



Effect of dietary incorporation of *Vernonia colorata* (Willd) leaves on blood lipid profile of albino rats

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ABSTRACT

The effect of 5 and 10% dietary incorporation of leaves of *Vernonia colorata* on serum triacylglycerol, cholesterol, high density lipoproteins (HDL), low density lipoproteins (LDL) and very low density lipoproteins (VLDL) was studied in albino rats. Processed and unprocessed leaves of *Vernonia colorata* (PVC and UPVC) were incorporated into standard Vital feed at 5 and 10% levels and fed to adult male wistar rats weighing 90-160g over a period of 28 days. Feeding of processed and unprocessed *Vernonia colorata* resulted in significant ($P \leq 0.05$) decreases in serum triacylglycerol concentration (mg/100ml) in groups fed with 5% PVC (133.91 ± 2.09), 10% PVC (110.39 ± 2.57), 5% UPVC (153.74 ± 1.64) and 10% UPVC (111.41 ± 2.30) relative to the control (159.15 ± 0.32) fed with the basal diet without the vegetable. Serum cholesterol concentration (mg/100 ml) also decreased significantly in groups fed 5% PVC (178.07 ± 3.46), 10% PVC (174.60 ± 4.21), and 10% UPVC (148.77 ± 1.88) relative to the control (195.31 ± 4.39). Serum HDL concentrations increased significantly in groups fed 5% PVC (106.02 ± 2.05), 10% PVC (120.15 ± 2.65), 5% UPVC (87.06 ± 2.47), and 10% UPVC (103.33 ± 2.61) relative to the control (61.79 ± 0.65). Serum LDL concentration decreased significantly in groups fed 5% PVC (45.27 ± 2.10), 10% PVC (32.38 ± 3.67), 5% UPVC (73.73 ± 3.07) and 10% UPVC (23.16 ± 2.49) relative to control (101.69 ± 3.66). Serum VLDL Concentrations decreased significantly in groups fed 5% PVC (26.78 ± 0.42), 10% PVC (22.08 ± 0.51), 5% UPVC (30.75 ± 0.33) and 10% UPVC (22.28 ± 0.46) relative to control (31.83 ± 0.06). Feeding of *Vernonia colorata* at 10% level of dietary incorporation in the unprocessed form resulted in a more marked decrease in serum Triacylglycerols, Cholesterol, LDL and VLDL and increase in HDL. These findings are indicative that dietary incorporation of *Vernonia colorata* at 10% levels in both processed and unprocessed forms could have positive modulatory effect on blood lipid profile, by increasing HDL which is beneficial while reducing blood levels of LDL, VLDL and cholesterol which are considered high risk factors for cardiovascular diseases.

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Key words: *Vernonia colorata*, lipids, cardiovascular diseases, albino rats.

INTRODUCTION

Cardiovascular diseases (CVDs) are responsible for one third of global deaths and are the leading and increasing contributor to

the global disease burden (WHO, 2002). Africa has witnessed increased urbanization and changing lifestyles which have, in turn increased the incidence of CVDs (Kadiri,

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2005). Hypercholesterolemia is a risk factor for CVDs such as atherosclerosis and myocardial infarction which are common causes of mortality and morbidity (Wald and Law, 1995; Krieger, 1998).

Vernonia colorata Willd belongs to the family Compositae (Burkill, 2000) and is relatively non bitter. It can be chewed raw as vegetable or sliced for direct use in soup without prior washing (Ijeh et al., 1996). It is used throughout Africa for the management of a variety of ailments including hypertension. In Nigeria, the Yorubas prescribe the leaf and invoke it and use it against Konu disease (Aubreville, 1959). In Congo, the sap is given for gastrointestinal complaints and for urethral discharge (Bouquet, 1969). *Vernonia colorata* has been used to cure nausea, abdominal pains, stomachic fever, pile and diarrhea. The aqueous extract has been used by African traditional medicine practitioners as a remedy for the treatment of diabetes (Akah and Okafor, 1992). Ijeh et al. (1996) reported the crude sap of *Vernonia colorata* as having slight inhibitory activity towards micro organisms. Aqueous extract from *Vernonia colorata* were also found to be inhibitory for toxoplasma growth (Benoitt et al., 2000). Pharmacological activity studies carried out on the leaves revealed that the leaves possessed high antibacterial activity (Rabe et al., 2002). An extract from *Vernonia colorata* has been shown to have six anti-inflammatory compounds (Cioff et al., 2004). The hexane extract has hypoglycemic activity (Sy et al., 2005). Processing results in the loss of nutrients and phytochemicals, leading to a reduction in pharmacological activity (Ejoh et al., 2007). There are varied reports on the effects of aqueous, ethanolic and methanolic extracts of *Vernonia* species on blood lipids.

