

Examining the Nutritional Contents of Finger Millet (Eleusine Coracana): A Dietary Intervention for Managing Diabetic Cases Among Families In Katsina State

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Abstract

Diabetes is a metabolic disorder that is often associated with high disease burden in Nigeria. Unlike in the early nineties when people relate diabetes to “curses” or “hexes”, currently, it has been highly accepted as a disease whose cost of management is on the high side for an average Nigerian with the disease. It is on the basis of the above that this study focuses on the examination of both the qualitative and quantitative nutritional contents of finger millet (eleusinecoracana) with a view to providing reasons to its acclaimed potency as a dietary intervention in managing type 2 diabetes among families in Katsina State. The study employed an experimental design and discovered that, the proximate analysis gave 49.86% carbohydrate, 16.93mg/100g total dietary fibre, 3.1% Ash content, 26.21% crude protein, 2.45% crude lipids and 1.45% moisture content. The phytochemical analysis indicates 11.62% Flavonoids, 8.47% Alkaloids, 9.72% saponins, 3.50mg/100g phytates, 0.33mg/100g oxalates, 0.35% Tannin presence in the powdered sample. The presence of the elements Na, K and Ca, with Abs. values (0.0082 – 0.14) respectively indicating high presence of Ca, and least Na and K, Co (240.7), Mn (279.5)nm, pb (283.3)nm, Zn (213.9) nm, Ni (232) nm and Cr (357.9)nm nmex and at Abs values (0.0002 – 0.5082) were obtained respectively from the calibration curves and flame tests at various concentrations, and gave a positive beer lamberts law in each case. Chi square regression values of (0.00352 – 0.9995) were obtained for the Vit. B₁ B₂ B₃ B₆ B₁₂ and Vit. A and C addition to the linear graphs of Absorbance against concentrations of the colored finger millet samples. The high dietary fibre content is explained in terms of the five layered testa (seed coat), high amounts of Ca, carbohydrates, flavonoids, phenolic components, presence of phytates, tannin, and oxalates, impart both antioxidant and aldose reductase enzyme inhibitory, stimulating nerve growths, properties thereby maintaining blood sugar homeostasis and eliminate insulin resistance in the management of diabetes. The need to make use of innovative processing technologies for the decortication, milling, and preparation of finger millet as well as the need to plant improved finger millet seedlings in order to produce high quality finger millet for consumption were some of the recommendations made.

Keywords: Finger millet, nutritional content, dietary intervention, diabetic cases

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I. INTRODUCTION

In Nigeria much attention has been given to good living and perfect health. This is because health is wealth. Food comes in various forms and each supplies the body with different nutrient. Grain for instance supply the right and needed nutrients to maintain the body and helps in functioning of the body system. All over the world, Nigeria inclusive, long range of good health and nutritional status of individuals are promoted by including varieties of grains in daily menu for healthy living and managing disease. One of such grain is finger millet (Haider2011).

According to Onwuka (2006) millet crops includes grasses like finger millet (EleusineCaracana), pearl millet, guinea grass tail, barn yard millet, elephant grass among others. Finger millet is an annual plant widely grown as a cereal in the arid areas of Africa and Asia. India is considered as pivot for finger millet because it grows extensively in various regions of India. Other major producers are Uganda, Nepal, China, Niger and in more than 25 countries in Africa Predominantly as a staple food grain. The production of finger millet in India stands sixth after wheat, Rice, Maize, Sorghum, and Bajra. (Onwuka , 2006). Oyenuga (2009) added that in the world, finger millet ranks fourth in importance among millets after sorghum. It is also widely cultivated in Africa and South Asia under varied agro climatic conditions and it is estimated that some 10% of the world’s 30

million tons of millets produced is finger millet. Hilu and Dewet (2012) stated that the main constituents of millet kernel are seed coat (testa), embryo and endosperm. Among several varieties of finger millets such as yellow, white, tan, red or violet color, only the red colored are cultivated extensively throughout the world.

Finger millet is rich in amino acids which are vital in normal functioning of the body and are essential for repairing body tissues. Finger millets contains tryptophan, threonine, valine, isoleusine and methioneamino acids-isoleusine helps in muscle repairs, blood formation, contributes to bone formation and improves skin health-valine is an essential amino acid which facilitates metabolism, helps in muscles coordination and repair of body tissues. It helps in balancing nitrogen in the body. Another essential amino acid, not found in most cereals is methionine which is useful in various body processes, helps in eliminating fat from the body, sulphur is essential for production of glutylhione body's natural antioxidant.

