

## Comparative Analysis of the Different *Brassica Oleracea* Varieties Grown on Jos, Plateau Using Albino Rats.

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**Abstract:** This study was carried out to determine and compare the phytochemical, anti-nutrients, proximate composition and the effects of *Brassica oleracea* varieties on hepatic and erythropoietic parameters such as liver enzymes and packed cell volume (PCV) respectively. Fresh samples of the different varieties of *Brassica oleracea* namely: *Brassica oleracearepa* (Chinese cabbage), *Brassica oleracearupetris* (red cabbage) and *Brassica oleraceapeviridis* (green cabbage) were collected from Kasa in Plateau state, Nigeria, and were identified. After the authentication of these samples, the effect of gastric inturbation (oral administration) of the aqueous extracts on Male White Albino rats was observed for 14 days. Each of the three (3) varieties were analysed for proximate composition, phytochemicals and anti-nutrients. It was observed that *Brassica oleracea* is an important source of nutrients, particularly minerals. However, the high content of anti-nutritional factors such as cyanides, tannins, oxalates and phytic acids make these minerals bio-unavailable due to the process of chelation. It was also observed that the 3 varieties could have possible effects in the reduction of packed cell volume (PCV)/ Haemoglobin (Hb) levels and in the elevation of liver enzymes activity (Alkaline phosphate, ALT and AST). One could therefore conclude that there is a change in PCV/Hb levels and liver enzymes activity of extract-fed subjects from *Brassica oleracea* varieties to the control subjects from normal diet.

**Keywords:** Antinutritional factors, *Brassica oleracea*, Liver enzymes, oral inturbation, Phytochemical, Proximate composition.

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### I. Introduction

Vegetables have a wide area of application and nutritional values. Each however, requires certain minimum quality of nutrition because the principle of nutrition for all animals is anchored on the whole content of balanced diet [1]. *Brassica oleracea* (cabbage) is a plant of *Brassicaceae* (or *Cruciferae*). It is an herbaceous, biennial and dicotyledonous flowering plant with leaves forming a characteristic compact cluster. The most commonly grown varieties of *Brassica oleracea* on Jos, Plateau are the Green, Red and Chinese cabbage respectively in their order of demand. The favourable climatic condition of Jos, Plateau contributes immensely to the commercial and subsistence production of these three (3) varieties. *Brassica oleracea* has both nutritional & medicinal benefits. The nutritional benefits among others include it's been a rich source of nutrients such as Minerals (Ca, K, P, Fe, Mg & Zn), Vitamins such as B-complex vitamins and ascorbic acid, Carbohydrates, fats, proteins & water [2]. The medicinal health benefits are a function of the nutritional properties some of which include lower risk of heart attack, birth defects, lung cancer, obesity and intestinal uncomfotability [3].

However, *Brassica oleracea* varieties also contains corresponding high amount of anti-nutrients such as phytic acid, cyanides, oxalate, tannins and glycosides, which makes some of the mineral nutrients bio-unavailable due to process of chelation. Prolonged bio-unavailability of essential nutrients can result to metabolic derangement and consequently leads to dietary deficiency diseases [4]. The human liver is one of the largest delicate and complex organs in the body with enormous functions among which include osmoregulation, detoxification and metabolism. Some of the normal roles of the liver may be altered if tissue injury occurs at specific sites [5]. This is the case with prolonged use of the immuno-suppressive plant extract of *Brassica oleracea* for nutritional and medicinal purposes. The study of the different *Brassica oleracea* varieties grown in Jos, Plateau seeks to determine & compare whether there are differences in the nutrient contents, phytochemicals, anti-nutrients of the plants and their effects on both hepatic and erythropoietic parameters [6]. This is also expected to influence populations that dwell strictly on the plant as food.

### II. Materials And Methods

#### 1.1 Collection of plants materials

As far as possible analytical reagents, biochemical and standard laboratory equipments were used throughout the experiments. Fresh samples, each of the 3 commonly grown varieties of *Brassica oleracea* (Green, Red and Chinese cabbage) were collected from Kasa, Barkin-Ladi L.G.A of Plateau state and were authenticated at the Botany Department of University of Jos.

**1.2 Extraction and Administration of the Extract**

They were sliced and dried separately. A portion of the dried powdered sample was used for both proximate composition, phytochemicals and anti-nutrients composition analysis at N.V.R.I Vom. 40g each of the plant was dissolved in 500mls of water for aqueous extraction and 0.2mls of the extract were orally intubated into 3 groups each of 9 male white albino Wistar rats.

