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Original Research Article

Functional Composition, Minerals and Antioxidant Vitamins Content of Juice of *(Botria africanus)*

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Abstract: Fruits play important role in human nutrition, particularly as sources of dietary fiber, minerals, and vitamins. This research is able to highlight essential composition available in juice of (Botria africanus), the functional composition, mineral and antioxidant vitamin contents were determined. The results identified availability of nutrients were obtained to be moisture content (20.17±0.76mg/dL), ash content (5.33±0.58mg/dL), crude protein (3.81±0.02mg/dL), crude lipid (12.33±0.12mg/dL), crude fibre (1.33±0.58mg/dL), and carbonhydrate (57.08±0.01mg/dL). The mineral contents were also identified to be Iron (3.723±0.003mg/dL), Manganese (0.405±0.005 mg/dL), Magnesium (ND±ND mg/dL), Phosphorus (31.15±0.050mg/dL), Potassium (5800 ± 100.000mg/dL), Sodium (150 ± 5.000mg/dL) and Zinc (0.016±0.008mg/dL) at the end the vitamins content were also obtained to be vit C> vit E > vit A the values are 53.6 ± 0.300> 50.21 ±3.357> 1.158±0.008, the research concluded that juice of (Botria africanus) contained an important nutritional components that are useful which are able to protect the body against oxidative stress.

Keywords: Antioxidant Vitamins, *Botria africanus,* Fruits, functional composition, Minerals.

1.0 INTRODUCTION

Nowadays, the eating of fruits and vegetables has been embraced globally for health benefits due to the occurrence of nutritive and non-nutritive substance from medicinal plants which protect the humans from oxidative stress associated disorders. Though the natural fruits are nutritious, excess consumption of such fruits may be unsafe to our body, hence the need to analyse antinutritional compound aimed finding the effects it may pose over excessive intake (Murugan *et al*., 2015).

Consumption of fruits is important for a diversified and nutritious diet. Adequate consumption of fruit and vegetables considerably minimize the occurrence of chronic diseases, such as cancer, cardiovascular diseases and other aging-related pathologies (Prakash *et al*., 2012). Fruits and vegetables have abundance of natural antioxidants in particular vitamin C and E. Contained in fruits are beta-carotene, phenolic compounds, such as anthocyanin and other flavonoids, which showcase an extensive range of biological benefits, as well as antioxidant (Olayiwola *et al*., 2013). Fruits present

safety against free radicals that harm lipids, proteins, and nucleic acids. Polyphenols, carotenoids (pro- vitamin A), vitamins C and E current in fruits contain antioxidant and free radical scavenging activities and participate a considerable function in the anticipation of several diseases (Prakash *et al*., 2012).

Natural antioxidants from edible plants are basis for dietary components to advance healthy life. For instance, α- amylase and α-glucosidase inhibitors are regard as one of the valuable measures for regulating type II diabetes by preventing the glucose oxidation (Murugan *et al*., 2015).

In current era, several researches are geared towards reactive oxygen species (ROS) and reactive nitrogen species (RNS) as the etiologic causes for IBD. The gastro intestinal tract is a main position for creation of pro-oxidants, whose production is mostly due to the existence of a plethora of microbes, food ingredients and interactions between immune cells. Moreover, the antioxidant capability of patients with IBD is reduced, still in the asymptomatic stage of the disease, to scavenge RONS; intestinal cells contain numerous enzymatic and non-enzymatic antioxidants, as well as super oxide dismutase (SOD), reduced glutathione (GSH) and catalase (CAT), although extreme generation of RONS increases lipid peroxidation (LP) and possibly will reduce antioxidant resistance. It must be well-known that OS is noticeably involved in IBD, when immune activation such as inflammation take place and might be a main causative factor to tissue injury and fibrosis that characterize CD. In this point, decrease of plasma antioxidants and total intestinal antioxidant capacity has been identified in CD. Same as in CD, many studies have revealed oxidative stress in UC. Additionally, Patients with UC frequently have antioxidant nutrient deficiencies at the period of diagnosis and that may possibly propose an increase of OS, In this situation, recent researches have recommended that the production of antioxidants from various sources, with supplementary anti-inflammatory action is useful in the treatment of IBD because inflammation is originated by OS and leads to the increase of OS which assist to tissue damage (Fabiana *et al*., 2015).