As shown in the table below, the presence of the five layered testa in finger millet makes it unique as compared to other millets such as foxtail millet, pearl millet, kodo millet, and proso millet. This could be one of the possible reasons for the higher dietary fiber content in finger millet.

Nutritional profile of Finger Millet(EleusineCoracana) as Compared to Other Cereals

| Nutrient Composition of Finger Millet with other Minor Millet | | | | | | | | |
|---|-------------|---------|------------|---------|-----------------|--------------------------|------------------------|------------------|
| | Protein (%) | Fat (%) | Starch (%) | Ash (%) | Crude fiber (%) | Total dietary fiber 100g | Total phenol (mg/100g) | Carbohydrate (0) |
| Finger Millet | 7.3 | 1.3 | 59.0 | 3 | 3.6 | 19.1 | 102 | 72.6 |
| Peal Millet | 14.5 | 5.1 | 60.5 | 2 | 2 | 7 | 51.4 | 67.5 |
| Proso Millet | 11 | 3.5 | 56.1 | 3.6 | 9 | 8.5 | 0.10 | 70.4 |
| Foxtail Millet | 11.7 | 3.9 | 59.1 | 3 | 7 | 19.11 | 106 | 60.9 |
| Kodo Millet | 8.3 | 1.4 | 59.1 | 3.6 | 9 | 37.8 | 368 | 65.9 |
| Little Millet | 7.7 | 4.7 | 60.9 | 6.9 | 7.6 | - | 21.2 | 67 |

Source: Chandrasekara&Shahidi (2010)

Finger millet is milled with the testa which is generally rich in dietary fiber and micro nutrients to prepare flour and the whole meal utilized in the preparation of traditional foods such as roti ;(Unleavened breads), Ambali (Thin porridge) and Mudde (dumplin) as well as malt-base-weaning foods (food and gricultural OVG. 2008). Aside the domestic use of finger millet, countries in Africa like Niger Republic, Kenya, Zimbabwe among others, uses finger millet to provide larger beer, (Haider, 2011; Malleshi and Deskman 2009; Oyenuga, 2009&Odouri2004). Finger millet contains all the necessary proteins, vitamins, abundant micro and macro minerals, natural ions, for core programmed in managing systematic condition, high cholesterol, marasmus, and similar disease (Oyenuga 2009).

Also Finger millet contains all the necessary proteins, vitamins, abundant micro and macro minerals, natural ions, for core programmed in managing systematic condition, high cholesterol, marasmus, and similar disease. Specifically, some of the health benefits, of finger millet as discovered by Malleshi and Deskman, (2009) include:

Weights lose: Finger millet contains an amino acid called tryptophan which lowers appetite and helps in keeping weight in control. It gets digested at a slower rate thus keeps one away from in-taking excessive calories. Also, fibers present in this gives a feeling of fullness thus controls excessive food consumption.

Bone Health: Finger millet is rich in calcium which helps in strengthening bones. It is an excellent source of natural calcium for growing children and aging people. Millet's consumption helps in development of bones in growing children and in maintenance of bone health in adult. It keeps diseases such as osteoporosis at bay and could reduce risk of fracture.

Lowering Blood Cholesterol: Finger millet contains amino acids lecithin and methionine which helps in eliminating excess fat from the liver thereby bringing dawn cholesterol level. Finger millet also contains threonine amino acid which hinders fat formation in the liver, which brings cholesterol level of the body dawn.

Anemia: Finger millet is a very good source of natural iron. Finger millet consumption helps in condition of anemia.

Relaxation: Finger millet consumption helps in relaxing body naturally; it is beneficial in conditions of anxiety, depression and insomnia. This is also useful in treating migraines.

Other Health Benefits: If consumed regularly finger millets could help in keeping malnutrition, degeneration disease and premature ageing at bay, high-tanin, phenolic compounds have been reported exhibit anti HIV activity.

