foundation, training, guidance and mentoring. I appreciate all my lecturers at the University of Ilorin: Prof. A. Sani (PhD supervisor), Prof. P. F. Omojasola (M.Sc. supervisor), Prof. A. B Olayemi (Undergraduate project supervisor), Prof. P. Akinyanju, Prof. T. A. Ande, Prof. P. O. Fatoba, Prof. F. A. Akinyosoye, Prof. V. L. A. Yoloye (late), Prof. R.O Alabi (late). I thank the following for being part of my success story from Unilorin (Prof. S.K. Olorunmaye, Prof. O.O. Oluwaniyi, Prof. S Oguntoye and Dr. D.O Owolabi) and my mentors: Prof. S.S Dada, Prof. M. A Akanji, Prof. S. Malomo, Prof. O. Famurewa and others too numerous to mention.

I appreciate the entire management of Kwara State University Under the leadership of our amiable Ag. Vice Chancellor, Prof. Shaykh Lukman Jimoh for providing the enabling environments to demonstrate my potentials and for all the various developmental programmes and projects being embarked upon by the university. My appreciation will not be conclusive without thanking the late Vice chancellor, Professor Muhammed Mustapha Akanbi SAN, former Deputy Vice Chancellor, Prof. Omololu Oladele Fapojuwo, other principal officers of the University and my Deputy Directors and staff at CEERMS. God bless you all.

To my academic colleagues from the Faculty of Pure and Applied Sciences, starting from the Dean, Prof Emmanuel Oladipo Ajani, Prof. O. Oladimeji, Prof A .O. Aina, Prof. E. Ofoezie, Head of Departments and Units, to the Department of Microbiology: Dr. E. A. Ajiboye, Dr. M.R Adedayo, Dr T.A Ajao, Dr. W.T. Aborisade, Dr. M. Adetumbi, Dr. I. Bale , Mrs Jimoh, Abdusalam, Yusuf, Afodun and all the laboratory staff. All friends from other faculties, Directorates and Units.

I appreciate my friends from other universities; Prof. J.A. Arotupin (FUTA), Prof. E. T. Olayinka Ajayi Crowder University Oyo, Prof. O. David (EKSU), Dr. S .K. Babatunde (Crown Hill University), Dr. B.F Bamisaye (FUOYE), Dr. M. Kayode Ishola (LASUED), Prof. R. M. O Kayode (UNILORIN)

I sincerely appreciate my very good friends: Prof. K.I.T Eniola you stand out; you are the friend that sticketh closer than a brother, you predicted this in 2015 and it has come to pass, Prof. M.A Aliyu, Dr S. O. M. Awoniyi and Dr. O. Sunday who have assisted in the preparation of this lecture. Thanks for your comments on the draft of this lecture.

I thank my past and present students, distinguished Microbiologist at Joseph Ayo Babalola University, Ikeji Arakeji (JABU), Ajayi Crowther University, Oyo, and Salem University

Lokoja, my Graduate Students Dr. R. T. Lawal, Dr I. Bale, all my PhD and M.Sc. students, you are appreciated. Some of the work reported here today, you have been part of the success stories.

My depth of gratitude goes to my Church, Deeper Life Bible Church, Ilorin Region especially Deeper Life Campus Fellowship (DLCF) for providing spiritual support and upliftment. Special thanks to my State Overseer (Pastor David Adebiyi), My State Coordinator (Pastor Prof. T. R. Fayeye), all Group Pastors, all Pastors and Associate coordinators Brothers and Sisters and the entire DLCF KWASU. Thank you all. I pray that on the resurrection morning we all reign with JESUS

I sincerely, appreciate my in-laws, Pa and Mama Olabisi for giving me this beautiful gift, my wife, My Brothers in-laws (Mr. Oladipo Olabisi and Mr. Oladotun Olabisi) and sisters in-laws (Mrs. Nike Ayodeji and Mrs Bola Alaka) you are appreciated.

Ag. Vice Chancellor Sir, I want to thank my children, Favour Toluwani Awe, Emmanuel Opeyemi Awe and Praise Oluwadarasimi Awe, I am very proud of you. May God bless you all.