Antioxidants, especially dietary antioxidants, have a protecting effect on the periodontium, they neutralize the FRs, ROS, and reactive nitrogen group that can led to oxidative stress, which end up in periodontal collapse and many tissue destroyed. With growing age, vitamins and minerals, the important constituents of food, are small amount usual competently absorbed and their creation within the body declines, thus raising the threat of inflammatory burden. Dietary antioxidants consist of certain essential vitamins and minerals with certain essential phytochemicals that facilitate to keep the periodontal damage at bay, indeed they are able to save our cells from entirely all of the diseases related with inflammation and the age process. For the reason of its relationship with several other systemic disorders, periodontitis has become a critical area to deal with (Gurbani *et al*., 2016).

Numerous of trace elements protect the cell from oxidative cell damage as these minerals are the cofactor of antioxidant enzymes. Zinc, copper and manganese are essential for superoxide dismutase in both cytosol and mitochondria. Iron is a constituent of catalase, a hem protein, which catalyzes the decomposition of hydrogen peroxide. Little amounts of micronutrients are necessary for excellent physical condition along with energy food and protein. Sodium, potassium, iron, calcium and many trace elements together with antioxidant vitamins and minerals are very important for the body. Fruits and vegetables, mainly leafy, have significant amounts of calcium, iron and potassium (Jahan *et al.*, 2011).

The date fruit contains an extensive series of nutritional useful components. It is rich in without doubt digestible sugars such as glucose and fructose. It stands for an ideal source of fibers and bioelements such as potassium, phosphorus, magnesium, calcium, selenium and iron and vitamins like ascorbic acid, niacin, and pyridoxine. Besides fruit contains bioactive components such as anthocyanins, phenolics, carotenoids, procyanidins, and flavonoids which led to protect against oxidative stress (Bouhlali *et al*., 2015).

Botria africanus is extensively derive in Africa continent with local name identified in Hausa language of Nigeria as faruu,Rogon daji and Lanbi is a forested vine, or liana of the grape family, containing edible fruit. It is restricted to habitat found in forested region in Nigeria, Guinea, Ivory Coast, Cameroon, Chad, Central African Republic, Sudan, Kenya, Rwanda, Burundi, Tanzania, Zanzibar Archipelago, Malawi, Zambia, Mozambique, Zimbabwe and Botswana (Withers and Keasling, 2007). It was initially described botanically in 1790 by Joao de Loureiro as *Botria africanus*, likewise is also refers to (*Ampelocissus Africana*) with English name aswildgrape (Withers and Keasling, 2007).

Apart from eating the fruits, many Nigerians are unaware of its several Nutritional values of the fruit. The fruit and other parts of *Botria africanus* can be used to care diseases such as malaria, typhoid

fever, tuberculosis, jaundice, hypertension, as well as intestinal worms and leprosy (Malhotra 1998).

A study into the functional composition, mineral and antioxidants vitamins of *Botria africanus* juice will offer advance imminent into its various nutritional values.

2.0 Analysis

2.1 Sample Collection and Treatment

Botria africanus was obtained from market recognized as (Kasuwan Daji) in Sokoto city, Nigeria. The fruit was authenticated at Botany unit of the Department of Biological Science, Usmanu Danfodiyo University, Sokoto, with voucher specimen (UDUH/ANS/0039) was placed.

Botria africanus were packed in a large container for the analysis; the juice was separated from the seeds and dried in drying cabinet for about 3 days, the juice sample was used for all analysis in studied.

2.2 Determination of Proximate Composition

The moisture content, ash content, crude protein, crude lipids, crude carbohydrates and fiber content of the *Ampelocissus africana* were determined using standard methods described by association of official analytical chemist (AOAC, 2007).

2.2.1 Determination of Moisture Content

2g of powder sample was weigh; the clean watch containing the sample was placed into oven at temperature of 105^{o}c for six hours (6hrs). The clean watch containing the dry sample was then weighed. The moisture of sample was calculated using this equation (AOAC, 2007).

Moisture content $= \frac{W_1 - W_2}{W_1 - W_O} \times 100$ …….. Equation (1)

Where W_0 = weight of empty clean watch
W_1 = weight of sample in clean watch
W_2 = weight of dry sample in clean watch

2.2.2 Determination of Ash Content

2g of powder sample was weigh; the crucible containing the samples was placed into the lenton furnace thermoset at 600^{o}c and allowed to burn the powder sample for 3 hours until the content become ash. The crucible containing the ash sample was weight using electrical weight balance, the ash content was determined using the equation below (AOAC, 2007).