The Concept of Diabetes

Diabetes is a disease that affects the body's ability to produce or use the hormone, insulin. (Dangeti, Karthikeyan, Kumar & Desai, 2013). When the body turns the food eating into energy also called sugar or glucose, insulin is released to help transport this energy to the cells. Insulin acts as a "key". Its chemical message tells the cell to open and receive glucose. If the body produces little or no insulin, or is insulin resistance, too much sugar remains in the body as such a condition known as diabetes occurs. Blood glucose levels become higher than normal for individuals with diabetes. There are two main types of diabetes: these are type 1 and type 2. Type 1 also called juvenile diabetes because it is often diagnose in children or teens is a situation where the pancreas does not produce insulin. For the type 2 diabetes, it occurs when the body does not produce enough insulin, or when the cells are unable to use insulin properly which is called insulin resistance. Type 2 diabetes is commonly called "adult-onset diabetes" since it is diagnose later in life generally after the age of 45. 90-95 % of people with diabetes have type 2 diabetes.

In the early nineties, in Nigeria people related diabetes to a "curse" or "hexes" but currently, it has been highly accepted as a disease whose cost of management is on the high side. Although there are complementary and alternative medicines that are widely used by persons with diabetes, for an average Nigerian with diabetes, an insulin requiring individual on a minimum wage would spend 29% of his or her monthly income on insulin. Meanwhile, Dangeti, Karthikeyan, Kumar, and Desai, (2013), discovered that Finger millet phytochemicals helps in slowing digestion process. This helps in controlling blood sugar level in condition of diabetes. In a study conducted by Klofenstainzon it was found that finger millet based diet helps diabetic as it contains higher fiber than rice and wheat. Also, the study found that diet base in whole finger millet has lower glycemic response i.e lower ability to increase blood sugar level. This is due to the presence of factors in finger millet's flour which lowers digestibility and absorption of starch. With this in mind, this study is undertaken to examine the nutritional content of finger millet so as to determine its dietary nutrition as an intervention for managing diabetes cases among families in Katsina State. This is in response to a wakeup call by Ogbera and Ekpebegeh (2014) suggestion, that there be a concerted effort towards reducing the burden of diabetes in Nigeria. Thus putting in place preventive measures like dietary intervention for both sufferers and non-suffers of the disease becomes a necessity.

Objectives of the Study

The objectives of this study are to:

- i. Create awareness to families on importance of finger millet as a source of managing diabetic cases.
- ii. Analyze the nutritional content of finger millet.
- iii. Find out if the graph of concentration of the elements against absorbance obeys Beer Lambert law.

Statement of the Problem

Finger millets are very rich in important nutrients. These important elements could prevent many prevailing diseases among families such as diabetes, high blood pressure and related disease. Finger millet would be milled and subjected to laboratory test, analyzing the nutritional content using statistical tools. The result would be recommended to family members to include finger millet in their daily diets. This vital discoveries will help in the management of prevailing diseases which include diabetes among others.

Significance of the Study

The importance of finger millets as regard to family health management cannot be over emphasized. As much there is awareness and enlightenment of the roles it plays in our daily family diets. Since, finger millet is an annual products, it is therefore preserved by families thereby gaining and increasing importance in terms of income generation as this alleviate family economic status especially in producing, areas. The preserved dried and milled finger millets powder could be packaged and generate income for families when not in season.

This study will enlighten individuals to take the advantage including this exceptionally rich in nutrients type of cereals (finger millet). Finally, the study is expected to serve as a useful material to individuals, scholars, and educators as a source of information for future reference.

II. METHODOLOGY

Research Design: Experimental design was basically adopted for data collection.

Collection and Preparation

The method applied of any research depends on the nature of the problem intended to be solved by the researcher. In this study therefore, the research methodology adopted was basically experimental. The study was conducted in Katsina State. Field trips were made to the farms and markets in two Local Government Areas of Plateau State where finger millets are much available for the collection. The finger millets were picked and washed, sun dried and milled into powdered forms. These were taken to food science laboratories (Food science

laboratory in Home Economics Department of Federal College of Education, Katsina Stare and NARICT Zaria for analyses of its nutritional contents, as shown in the sample below prior to analysis.)