**1.3 Collection of Experimental Animals**

The rats were collected from the Animal house, Anatomy department; University of Jos, housed in Aluminium cages. The rats were also fed Guinea feed growers mash in addition to the extract with the exception of the control group (Rats fed on only diet). The weights of the animals were monitored on the alternate days throughout the experimental periods and were found to be between the ranges of 140-150grams.

**1.4 Experimental grouping**

The rats were divided into four groups of nine animals each and are allowed to acclimatize for three days before the commencement of the study. The experimental groupings are A,B,C and D.

Group A: Rats fed with Green cabbage extract

Group B: Rats fed with Red cabbage extract

Group C: Rats fed with Chinese extract

Group D: Rats fed with Normal diet

**1.5 Collection of blood sample**

At the end of 14days, blood was collected into heparinized haemocrit tubes from the tails of each group on alternate times and was analyzed for PCV/Hb levels. Also, sacrificial blood was collected into plain tubes for liver enzymes analysis.

**1.6 Statistical analysis**

Means were compared using the students T-test. The levels of significance was determined by placing  $P < 0.05$  in two-tailed frequency distribution table.

**III. Results**

TABLE 1: Results of Proximate Composition of the three (3) varieties of *Brassica oleracea* (in mg/100g of dry samples)

Proximate composition	Green cabbage	Red cabbage	Chinese cabbage
Moisture (%)	14.80 ± 0.02	8.35 ± 0.61	12.28 ± 0.62
Crude protein (g)	30.09 ± 1.09	26.67 ± 0.38	31.98 ± 1.04
Crude fibre (g)	33.31 ± 1.19	44.87 ± 0.05	17.00 ± 0.09
Crude fat (g)	0.52 ± 0.04	0.85 ± 0.06	1.23 ± 0.43
Ash (g)	7.96 ± 0.08	9.77 ± 0.77	10.18 ± 0.71
NFE (g)	35.12 ± 0.27	17.84 ± 0.09	39.61 ± 0.61
Ca (g)	1.76 ± 0.04	0.96 ± 0.09	0.68 ± 0.08
P (g)	0.86 ± 0.09	1.89 ± 0.19	0.64 ± 0.04

TABLE 2: Results of Anti-nutrients factors of the 3 varieties of *Brassica oleracea* plant (in mg/100g of dry samples)

Anti-nutrients (mg/100g)	Green cabbage	Red cabbage	Chinese cabbage
Tannins	1.50 ± 0.54	1.57 ± 0.39	1.57 ± 0.36
Oxalate	225.00 ± 6.60	265.06 ± 13.70	265.00 ± 13.70
Phytic acid	27.83 ± 0.40	30.36 ± 0.90	27.83 ± 0.40
Cyanide	82.50 ± 2.60	82.50 ± 2.80	75.63 ± 1.60

TABLE 3: Percentage (%) change in PCV/Hb levels for rats fed with normal diet (control) and extract-fed rats (test)

Groups	% change in PCV	% change in Hb levels
Group A	41.00 ± 2.70	14.80 ± 0.90
Group B	32.00 ± 2.00a	11.60 ± 0.80a
Group C	22.00 ± 3.60ab	7.90 ± 1.30ab
Group D	42.00 ± 5.30c	15.10 ± 1.90c

a = statistically significantly different when compared to A at p<0.05

b = statistically significantly different when compared to B at P<0.05

c = statistically significant different when compared to C at P<0.05

TABLE 4: Results of some plasma enzyme activity and other biochemical indices for rats fed with normal diet and rats fed with diet extracts of the 3 varieties of Brassica oleracea plant.

Groups	GOT/AST (iu/L)	GPT/ALT (iu/L)	Alkaline phosphate (iu/L)	Total protein (g/L)	Albumin (g/L)
Group A	94.00 ± 3.60	30.00 ± 3.90	126.00 ± 2.00	82.00 ± 2.00	25.00 ± 2.30
Group B	97.00 ± 4.60	37.00 ± 7.20	170.00 ± 0.70a	51.00 ± 1.80a	27.00 ± 2.70
Group C	51.00 ± 2.00ab	25.00 ± 2.00	144.00 ± 0.50ab	80.00 ± 3.70	30.00 ± 4.00b
Group D	40.00 ± 2.70abc	25.00 ± 1.40b	144.00 ± 0.70ab	87.00 ± 3.00b	27.00 ± 4.60c