Ash content (%) $= \frac{W_2 - W_O}{W_1 - W_O} \times 100$ …….. equation (2)

Where W_O = weight of empty crucible

W_1 = weight of sample before ashes + weight of the crucible

W_2 = weight of ash sample + weight of crucible after ashes

2.2.3 Determination of Fiber Content

Two grams of the sample was placed in a conical flask and 20mls of distilled water, 20mls of 10%H_2SO_4 was added and fixed to boil for 30 mins to maintain constant volume. The sample was filtered with muslin cloth and rinsed with warm water. The sample was scrapped into a flask with the aid of spatula. 20mls of 10% NaOH was added and then placed on a heater again to boil for 30 mins. The sample was filtered using a muslin cloth and ethanol was used to rinse the sample once again, it was allowed to drain and the residue was crapped into crucible. The crucible was then placed in an oven to dry at 105^{0}c for 1 hour after which weight was taken (w_1). The crucible was then placed in muffle furnace to ash for 2 hours at 550^{0}c and allowed to cool in desiccators and weighed again (w_2). Percentage fiber was then calculated using the following (AOAC, 2007).

$\%crude\ fibre = \frac{w_1 - w_2}{weight\ of\ sample} \times 10$ ….. equation (3)

Where W_1= weight after drying
W_2= weight after ashing

2.2.4 Determination of Crude Protein

The analysis involves three (3) steps:

1. **First Step Digestion:** Two grams of sample was collected and put in a clean dry 100ml kjeldahl flask. One tablet of mixed catalyst and 20ml conc. H_2SO_4 was added. Little amount of distilled water was also added to the mixture to digest the inorganic matter present. The flask was then heated in a fume cupboard until a clear solution was obtained. The content was cooled and transferred to a volumetric flask.
2. **Second Step Distillation:** One hundred milliliters of aliquot was put into kjeldahl flask, 20mls of 40% NaOH and 50mls distilled water was added to make up the solution to extract out ammonia present in the sample which will be evaporated into the boric acid indicator. 20mls of boric acid indicator was used as the receiver of the nitrogen extracted. The ammonia was liberated into thee boric acid until the value is made up to 20mls in the conical. Colour change from pink to green was observed.
3. **Third Step Titration:** the collected sample with ammonia was then titrated against 0.01N HCl to end point, which give the actual amount of protein content in sample. The color change was from green to pink and the end point and the titer value was recorded. The crude protein was calculated using the following equations (AOAC, 2007).

% Nitrogen = $\frac{Tv \times N \times 0.014 \times Dilution\ factor \times 100}{weight\ of\ sample\ (w) \times mls\ of\ aliqout}$……equation (4)

%crude protein =%Nitrogen × conversion factor (6.25) ……equation (5)

Where,

TV= titre value
N= normality of acid (0.01N)
50=dilution factor i.e. volume of acid.

2.2.5 Determination of Crude Lipid

The soxhlet apparatus was set up and 2g of the sample was placed into a thimble which has been dried and weighed w1. The thimble containing the powdered sample was weighed w_2 and the mouth of the porous thimble was covered with cotton wool in order to distribute the draping n-hexane. The thimble was then placed in the extraction chamber and n-hexane was added. The flask was then heated using heating mantel for 60 minutes (1 hour), after which the flask was removed with care and the n-hexane at the top of the flask was evaporated. Finally, extraction flask containing the oil was weighed to know the content of the crude lipid (AOAC, 2007).

%Crude lipid $= \frac{weight\ loss\ by\ thimble}{weight\ of\ sample} \times 100$

%Crude lipid $= \frac{W_2 - W_{3O}}{W_2 - W_1} \times 100$…….. equation (6)

2.2.6 Determination of Crude Carbohydrate

The carbohydrate content a food is not determined directly but obtained by differences as shown below (AOAC, 2007).

%Total carbohydrate=100-(%AC + %MC + %CP + %CL + % FC)…….equation (7)

Where, %AC = Ash content, %MC = Moisture content, %CP = Crude protein, %CL = Crude lipid and %FC = crude fibre.