The present study is aimed at assessing the level of dietary incorporation (5% and 10%) at which the processed and unprocessed *Vernonia colorata* (PVC and UPVC respectively) can confer beneficial effects on blood lipid profile.

MATERIALS AND METHODS

Animal and plant materials

Twenty five male albino rats of the wistar strain weighing 90-160 g were purchased from the animal breeding unit of the Faculty of Veterinary Medicine, University of Nigeria, Nsukka, Nigeria. Fresh matured leaves of *Vernonia colorata* were harvested from farms in the Forestry Research Institute, Ahiaeke Abia State. (Plant cutting bearing leaves were identified by Mr. Ibe .K. Ndukwe a taxonomist at the herbarium unit of Department of Forestry and Environmental Management, Michael Okpara University of Agriculture, Umudike. A voucher specimen of both varieties was also deposited in the herbarium). A portion of the leaves were thoroughly macerated in cold water for 30mins with several changes of water. They were boiled for ten minutes and air dried to a constant weight and ground in a dry blender and stored in a plastic air-tight container as PVC. A second portion was air dried to a constant weight without processing and ground to fine powder and stored as UPVC.

Experimental procedure

The animals were separated into five groups of five animals each and housed in stainless steel cages with plastic base under humid tropical conditions. The animals were exposed to 12 h light/dark cycles and supplied feed and water *ad libitum*. The protocol conforms to the guidelines of the National Institute of Health (NIH) (NIH publication 85-23, 1985) for laboratory animal care and use. The animals were allowed to equilibrate on the control feed (Vital grower's feed) for one month before the experimental diets, 5% and 10% PVC and UPVC were administered to the experimental groups for 28 days. The control group received growers' feed and water only.

The animals were sacrificed by dazing with a cervical blow and bled by cardiac puncture.

Serum lipid assay

Serum lipids and lipoproteins were assayed using commercial kits purchased from RANDOX Laboratories Co (UK). The determination of serum levels of cholesterol was carried out using enzymatic colorimetric endpoint method. It was determined using the cholesterol oxidase method as described by (Richmond, 1973). Serum triacylglycerols were determined using the GPO-PAP method of Trinder (1969) after enzymatic hydrolysis with lipases. The phosphotungstate precipitation method of Richmond (1973) as applied in RANDOX kits were used for the determination of HDL-Cholesterol. The low-density lipoprotein (LDL) cholesterol was estimated as the difference between the total cholesterol and the sum of HDL-cholesterol and VLDL cholesterol (Friedewald et al., 1972). The VLDL cholesterol content of serum was determined by calculation from determined triacylglycerols concentration according to method of the Burnstein and Samaille (1960). The serum triacylglycerols concentration was divided by a factor 5. This factor was based on the understanding that in a fasting human subject with triacylglycerols concentration of 400 mg/dl, the VLDL to total plasma cholesterol ratio is relatively fixed at 1:5.

Statistical analysis

Statistical analysis of data was done using SPSS version 16.0 (SPSS Inc Chicago IL) and $p \leq 0.05$ considered statistically significant.

RESULTS AND DISCUSSION

The results show that dietary incorporation of processed *Vernonia colorata* (Vc) at 5 and 10% levels in rats resulted in a significant ($P \leq 0.05$) decrease in serum triacylglycerols (Figure 1). This decrease was concentration dependent as feeding of 10% *Vernonia colorata* at 10% level in both processed and unprocessed forms resulted in a greater decrease in triacylglycerols concentration than at the 5% level.

Serum cholesterol (Figure 2), LDL-cholesterol (Figure 3) and VLDL-cholesterol (Figure 4) concentrations decreased significantly ($P \leq 0.05$) in a concentration dependent pattern in all groups fed the Vc incorporated diet. Saponins present in these leaves have been reported to have hypocholesterolemic effects (Price et al., 1987). Saponin bind to cholesterol, and makes it unable to be reabsorbed into the system and therefore excreted from the body (Mayes, 1996). This reduction in serum cholesterol could offer chemoprotective benefits in individuals with hypercholesterolemia reducing the risk of cardiovascular diseases and its attendant morbidity and mortality. LDL -cholesterol poses a risk for CVDs as it transports cholesterol to the arteries, invades the endothelium and becomes oxidized. This oxidized form is easily retained by arterial proteoglycans and thereby trigger plaque formation. Increased levels of LDL-cholesterol are associated with atherosclerosis, heart attack, stroke and peripheral vascular diseases (Cromwell and Otvos, 2004). Feeding of Vc in the unprocessed form resulted in a more marked decrease in the lipid fractions at the 10% level of incorporation suggesting that processing could reduce the beneficial effect of the vegetable on blood lipid profile.

