

Evaluation of folic acid and iron in jute leaf consumed in Nigeria

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ABSTRACT

Deficiency of iron (mineral) and folic acid (vitamin) is a serious health problem that affects a large proportion of the world population. This research is aimed at evaluating the level of iron and folic acid content in enriched jute leaf (rama). The quantification of both the folic acid and iron was done by High performance liquid chromatography (HPLC-20) and spectrophotometric determination respectively. The results indicated the level of folic acid to be 0.03mg/L at 282nm and the level of iron was found to be 72.23µg/g at 515nm. The Nigerian population is exposed to inadequate concentration of folic acid and iron incorporated in the jute leaf.

Keywords: Folic acid, Iron, Jute leaf

INTRODUCTION

Folic acid (folate) is a B vitamin. It helps the body make healthy new cells. Folic acid is essential for numerous body functions. The human body needs folic acid to synthesize DNA, repair DNA, and methylate DNA as well as to act as a cofactor in certain biological reactions [1, 2]. It is especially important in aiding rapid cell division and growth, especially during infancy and pregnancy, and to prevent the occurrence of birth defects. The deficiency of folic acid may result in many health problems including; colorectal cancer, immense bleeding of gastro intestinal tract, macrocytic anaemia, and the most notable one being birth defects in developing embryos [3, 4]. Folic acid was named after leafy vegetables, however it is found in many foods. Some of the sources of folic acid include garbanzo beans, asparagus, broccoli and navy beans, other folic acid containing foods include brussels, cabbage, spinach, peanuts, fortified cereals, lentils and cake [5, 6].

Iron is a chemical element with symbol Fe. It is present in all cells in the human body, and has several vital functions including viz; carrier of oxygen to the tissues from the lungs in the form of haemoglobin; as a transport medium for electrons within the cells in the form of cytochromes, and as an integral part of enzyme reactions in various tissues. However, if iron is lacking in the diet, iron reserves in the body are used [5, 6]. Once this supply is depleted, the formation of hemoglobin is affected; hence, the red blood cells cannot carry oxygen needed by the cells as such iron deficiency occurs and anemia results. According to the World Health Organization, iron deficiency anemia is one of the most common nutrient deficiencies in the world. It can be caused by a low dietary intake of iron, poor iron absorption or excessive blood loss. Signs of anemia include: constantly feeling weak and tiredness; short attention span; irritability; decreased performance at work or school; delayed cognitive development in infants and young children; decreased immune function leading to increased illness; swollen and red tongue and difficulty maintaining body temperature [7, 8].

Many babies are born with congenital abnormalities caused by failure of neural tubes to form normally as a result of the folic acid deficiency, and the eventual consequence of iron deficiency anaemia necessitate the search for good sources of these minerals. The aim of this research therefore was to evaluate the levels of folic acid and iron in enriched jute leaves.

Jute leaf is a dicotyledonous fibre belonging to the *Sparrmanniaceae* family with common names such as saluyot, rama or ewedu [9]. It is a green, leafy vegetable rich in Beta-carotene for good eye sight, iron for healthy red blood cells, calcium for strong bones and teeth, and vitamin C for smooth, clear skin, strong immune cells and fast wound healing [10-12]. Jute leaf as vegetable contains abundance of antioxidants that have been associated with protection from chronic diseases such as heart diseases, cancer, diabetes and hypertension [12, 13]. Fresh jute leaves has higher demand, ethnomedicinal uses of the leaves include; treatment of pain, piles, tumors, cystitis, fever, dysentery and gonorrhoea [12, 14]. Jute leaves also have nutritional value and they act as thickeners in soups, stew and sauces [15].

MATERIALS AND METHODS

Equipments and Reagents

GBC UV-visible central 101/202/303/404 spectrophotometer was used for measuring the absorbance of the sample (iron determination). High performance liquid chromatography (BLC-20) centrifuging machine and mechanical shaker (folic acid determination). All chemicals and reagents used were of analytical grade.

Sample Preparation for folic acid determination

The sample (3g of jute leaves) were extracted with 50ml of 0.1mol/L phosphate buffer pH 7.0 and 0.1% (V/V) of 2-mercaptoethanol was added. The mixture was shaken for 30 minute in a vortex shaker, and centrifuged at 3500rpm for 15 minute and filtered through a Millipore filter paper before chromatography analysis.