2.3 Determination of Mineral Element Composition

2.3.1 Determination of Minerals Using Flame Photometer

The flame photometer was set by inserting appropriate filter (usually 768m). The instrument was set to 100% transmittance by feeding 25ppm solution. All the standard solution was run and the curve was prepared by plotting transmittance readings against concentration of standard solution. The amount of k and ca was calculated present in the sample as mill equivalent per 100g oven air weight of the sample by getting K and Ca concentration in the solution from standard curve (AOAC, 2007).

2.3.1.1 Sodium Standard Curve

Exactly 2.5g of dried NaCl was weighed and dissolved in distilled water. The dilution was then made to a volume of 1 litre, giving a stock solution of 100ppm. Serial dilution was made to give 0-20ppm solution. The readings were taken using a corning 400-flame photometer. A graph was plotted using these values. Distilled water was then used to adjust the flame photometer to zero, while 20ppm was used to obtain the highest percentage transmittance. The readings of the sample were taken after adjusting the flame photometry to zero at 100% transmittance. A standard curve transmittance reading plotted against the concentration of standard Na and reading of the sample was extrapolated from the standard curve (AOAC, 2007).

2.3.1.2 Potassium Standard Curve

Exactly 1.9g of dry KCl was weighed and dissolve in distilled H_2O, and further dilution to 1 litre solution (100pm), after changing the filter from sodium to potassium. Serial dilution was made from this to give 0-20ppm solutions. The readings were then taken using a corning 400-flame photometer. A graph was plotted with transmittance against the reading obtained. The readings were then extrapolated from the standard curve (AOAC, 2007).

2.3.2 Determination of Minerals Using Atomic Absorption Spectrophotometer (AAS)

Atomic absorption spectroscopic standard solutions (1000mg/dl) of Mn, Fe, Zn, Mg, and P supplied by the manufacturer of the AAS machine were used to prepare working standard solutions by appropriate dilution of the stock solutions. The AAS machine (Sens AA model) will be set up in accordance with the manufacturer´s instructions for each element to be analyzed. The standards, blanks and the samples will be aspirated into the flame. Elemental ions will then be atomized and the atoms then absorb radiation of a characteristic wavelength from a hallow-cathode. The absorbance measured is proportional to the amount analyte in the sample solution (AOAC, 2007).

Minerals were analysis using a Perkin Elmer model 306 Atomic Absorption spectrophotometer at standard laboratory of Usman Danfodiyo University Central laboratory Nigeria.

2.4 Determination of Antioxidant Vitamins A, E and C

2.4.1 Determination of Vitamin C Using Rutkowski Method

One milliliters of the analyzed liquid was measured into the centrifugal test tube and 1ml of the PR was added, and it was mixed thoroughly and left in a room temperature for 30 minutes. The tube was Centrifuged (7000×g, 10 minutes), and the

whole of the separated supernatant was collected with a pipette, the supernatant is a test sample for spectrophotometric measurement. The prepared standard sample was done as above (using 1ml of the standard solution instead of the analyzed liquid), without centrifugation. The absorbance of the test sample Ax was measured and of the standard sample as at 700nm against the mixture PR. 50mM solution of oxalic acid=1:1(v/v) as a reference sample. The concentration Cx of vitamin C (µM) in the analysed liquid was calculated using formula (Rutkowski *et al.,* 2005).

$$Cx = \frac{Ax}{As} \times Cs$$

Where,
Cs is the concentration of standard solution;
Cx is the concentration of vitamin C in the test sample;
As is the absorbance of the sample standard;
Ax is the absorbance of the test sample.

2.4.2 Determination of Vitamin E

Some amount 0.5ml of the analyzed liquid was poured into the test tube with a tight stopper then another 0.5ml of anhydrous ethanol was poured and shake vigorously the plugged test tube for 1 minute, 3ml xylene was added and shakes vigorously for another 1 minute. The tube was centrifuged to separate the extract (1500xg, 10 minutes); simultaneously 0.25ml solution of Batophenantroline was measured into usual test tube 2. 1.5ml of the extract was collected (upper layer), transferred to the test tube 2 and the content was mixed. 0.25ml of $FeCl_3$ solution was added to the test tube 2, and mixed 0.25ml of H_3PO_4 solution was added and mixed again. This way a test sample is obtained for spectrophotomertic measurement. After preparation of standard sample absorbance of test sample was taken as Ax and that of the standard as As at 539nm against blank. The concentraton is calculated using the following equation (Rutkowski *et al.,* 2005).

$$Cx\ of\ vitamin\ E = \frac{Ax}{As} \times Cs$$

Where
Cx = concentration of vitamin E in the test sample in (µM).
Cs = concentration of vitamin E standard
Ax = absorbance of test sample As = absorbance of standard

2.4.3 Determination of Vitamin A Using Latimer Method

Two grams of the analysed liquid and 7×3ml acetone solution was added, and centrifuged (6000rpm for 2min). The tube was filtered (dense filter paper) and the absorbance was taken at 450nm for subtraction of β-carotene content a calibration/standard curve is in the Appendix.