Finally, in the book of Prov 18:12 the Bible Says: ***"Whoso findeth a wife findeth a good thing, and obtaineth favour of the Lord"***. I want to specially thank my dear wife, my joy, confidant, adviser and friend, Mrs Olaide Ajoke Awe, a virtuous woman, for all your support, patience, care and love. She was always there to hold forth for the better part of my research work. I may not have gone this far IFEMI, if not for your understanding, I say thank you and God bless us together.

Ag. Vice Chancellor sir, distinguished guests, ladies and gentlemen. I thank you all for attention and may God bless you all.

## Reference


Ajani Emmanuel O., Mutiu A. Alabi, Sunday Awe, Lateefat B. Ibrahim, Olajumoke A. Awoyemi and Sekinat A. Balogun (2020). Dietary inclusion of locally made sweet potato wine protects against biochemical alterations in high cholesterol fed rats. *Trends in Applied Sciences Research,* 15(3):168-178.

Awe, S and Abdulmumini S. A (2019). Effect of Different Preservatives on Microbial Load of Zobo Drink and Molecular Characterization of Its Bacterial Flora. *Nigeria Journal of Microbiology*. 33 (2): 4678 – 4686.

Awe, S and Oshomah, O.C. (2019). Microbial, Proximate and Heavy Metal Composition of Smoked Frog (*Rana esculanta*) from Ilorin Markets in Nigeria. *Nature and Science*. 17(6):86-90.

Awe, S and Adejo, S. O. (2018). Microorganisms Associated With Selected Fresh Fishes from River Niger, Lokoja and Their Antibiotic Susceptibility. *International Journal of Agriculture Innovations and Research (IJAIR)*. 6 (4): 136-141.

Awe, S (2018). Effect of Clarifying Agents (Gelatin and Kaolin) On Fruit Wine Production. *International Journal of Agriculture Innovations and Research (IJAIR).* 6 (4):130-132.

Awe S, Salemcity A.J, Osebor, E and Nwaneri-Chidozie V. O (2017). Effect of *Phoenix dactylifera* (L) Fruit Wine produced by Saccharomyces *cerevisae* on Hepatic and Renal Functions of Albino Rats. *Uniosun Journal of Sciences.* 2 (2): 134- 139.

Awe, S and Nadozie, S. N (2015); Production and Microbiological Assessment of Date Palm (*Phoenix*

*dactylifera* L.) Fruit Wine. British *Microbiology Research Journal*. 8 (3):480-488.

Awe, S. Gimba F.I and Madueke S. N.2 (2015). Bacteriological and Parasitological Assessment of Fresh Vegetables and Fruits Sold in Two Major Markets in Lokoja, Kogi State Nigeria. *American Journal of Nutrition and Food Science (AJNFS)*. 1(2): 32- 37.

Awe, S and Okorie, N.A (2014): Effect of Laboratory Produced Pawpaw Wine on Some Haematological Parameter of Rats. International Journal of Biology, *Pharmacy and Allied Sciences (IJBPAS)*. 3(8):1139 – 1145.

Awe, S, Sani, A, Eniola, K.I.T, and Kayode, R.M.O (2013). Toxicological Assessment of Locally Produced Cashew Wine. *International Journal of Research and reviews in Applied Science (IJRRAS)*. 15(1):125-131.

Awe, S, Eniola, K.I.T and Kayode-Ishola, T.M (2013): Proximate and Mineral Composition of Pawpaw and Banana Wine. *American Journal of Research Communication*. 1(12):338- 397.

Awe, S and Madueke, S.N: (2012). Effect of laboratory produced pawpaw (*Carica papaya*) and pineapple (*Ananas comonsus (l.) merr, syn*) wines on enzyme activities of rat liver. *Journal of Microbiology Research.* 2(4):73-77.

Awe, S., Madueke, S.N and Olonila, O.T (2012): Bacteriological Examination of Spring water in five different locations in Enugu Metropolis. *Nature and Science*. 10(9):176-179.

Awe, S., Sani, A. and Tunde Olayinka. E (2011). Haematological studies of Rats fed with some selected locally produced Fruit Wines. *Bioresearch Bulletin.* 4:217-222.