Solid phase extraction

The stationary phase was flushed with 5mL methanol and 5mL deionized water to actuate the stationary phase, the sample extract was passed through with a flow rate of 2-3 drops and the sample was eluted with 5mL NaOH (0.005 mol/L) pH 10.0 prior to HPLC analysis. All samples were filtered through a Millipore filter and then injected into the chromatograph.

Procedure

The elute was passed through the column monitored with a photodiode array detector at 282nm for folic acid. The mobile phase (pH 7.0; 90:10 KH₂PO₄: Methanol) was filtered through a 0.5µm membrane and degassed by saponification before use. The flow rate was 0.7ml/min. The column was operated at room temperature.

Iron Determination

Preparation of reagents

- HCl: H₂O = 1:1 (36% HCl and distilled water used for the preparation of 1:1 ratio).
- 10% NH₂OH.HCl solution: 10% NH₂OH. HCl was prepared by dissolving 25gm NH₂OH. HCl in 25ml distilled water.
- NH₄OH. H₂O = 1:1 (14.3N NH₄OH were used for the preparation of 1:1 ratio).
- Buffer solution: Buffer (pH=5) was prepared by water containing 15ml of 1N HCl and diluted with distilled water to 250mL.
- Orthophenanthroline solution: Orthophenanthroline solution was prepared by dissolving 0.13gm Orthophenanthroline powder in a 25mL volumetric flask and diluted up to mark with distilled water. The powder was fully dissolved by shaking.
- Congo red paper: 0.1gm congo red powder was dissolved in 10ml ethanol and dried.
- Ferric ammonium sulphate solution: 0.216gm A.R. ferric ammonium sulphate was dissolved in one liter volumetric flask with distilled water and 1.25ml conc. HCl was added. The total volume was made 250ml with distilled water in this solution 1mL contains = 0.1mg Fe³⁺ this solution was kept as stock solution and was used for the preparation of calibration curve.

Procedure

The level of iron was determined by Orthophenanthroline method. Two grams (2g) of jute leaves were dissolved in 2mL conc. HCl in a 250ml beaker and the solution was diluted with 100ml of distilled water. To the 20mL stock solution, 1mL of 10% NH₂OH.HCl solution was added to reduce Fe³⁺.

5mL Orthophenanthroline solution (W/V) and one congo red paper were added to the solution and the color of the paper changed from red to blue. NH₄OH solution was added drop wise until it turned alkaline (i.e. congo red paper becomes red). 5ml of Buffer (pH=5) solution was added to the solution and filtered using whatmann – 42 filter paper, the solution was diluted with 100ml distilled water. An orange red color developed and its absorbance was measured in spectrophotometer within 10 to 20 minutes at 515nm. A blank solution was prepared by using the entire reagent by similar procedure and was used for calibration of the spectrophotometer.

RESULTS AND DISCUSSION

The result of folic acid determination is presented in Table 1 and 2 and the level of iron in jute leaves is shown in Table 3.

Iron supplementation alone or in combination with folic acid has been associated with the well being of the mother and fetus. It leads to a significant reduction in anaemia incidence during pregnancy and, thus plays a vital role in reducing maternal, morbidity and mortality [16].

Folic acid and iron deficiency during pregnancy are risk of factors for anemia, preterm delivery, and low birth weight, and may increased maternal mortality [17, 18]. The WHO recommends supplementation of folic acid and iron for all pregnant women at risk of malnutrition to prevent anaemia and birth defects [19], however people can get rid of their diseases by consumption of jute leaves (rama) which is rich in folic acid and iron as suggested by the findings of this work.

Table 1: Linearity and detection limits of folic acid

Vitamin linear range (mg/L)	Folic acid conc. (mg/L)
0.8 – 100	0.033

Table 2: Precision of method for determination of folic acid

Vitamin	mean = S.D (mg.L-1)
Folic acid	2.62 + 0.39

Table 3: Amount of iron (Fe) (Microgram/g) in the jute leaves

Sample	Orthophenanthroline method			Absorbance
	A	B	C	
Jute	72.3	70.8	73.6	515 nm
Mean	72.23			

CONCLUSION

The findings of this research indicates that jute leaves are enriched with folic acid and iron contents and can be a good source of these minerals.

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