Proximal analysis nutritional content

| Nutrients | | Percentage % |
|------------------------------|------------|---------------------|
| Fat | | 1.5g |
| Carbohydrate | 88g | |
| Calcium | 370mg/500% | |
| Vitamin A | | 0.48mg |
| Thiamin (B) | | 0.33mg |
| Riboflobin (B ²) | 0.11mg | |
| Niacin (B ³) | | 1.2mg |
| Tiber | | 3g |
| Iron and Manganese | 550% | |
| Protein | 7.69 | |

Finger millet is reputed to possess natural antioxidant properties needed for controlling some known diseases like diabetes. It is therefore necessary to determine, by way of analyzing the contents of the powdered finger millet sample using phytochemical, proximate and uv-visible analysis in order to ascertain the presence and levels of the natural chemicals and other nutritional parameters. All the result so obtained from the research were interpreted and discussed by comparison with existing findings and relevant supporting theories. Phytochemical analysis result showing quantitative Analysis of chemicals in the powder

| Sample ID Finger millet | Tannin | Oxalate | Phytate | Saponin | Alkaloid | Flavonoids |
|------------------------------------|---------------|----------------|----------------|----------------|-----------------|-------------------|
| | 0.35% | 0.33 Mg/100g | 3.50 Mg/100g | 9.72% | 8.47% | 11.62% |

III. DISCUSSION OF THE FINDINGS

The relative abundance of percentages of chemicals found in the powdered sample of finger millet have indicated the presence of a potent medicinal specy for controlling type 11 diabetics: 0.35% Tanin in the powdered sample as high as this value only suggest that it does not interfere with the nutritional parameters present in the finger millet and is therefore not lethal when the powdered samples are used as antioxidant for curing ravaging diseases afflicting the human populace. The low value above, also agrees with the NAFDAC level requirement and the findings of (Dinesh, Satish, Pallavi and Sharma, 2016)

Phytates are anti-nutrients that have toxic effects when in higher proportions. In this research, 3.50 mg/100g value has been determined in the powdered finger millet sample. This is an indication that its presence and proportion does not affect the useful nutritional parameters contained in the plant, and therefore can be consumed. Flavonoids 11.62%, Alkaloids 8.47%, Saponins 9.72% have been analytically determined in the sample. The above chemicals are bio-active and essential for the treatment of diseases. The values above, suggest that the powdered finger millet sample has great medicinal properties. The high values of these chemical parameters also agrees with the Dangeti , Karthikeyan, Kumar, and Desai, (2013), Dida, Wangera, Dunn, Bennetzen, and Devos, (2008), and Shobana et al (2013) findings.

Proximate Analysis for determining discussion

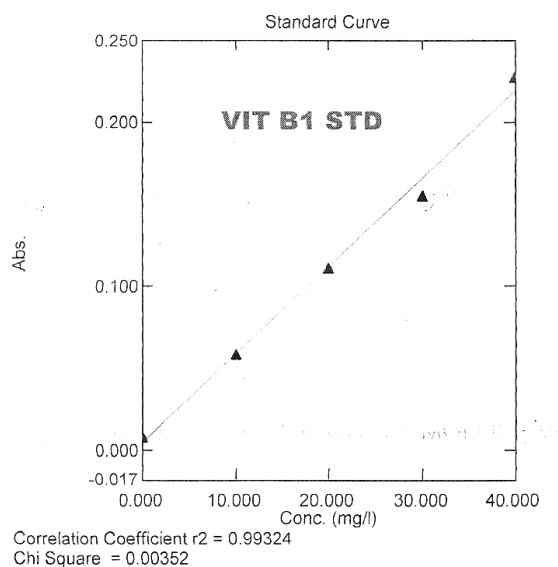
The high dietary fibre and carbohydrate contents of 16.93% and 49.86% respectively found in the powdered sample is as a result of the many seed coast ortesta possessed by the finger millet, which according to this values agree with the 19.1mg/100g and 72.6% obtained by Dangeti, et al (2013) in similar studies. The mineral presence of the minerals Na, K and Ca in which the Ca and K had the highest absorbance values with Na being the least agrees with the works Shabana et al (2013) on finger millet. Similarly, the presence of the element Zn having the least absorbance, when compared to Mn as a function of the concentrations in the finger millet sample agrees with the findings of Sankara and Deosthale (1983). The presence of the water activity and gives a measure of stability and susceptibility to microbial contamination. The low value of 1.45% moisture content means that there is a possibility that dehydration would decrease the relative concentrations of other nutrients in the finger millet and thereby decreasing preservation chances of the finger millet.

The crude lipid content 2.45% obtained in the finger millet used, and agrees with the findings of Shabana et al (2013) and Dinesh (2014), and is believed to vary according to the specy of variety and location of the finger millet. The Ash content of 3.10% determined in this indicates the amount of inorganic residue that

remained after the ignition/oxidation of or the total amount of minerals present in a sample and is obtained by subtracting the concentration of the minerals in the blank from the value determined for the sample. The 3.10% Ash content indicates that 96.90% of minerals are retained. This result implies high mineral or nutritional parameters contents retention in the finger millet.