Figure 5 shows that the serum HDL-cholesterol for all groups fed diets incorporated with *Vernonia colorata* increased significantly ($P \leq 0.05$) relative to control. Serum HDL-cholesterol in groups fed with the processed diet at both levels was significantly higher than their counterparts fed with unprocessed diets. This suggests that feeding experimental animals with *Vernonia colorata* may probably play an anti-atherogenic role. HDL-cholesterol promotes the reverse cholesterol transport pathway by inducing the efflux of excess accumulated cellular cholesterol and prevents the generation of an oxidized modified

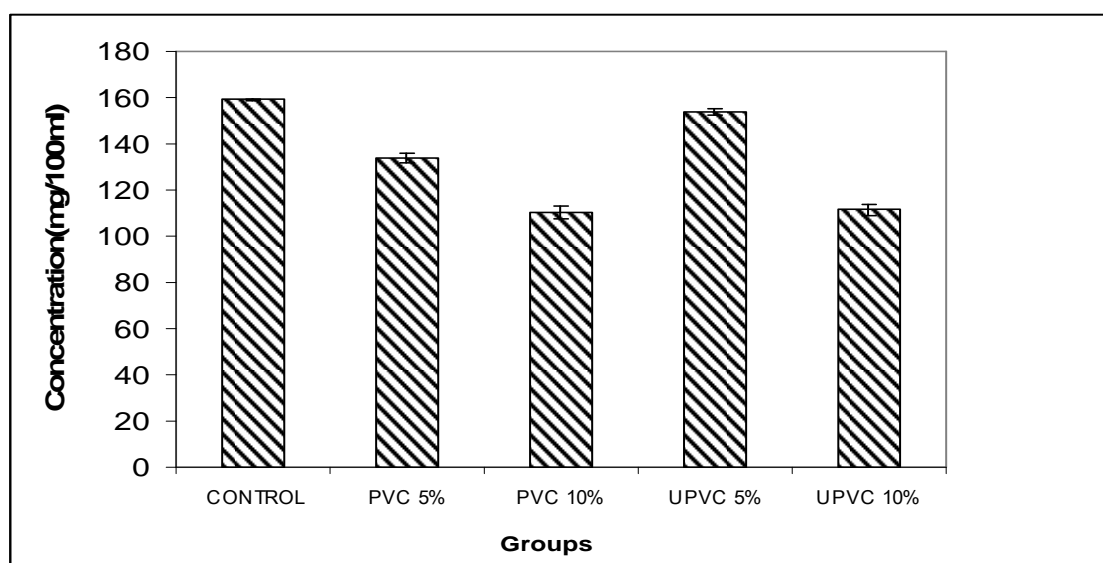


Figure 1: Serum triacylglycerol in rats fed with processed and unprocessed *Vernonia colorata* incorporated diets.