3.0 RESULTS AND DISCUSSIONS

3.1 Results

Table 3.1.1 Results of Functional Composition of (*Botria africanus*)

NUTRIENT	JUICE (mg/dL)
Moisture content	20.17 ± 0.76
Ash content	5.33 ± 0.58
Crude protein	3.81 ± 0.02
Crude lipid	12.33 ± 0.12
Crude fibre	1.33 ± 0.58
Carbohydrate	57.08 ± 0.01

*Results are means and means standard deviation of three replicate analyses

KEYS: Values represent mean + SD (n=3), values followed by different superscript letters in the same row are considered significantly different ($p < 0.05$) as analyzed using student's t-test with GraphPad Instat.

Table 3.1.2 Result of Minerals Content of (*Botria africanus*)

MINERALS	JUICE (mg/dl)
Iron (Fe)	3.723 ± 0.003
Manganese (Mn)	0.405 ± 0.005
Magnesium (Mg)	ND ± ND
Phosphorus (P)	31.15 ± 0.050
Potassium (K)	5800 ± 100.000
Sodium (Na)	150 ± 5.000
Zinc (Zn)	0.016 ± 0.008

*Results are means and means standard deviation of three replicate analyses

KEYS: Values represent mean + SD (n=3), values followed by different superscript letters in the same row are considered significantly different ($p < 0.05$) as analyzed using student's t-test with GraphPad Instat.

3.1.3 Result of Vitamins Content of (*Botria africanus*)

VITAMINS	JUICE (mg/dL)
Vitamin A	1.158±0.008
Vitamin C	53.6 ± 0.300
Vitamin E	50.21 ± 3.357

*Results are means and means standard deviation of three replicate analyses

KEYS: Values represent mean + SD (n=3), values followed by different superscript letters in the same row are considered significantly different ($p < 0.05$) as analyzed using student's t-test with GraphPad Instat.

3.2 DISCUSSION

3.2.1 Proximate Analysis

The amount of moisture was found to be 20.17 ± 0.76, the result also indicate that there is high moisture content in the juice of (*Botria africanus*). The moisture content was determined as

the loss in weight that results from drying a known weight of food to constant weight at 100c. This method is acceptable for nearly all foods, but with a few, such as fodder, considerable losses of volatile material may take place (Kerfeld, 2004).

The amount of Ash content was found to be 5.33 ± 0.58. It was reported that Ash content was determined by ignition of a known weight of the food at 540c until all carbon has been removed, the residue that is remain was the ash and was taken to represent the inorganic constituents of the food. The ash may still, contain organic material such as sulphur and phosphorus from proteins and some loss of volatile material in the form Na, Cl, K, P, and Sulphur will take place during ignition (Grooper *et al*., 2008).

The Crude protein was obtained to be 3.81 ± 0.02. Protein is a nutrient that the body requires which is essential for body growth and excellent in maintaining the body (Arinola, 2008).

Crude lipidwas obtained to be 12.33 ± 0.12. Lipid is one of the important substances that assist cell to function in the body and supply fatty acid (FA) to the body (Beilstein *et al*., 2015).

The Crude fibre was found to be 1.33 ± 0.58. It has been reported that fibre prevents diverticulosis and assists absorption of trace elements in the gut; additionally it facilitate in the removal of undigested food materials through the bowel (Atamgba *et al*., 2015).

Carbohydrate was found to be 57.08 ± 0.01; the carbohydrate content is significantly higher. Carbohydrates serve as a source of energy and help in digestion and the assimilation of other nutrients (Walter 2008).

3.2.2 Minerals Content of (*Botria africanus*)

The Mineral content indicates, Iron to be (Fe) 3.723 ± 0.003, Iron is a necessary bioelements which is additionally to the biological role and is an essential element for the development of the human body (Jamal, 2012). Manganese (Mn) was found to be 0.405 ± 0.005. Manganese stimulates an important component of enzyme systems that metabolize proteins and energy in all animals, moreover involved in the development of mucopolysaccharides required for healthy joint membranes and as well, it concentrates in the mitochondria and is available in higher concentrations in tissues rich in mitochondria (Arinola 2008).