Awe, S and E. Tunde Olayinka (2011). Effect of Cashew wine on Histology and Enzyme Activities of Rats Liver. *Journal*

*of Toxicology and Environmental Health Sciences*. 3(2):31-38.

Awe, S (2011) Production and Microbiology of Pawpaw *(Carica papaya* L) Wine Current Research Journal of Biological Sciences. 3(5):443-447.

Eniola, K. I. T, Alege, A.A., Aluko, A.G. Akinyemi, O.B., Falaiye, O.A and Awe, S. F. (2011). Solar Disinfection of Stream and Well Water. *New York Science Journal*. 4(5):92-97.

Eniola, K.I.T., Obafemi, D.Y., Awe, S., Yusuf, I.I., Falaiye, O.A., and Olowe, A.O (2007).Effects Of Containers and storage on bacteriological quality of borehole water. *Nature and Science*. 5(4):1-6.

Eniola, K.I.T., Olayemi, A.B., Awe, S., Adekoge, A Osanoto, I.B., Abolade, G.O.and Kayode-Ishola, T.M (2006). Effect of storage on bacteriological quality of well water. *African Journal of Clinical and Experimental Microbiology.* 7(1): 27-31.

Lawal, R. T and Awe, S, Ajani E and Eniola, K.I.T. (2021). Haematological and Histological Study of Animals Fed with Different Fermentation Methods of Puvirized Mung Beans Flour *(Vigna radiata*). *JABU Journal of Sciences and Technology* 5(2): 45-55.

Lawal, R. T and Awe, S (2020). Effect of Microbial Fermentation on the Nutritional and Anti-Nutritional Composition of Fermented Mung Bean (*Vigna radiata*). *Nigerian Journal of Microbiology*, 34(2): - 5390 – 4500

Madeline, P and Justin, H (2015). Wine folly: the essential guide to wine. Penguin books limited. http://www.books.google.com.ng . (accessed on 26 September 2022).

Madueke, S.N., Awe, S. and Jonah, A.I (2014). Microbiological Analysis of Street Foods along Lokoja- Abuja Express Way, Lokoja. *American Journal of Research Communication.* 2(1):196 -211.

Mensah, J.K. and Olukoya, D.K (2007). Performance of mungo beans (*Vigna mungo* (L) Hepper) grown in mid-western Nigeria. American -Eurasian Journal of Agriculture and Environmental Science, 2: 296 – 701.

Moore, K. L. and Dalley, A. F. (1999). Clinically Oriented anatomy 4th Edition. Lippincott, Williams and Wilkins, Philadelphia pp 262 – 289.

Michael, P (2000). Foods of the Gods: part 1 – Wine in Ancient Egypt.

Olawale, K. A., Awe, S and Salako, G. K (2019). Assessment of Drinking water sources in selected Village Schools within Offa and Oyun Local Government Areas of Kwara State. *Journal of Library, Science Education and Learning Technology (JOLSELT*), 1(2):10-125.

Olowe, A.O., Eniola, K.I.T., Adeyeba, A.O., Awe, S. (2003). Bacteriological quality of Sobo drinks within Ilorin Metropolis. *African Journal of Clinical and Experimental Microbiology.* 4(2): 35-39.

Olsson, M. E., Gustavsson, K.E., Andersson, S., Nilsson, Å., and Duan, R. -D. (2004). Inhibition of cancer cell proliferation in vitro by fruit and berry extracts and correlations with antioxidant levels. Journal of Agricultural and Food Chemistry, 52, 7264–7271.Okafor, N. (1987). Industrial Microbiology. University of Ife Press Ltd. Pp. 413.

Robert, P. G (2011). Germ Theory. ASM Press, Washington DC, USA. Pp 148 – 151.

WHO (2016). Guidelines on sanitation and health. Geneva, World Health Organization

(https://www.who.int/publications/i/item/9789241514705).

Yi, W., Akoh, C. C., Fischer, J., and Krewer, G. (2006). Absorption of anthocyanins from blueberry extracts by Caco-2 human intestinal cell monolayers. *Journal of Agricultural and Food Chemistry,* 54, 5651–5658




**KWASU Press and Publishing**
**07035014265**