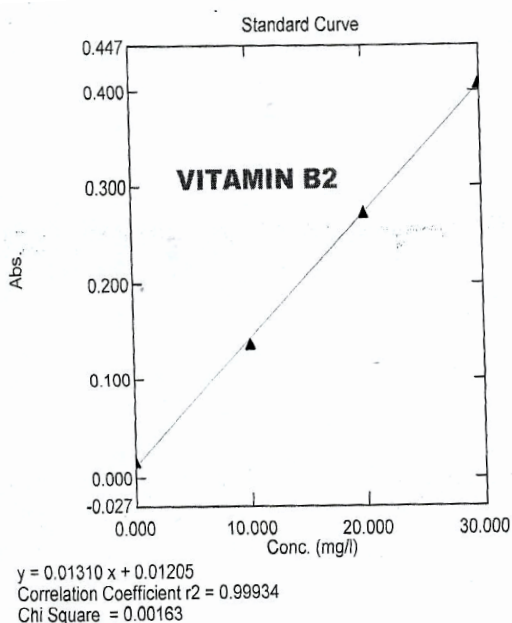
The uv-visible analysis report -3.0

The uv-visible analysis was carried out on the powdered sample, and the presence of vitamins B1, B2, B3, B6, B12 and Vitamin A and C were detected linear graphs of absorbance against concentration at various wave lengths of maximum absorbance were obtained according to Beer-Lambert law.



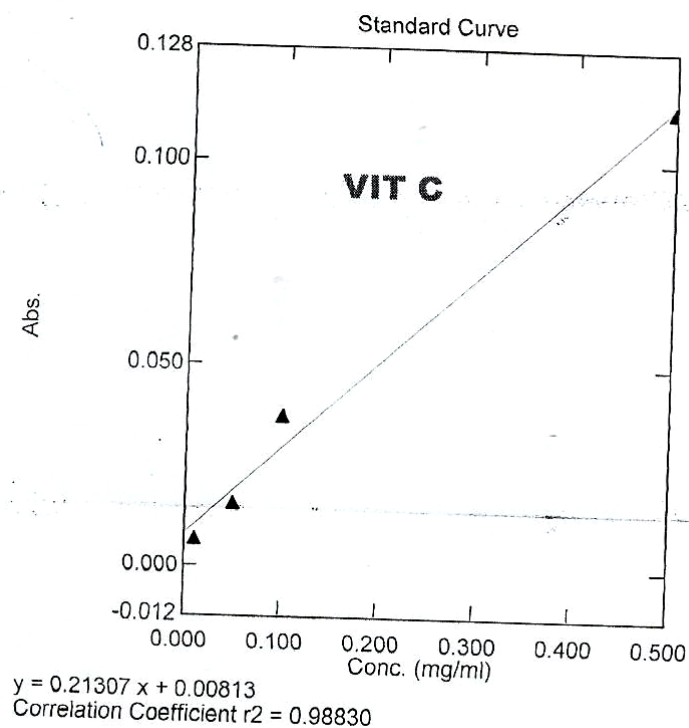
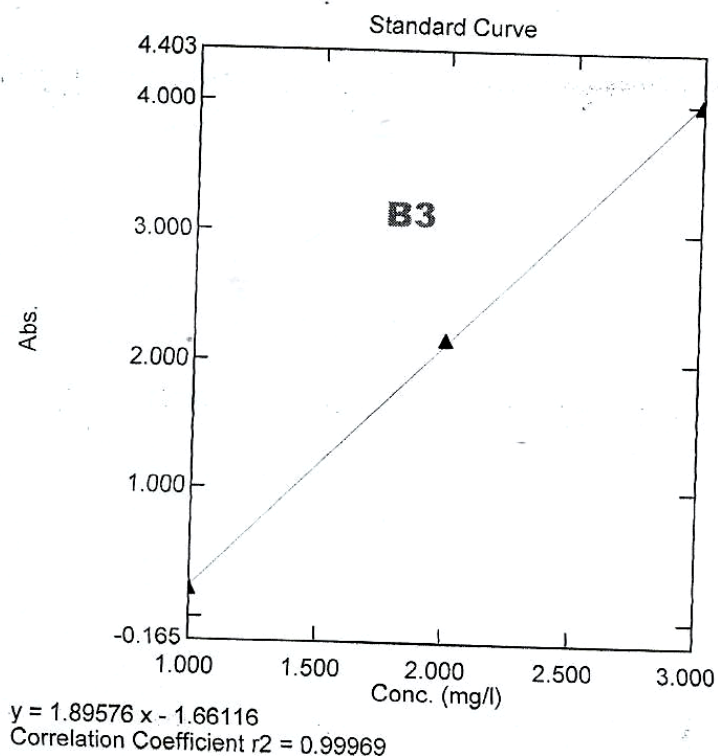
Discussion of the Graph of Vitamin B₁