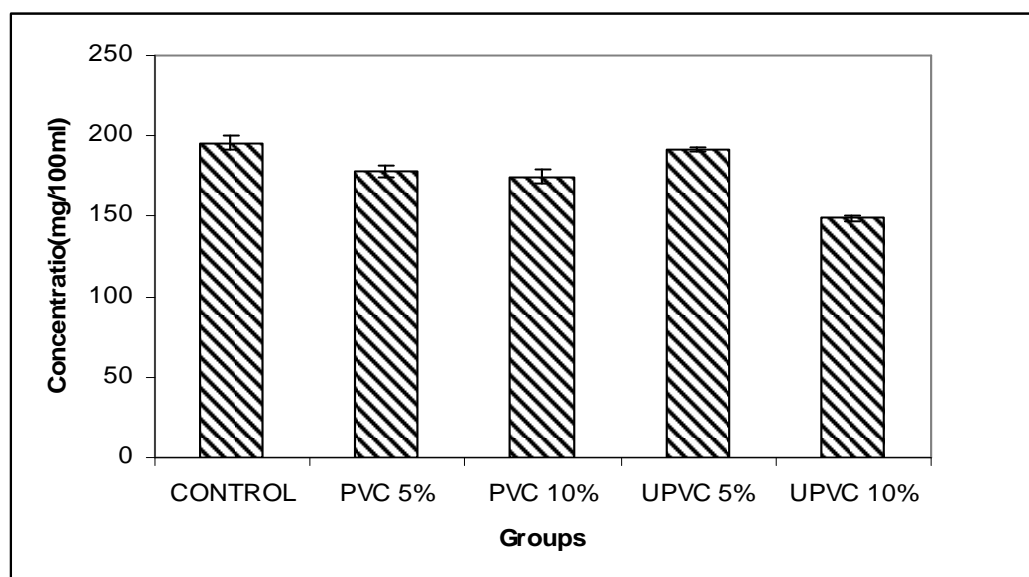


Figure 2: Cholesterol concentration in rats fed with processed and unprocessed *Vernonia colorata* incorporated diets.

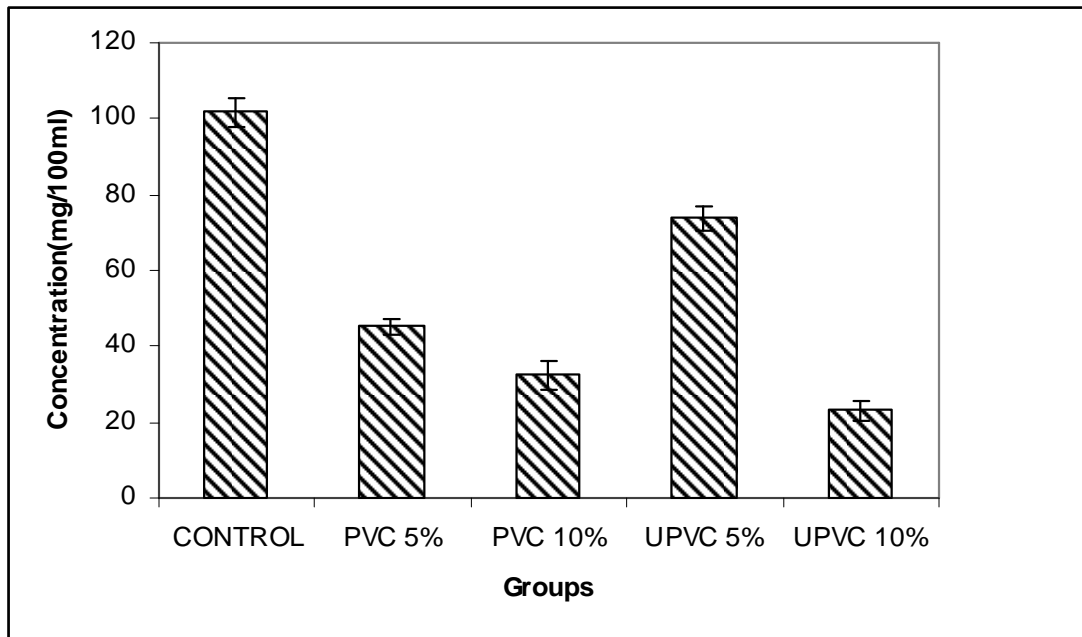


Figure 3: LDL-cholesterol concentrations in rats fed with processed and unprocessed *Vernonia colorata* incorporated diets.