Magnesium (Mg) was not found in the sample even do magnesium is necessary for the development of teeth and bones. It serves as a cofactor for various enzymes needing ATP e.g. hexokinase, glucokinase phosphofructokinase, adenylate cyclase etc. magnesium is also necessary for proper neuromuscular function (Walter, 2008). But magnesium shortage is not frequently a problem for humans who eat it as a component of chlorophyll in green leafy vegetables (Satyanarayana and Chakrapani, 2006).

Phosphorus (P) was obtained to be31.15 ± 0.050. Phosphorus is required for the development of teeth, it plays important role for the creation and utilization of high-energy phosphate compounds (phosphagens). Phosphate is necessary for the formation of phospholipids, phosphoproteins and nucleic acids (DNA and RNA). It is an important component of nucleotides coenzymes e.g. NAD^+, $NADP^+$, pyridoxal phosphate, ADP, AMP, phosphate buffer system is essential for the utilization of pH in blood (around 7.4) and in the cells (Gatti *et al*., 2010).

Potassium (K) was obtained to be 5800 ± 100.00. Potassium is needed in the regulation of acid base stability in the cells, transmission of nerve impulse, maintain intracellular osmotic pressure, and influence cardiac muscle activity. Furthermore sufficient intracellular concentration of potassium is required for appropriate biosynthesis of protein by ribosome (Satyanarayana and Chakrapani, 2006).

Sodium (Na) was found to be 150 ± 5.000. Sodium is used to normalize plasma quantity and acid-base stability, involved in the preservation of osmotic pressure of the body fluids, maintains normal irritability of muscles and cell permeability, activate nerve and muscle function and involved in Na/K ATPase, maintenance of membrane potentials, transmission of nerve impulses and the absorptive processes of monosaccharide, amino acids, pyrimidines and bile salt (Gatti *et al*., 2010).

Zinc (Zn) was found to be 0.016 ± 0.008. Zinc is dispersed generally in plant and animal tissues and transpires in all living cells. It services as a cofactor and is a component of many enzymes related to lactate dehydrogenase, alcohol dehydrogenase, glutamate dehydrogenase, alkaline phophatase, carbonic anhydrase, carboxypeptidase, superoxide dismutase, retinene reductase, DNA and RNA polymerase. Major roles of zinc it attendance to be in cell reproduction and genetic appearance, and it present in nucleic acid and amino acid metabolism (Arinola, 2008).

3.2.3 Antioxidant Vitamins Content of (*Botria africanus*)

The results of vitamins were found in the order (vit C > vit E > vit A 53.6 ± 0.300, 50.21 ±3.357, 1.158±0.008). Vitamin C is an important antioxidant hydrophilic in humans. In addition, vitamin C proceeds as a regulator of catabolism of cholesterol to bile acid and has been demonstrated to be a significant factor in lipid regulation, also it is an important cofactor for the development of collagen and production of hydroxyproline and hydroxylysine. Therefore, it plays a role as a vital micronutrient for the maintenance of bone health, it also has been reported that vitamin C has a sparing action for vitamin E, since it is capable of reacting with tocoperoxyl radical to regenerate new alpha-tocopherol, accordingly acting indirectly to protect lipid-membrane bound vitamin E (Nihal *et al*., 2014). On the other hand, Vitamin E is the collective name for a set of eight related tocopherols and tocotrienols, which are fat-soluble vitamins with antioxidant properties that are capable of protecting membranes from oxidation by reacting with lipid radicals produced in the lipid peroxidation chain reaction (Hirst *et al.,* 2008).

4.0 CONCLUSION AND RECOMMENDATION

4.1 Conclusion

In conclusion, there is high rate of carbohydrate and moisture content in the functional composition with the presence of iron, manganese, phosphorus, potassium, sodium and zinc as well essential minerals, with the exception of magnesium, vitamin C content was significantly higher compared to other antioxidants. The presence of these important parameters indicates that juice of (*Botria africanus*) contains important nutritional components that are useful and capable of protecting the body against oxidative stress.

4.2 Recommendations

It is recommended that further research should be conduct in order to determine some important minerals that have not been highlighted in this research and to identify anticancer properties of (*Botria africanus*).

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