a = statistically significantly different when compared to A at p<0.05

b = statistically significantly different when compared to B at P<0.05

c = statistically significant different when compared to C at P<0.05

#### IV. Discussion

The results of the phytochemical studies showed that Alkaloids, Saponins, Cardiac glycosides, Resins and terpenes/steroids are present in the 3 Brassica oleracea varieties. However, Tannins, Balsam and Phenol are not present in the 3 varieties and Flavonoids is absent in only the Red cabbage variety but its present in the Green and Chinese cabbage varieties which is in line with findings of Sousa [7]. From Table 1, results showed that Green variety contains high amount of moisture content (14.80 ± 0.62) and calcium (1.76 ± 0.04) than the Red and Chinese varieties. The Red variety has high amount of crude fibre (44.87 ± 1.05) and phosphorus (1.89 ± 0.19) than the Green and Chinese varieties. Crude protein (31.98 ± 1.04), crude fat (1.23 ± 0.43), nitrogen free extract NFE (39.61 ± 0.66) and Ash (10.18 ± 0.71) were found to be higher in the Chinese variety than the red and Green varieties. The results from the Table 2 showed that Red and Chinese varieties have equal amount of Tannins (1.57 ± 0.39) and Oxalate (265.00 ± 13.70) and values are higher than Green cabbage (1.50 ± 0.54 and 255.00 ± 6.00) respectively. Cyanide is present in the equal amount in Green and Red cabbage varieties (82.50 ± 2.60) per each. Both Green and Chinese cabbage varieties contain equal amount of phytic acid (27.83 ± 0.40). However, red cabbage contains high amount of phytic acid (30.36 ± 0.90) than Green and Chinese varieties. Table 3 shows that rats fed with Chinese, green and red cabbage extracts (Groups A,B, and C) have reduced PCV and haemoglobin levels at the end of the 14 days of experimental period compared to the normal/control group D, results from the table 4 showed that there were significant increase in the serum levels of the plasma enzymes activities and other biochemical indices for the case samples when compared to the control group, revealing health problems of various degree which may be occasioned by liver and pancreatic damage [8]. The disease conditions associated with the elevated determined biochemical parameters are as follows; increased levels of alkaline phosphatase may indicate cholestasis, liver tumors and obstructive biliary disease. Increased levels of transaminases may indicate hepatocellular destruction, myocardial infarction, liver cirrhosis, severe pancreatitis, shock liver, toxic hepatitis, mononucleosis, and post-hepatic biliary obstructive disease haemolysis[9].

#### V. Conclusion

Since Brassica oleracea varieties contains high amount of nutrients and anti-nutrients, it is important to encourage further studies on the mineral profile composition and the method of reducing the ratio of the anti-nutrients to the nutrients component to provide beneficial health effects to the body without decreasing nutrients bio-availability.

### References

- [1] R. Hall, *Brassica oleraceae* (Acephala Group). USDA Database for Standard Reference, Release 12 (March, 1998). about.com. Nutritionguide. <http://www.nutrition.about.com>. Accessed 10/4/2009.
- [2] E.A.S. Rosa, Glucosinolates from flower buds of Portuguese *Brassica* crops, *Phytochemistry* 1997, **44**: 1415-1419.
- [3] A.U. Osagie, *Anti-nutritional factors in nutritional quality of plant food*, 1998, Pg 221-244
- [4] E.W. Chipman and E. Thorpe. Effects of maturity and frost on the leaf colour of storage cabbage. *Canadian journal of plant science*. 1978, **59**: 429-435
- [5] Berg J, Tymoczko, L. Stryer, *Biochemistry*, 5th Edition, San Francisco, W.H. Freeman, 2002, 603
- [6] E.P.A. Summary review of health effects associated with Hydrogen cyanide, health issue assessment; Environmental criteria and assessment office, Office of Health and Environmental Research and Development, US Environmental Protection Agency, Triangle Park, North Carolina, 1990.
- [7] C. Sousa, P. Valentão, M. David, Phytochemical and Antioxidant Characterization of *Brassica oleracea* Var. *Costata* Extracts 18, 2009, 311-339.
- [8] E.U. Onyeka and I.O. Nwambekwe, Phytochemical profile of some green leafy vegetables in South East Nigeria., *Nig. Food J.* 2007, **25**: 67-76.
- [9] P.K. Emebu and J.U. Anyika. Vitamin and Antinutrient Composition of Kale (*Brassica oleracea*) Grown in Delta State, Nigeria. *Pakistan Journal of Nutrition* 10 (1) 2011, 76-79.