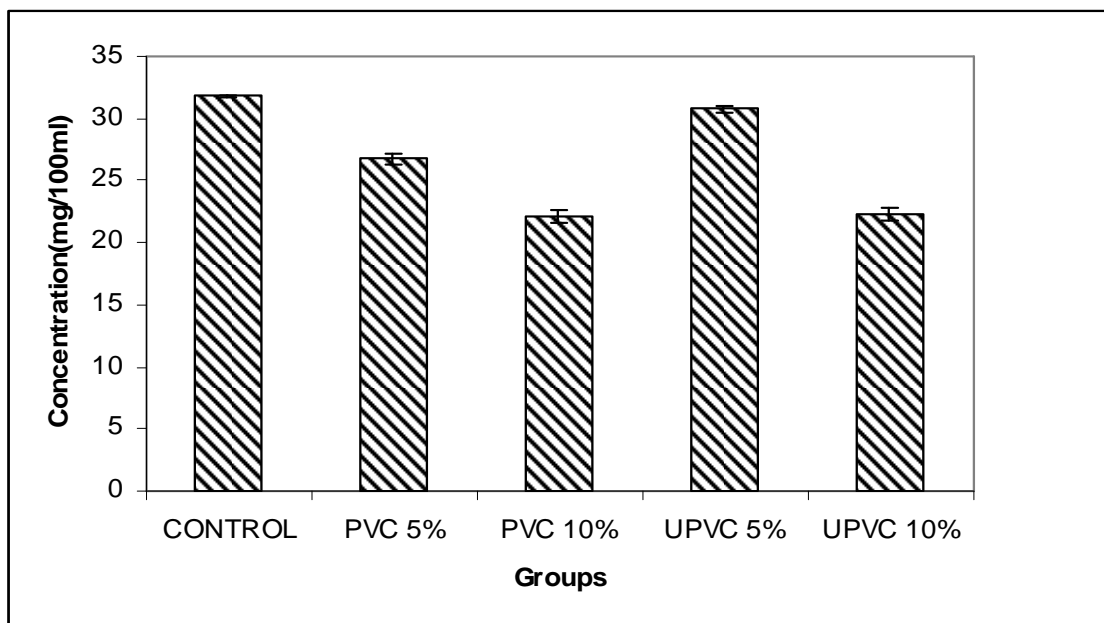


Figure 4: VLDL-cholesterol concentrations in rats fed with processed and unprocessed *Vernonia colorata* incorporated diets.

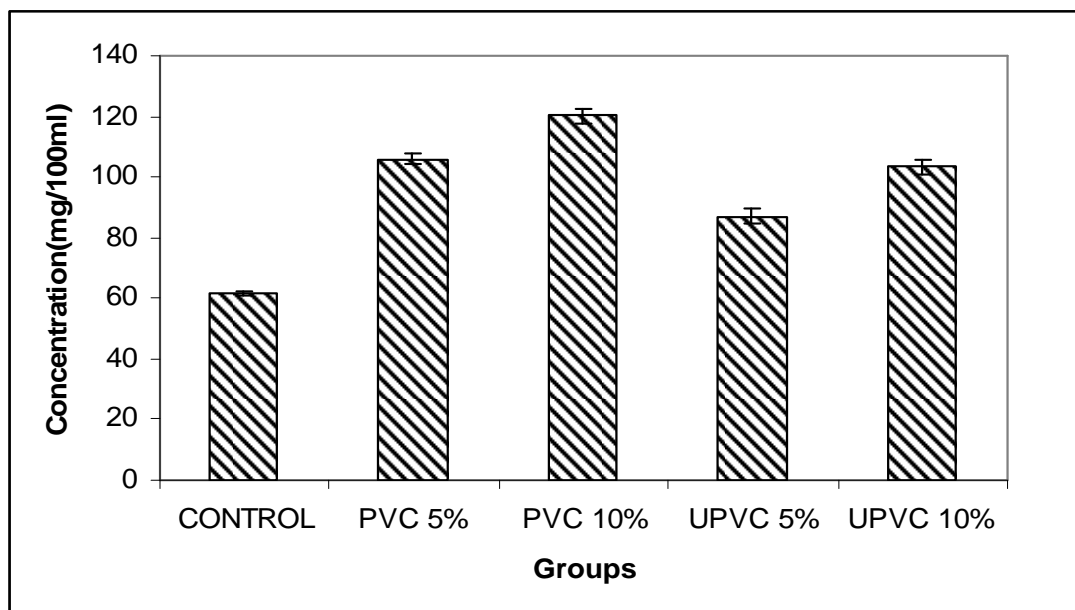


Figure 5: HDL-cholesterol concentrations in rats fed with processed and unprocessed *Vernonia colorata* incorporated diets.

LDL (Yokozawa et al., 2006). It could also promote the pathway by removing cholesterol from the atheroma within the arteries and transport it back to the liver for excretion or re-utilization. It is hypothesized that high level of HDL-cholesterol protect against Cardiovascular Diseases (Kwiterovich, 2000).

These findings are indicative that *Vernonia colorata* could have a positive modulatory effect on blood lipid profile by reducing blood levels of lipids with atherogenic potentials (LDL and VLDL) while increasing HDL that has a cardio protective effect. This finding could justify the ethnomedicinal use of *Vernonia colorata* in the management of diabetes mellitus which is associated with abnormalities in lipid metabolism (Sy et al., 2005).

This leafy vegetable could be beneficial for individuals predisposed to cardiovascular diseases. *Vernonia colorata* is less bitter than the more popularly used *Vernonia amygdalina*. It involves less tedious processing and is often used in the unprocessed form which has been shown in

the present study to have higher hypolipidaemic potentials. Its consumption should therefore be encouraged in individuals predisposed to CVDs.

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