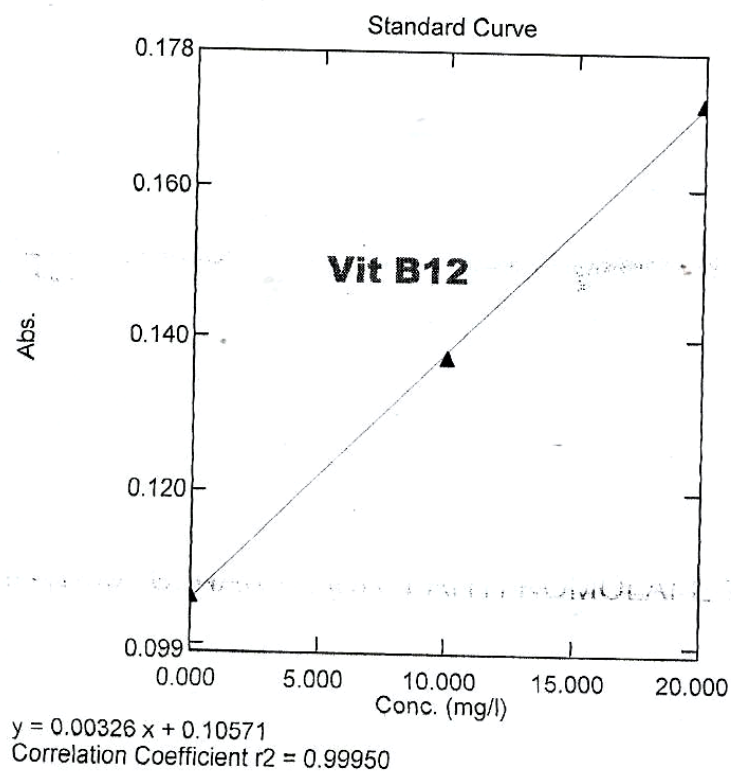
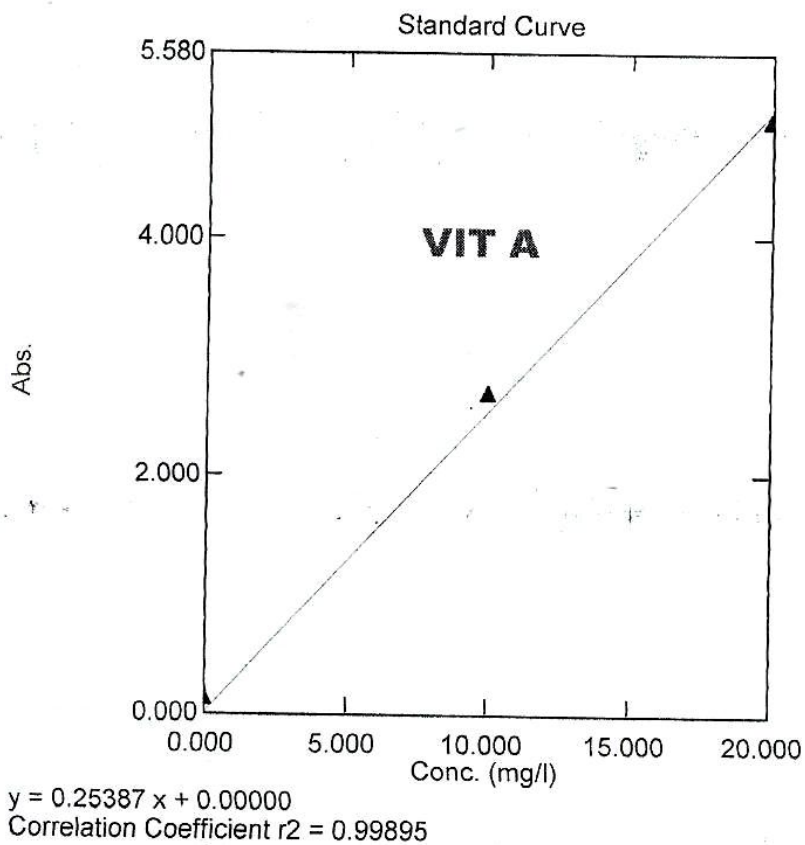
Vitamin B₁ ($C_{12}H_{17}ClN_4O_5$), molecular weight 300.807g/mol shows a linear relationship of concentration and absorbance. In fact at $C = 20\text{mg/l}$, the Abs = 0.10, while at $C = 30\text{mg/l}$, Abs is approximately 0.15. This is true because the finger millet aqueous solution is colored, and the more the concentration, the more the amount of presence of more chromophore and the higher the amount of visible light absorbed/emitted. Furthermore, the presence of Cl, N, O and S atom in the molecule is an indication of possession of electron pairs that can help in light absorbing in the visible region.



Vitamin B2

Vitamin B2 (Riboflavin) $C_{17}H_{2}N_{4}O_{6}$ being a water soluble vitamin, usually absorb at $\lambda_{max} = 266\text{nm}$ usually at the UV region. The absorbing atoms in a vitamin B2 molecule are N and O atoms, A straight line graph of Abs. against concentration is obtained, with a lower chi-square value of 0.00163, and conforms/agrees with the Beer-Lambert Law positively.





IV. SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

Based on the various analysis made on the powdered finger millet, and the interpretation of the result so obtained from the analysis, it is discovered that the plant can play unique role in both the nutrition and health of humans, as it is a source of powerful oxidants that can serve as antidiabetic it has high antioxidant capacity due to the high total phenolic content as well as flavonoids. The plant help in lowering blood glucose as well as cholesterol lowering by reducing serum and inhiding the intestinal α – glucosidase and pancreatic amylase. In diabetic patients, wound healing is impaired but finger millet can help in ameliorating this problem by improving the nerve growth factor production. The presence of high dietary fibre as well as the high phenolic content and low glycemic index GI finger millet very beneficial for diabetic patients as it helps in maintaining blood sugar by reducing the levels, decreases fasting glucose and capable of eliminating insulin resistance. It helps in improving carbohydrate digestion.

Conclusion

Having examined the nutritional content of finger millet (eleusinecoracana) vis-à-vis the types of components contained, and their respective quantities as well as the effort male to provide scientific credence for the efficacy of the plant as a potent source of antioxidant and a natural ant diabetic agent, plausible explanations are that it possesses active chemical agents that can prevent any damage to generated free-radicals and oxygen in human systems, thereby reducing risks of further oxidations on by product in human system that are capable of afflicting humans such as diabetics.

Consumption of the finger millet product equally enhances lowering of blood glucose through the Tannis, Flavonoids, Vitamin A and C and other phenolic components that may be available in the plant. The dietary fiber and the polyphony in finger millet can offer several health benefits such as anti diabetic, antioxidant, and antimicrobial as well as offer protection against diet related diseases when sufficiently and regularly consumed.

The non-starchy polysaccherides of the millet from bulk of its dietary fibre constituents allows the millet to offer health benefits such as delayed nutrition absorption, increased faecalbulk and lowering of blood lipids. Its consumption on regular basis help in regulating glucose homeostasis and it is also a good therapeutic and health building food.

Recommendations

- Home Economist Association of Nigeria should create awareness for households on adequate use of finger millet in daily diet.
- There is the need to organize seminar workshop and conferences for Nutritionist and health educationist in order to keep them abreast with the benefits of the millet.
- There is the need to create awareness on the best ways and practices of processing, storing and converting finger millet to preserve its nutritional composition.
- There is the need for innovative processing technologies for the decortications, milling, and preparation of finger millet
- Improved finger millet seedlings should be planted in order to produce high quality finger millet for consumption.
- There is the need for constant evaluation of the nutritive value and the potential health benefits of finger millet
- More researches that would help in determining the bioavailability and metabolic route of finger millet in humans should be encouraged.
- The utilization of finger millet snacks should be radically promoted among Nigerian citizen. This effect would help to open new market for farmers to improve their income.

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