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Impact of Some Antioxidants (Allicin-AL, Saponin -SN, Carotenes-CN, Euginol, Vitamins C and E) Rich Vegetables on Common Metabolic Lipid Parameters

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Abstract: Attempt at comparing the impact of some antioxidant – rich vegetables (singularly or combinations) on common atherosclerosis lipid parameters. The experiments were conducted in three phases. Phase (A) Five (5) ml each of aqueous extract of (i) fresh (ocimum gratissimum) scent leaf (ii) bitter leafs (vernonia amygdalina) (iii) 2.5ml each of bitter leaf and scent leaf mix; was mixed thoroughly with 100g of normal rat feed. Phase (B) five (5) ml each of aqueous extract of (i) utazi (gongronema latifolium) leafs (ii) aloevera leafs (iii) 2.5g each of utazi and aloe vera mix; was mixed into 100g normal rat feed. The third phase involved 5g each of (i) fresh (docasus carota) carrot (ii) tomato (solanum lycopersicum) (iii) carrot and tomato mix. Each of the nine (9) feed samples (3 from each phase) were separately feed to a set of three albino rats for 21 days; so was 100% (control) rat feed and garlic supplemented (5g crushed garlic, blended with 100g) rat feed. The weights, feed intake and weight of droppings of the rats were recorded at three days' intervals during experimental feeding. The blood samples of the rats were harvested at the end of the 21 days and lipid analysis carried out on them. The rat feeds supplemented with utazi, nchanwu and aloevera leafs' water extracts respectively scored 2.7, 3.7 and 2.9mmol/ml respectively regarding total cholesterol; all significantly lower than the normal range of 5.17mmol/ml ($p \leq 0.05$). With respect to triglycerides, 1.9, 1.9 and 1.7 respectively scored by Utazi, aloe vera and bitter leaf supplemented feeds were all close to the acceptable range of 0.7 – 1.7Mmol/ml. The combined effect of utazi and Aloe vera on HDL, was significantly lowering (0.5Mmol/ml) compared to 1.5 and 1.6 Mmol/ml of individual Utazi and Aloe vera respectively. The three feed samples (Utazi/aleovera, tomatoe/carrot and bitter leaf/scent leaf) that combined two vegetables rich in same or different antioxidants, all reported lower weight gains with collaborating lower scores in lipid parameters; clue for broad spectrum anti atherosclerosis therapy preparation.

Keywords: Antioxidant-Rich Vegetables, Combination Impacts, Lipid Parameters, Atherosclerosis

1. Introduction

Anti oxidants are described as substances that protect cells from the damage caused by free radicals (unstable molecules made by the process of oxidation during normal metabolism). Common antioxidants include Vitamin C, vitamin E, carotenoids, manganese and selenium. A growing number of evidence indicated that some plant saponins have strong antioxidant activities therefore may be novel potential antioxidant substances relying on their free radical

scavenging abilities [6, 14]. The saponin fractions isolated from Ivy all showed above 75% inhibition on lipid peroxidation of linolenic acid emulsion. The pericalp of Bitter kola (garcinia kola) extract has been shown to contain saponins, alkaloids and flavonoids, with (2, 2 diphenyl-1-picryl hydroxyl) DPPH radical scavenging test indicating high antioxidant activity [4]. The high total phenolic content of 'utazi' (gengronema latifolium) leaf extract is linked with its high DPPH scavenging activity [1, 15]. Other natural products with remarkable contents of saponins as well as other phenolic compounds and hence antioxidant activities include Bitter leaf (vernonia amygdalina) and Aloe Vera leaves. The bitter taste of Bitter leaf is as a result of saponins, alkaloids and tannins that it contains. The saponins and other phenolic compounds found in Aloe Vera are responsible for its antioxidant effects on foods and cosmetics [1, 4, 7]. The work of Yaugzh 2022 [12] indicated that the antioxidant effect observed in 'nchawu' (Ocimum gratisimum) is linked to the essential oil euginol. The leaf also contains Vitamins E, C and some saponnins. Caroteinoids belong to category of polyene hydrocarbons tetraterpenoids (contains 40 carbon atoms built from four terpein units with each containing 10 carbon units). According to Norman, carotenoid has high free radical scavenging capabilities and is one of the popular antioxidants documented [7].

The numerous biological activities attributed to Garlic (allium sativum), have been associated with the rich content of different volatile organo-sulfur compounds (OSC) and phyto-chemicals that work synergistically with hundreds of organic compounds [12]. Investigations by Aouadi [2] noted that garlic supplement increased high density lipoproteins and decreased low density lipoproteins in normal hypercholesterolemic rats. Hypercholesterolemia is a disease condition usually associated with cholesterol levels equal to or higher than 5Mmol/Ml. Low density lipoproteins are the major causes of atherosclerotic cardiovascular diseases. Evidence of this abounds from genetic epidemiologic and clinical studies. It is also a consensus statement from the European Atherosclerosis society consensus committee [5, 13].

When garlic is chopped or crushed, allinase enzyme is activated and produces allicin from the allin present in intact bulb [8, 10]. Garlic extract contains at least 33 sulfur compounds, several enzymes, 17 amino acids and minerals such as selenium. DPPH and hydroperoxide scavenging activities of distilled water extract of garlic were significantly higher than those of ethanol and chloroform extract. The iron chelating activities of ethanol and chloroform extract were higher than those of pure water extracts and these results obtained by Hyun [5] among others, put garlic in the class of remarkable antioxidants.

This research sought to compare the impact of substitutions of conventional feed of experimental winster (albino) rats with (some natural antioxidants rich) generally regarded as safe (GRASS) plant materials (individually and in combinations) on certain lipid parameters.

2. Materials and Methods

A total of 40 two months old albino rats were acquired from veterinary research institute Vom near Jos Nigeria for this research work and the experiments were conducted in three stages. Aqueous extracts of the leaves used where gotten by soaking stock free, washed and dried 5g of each leave sample in a separate bottle containing 100ml of distilled water. In one stage of the experiments, 5ml each of (i) aqueous extract of scent leave (ii) fresh bitter leave and (iii) 2.5ml each of bitter leave and scent leave mixed; was mixed into 100g of normal rat feed. Each of the resulting feed samples was feed to a set of three (3) rats out of a group of (9) nine.

The second stage of experiments involved 'Utazi' and Aloe Vera leaves. Just like the first one, 5ml each of (i) aqueous extract of utazi leaves (ii) Aloe Vera leaves and (iii) 2.5g each of aloe vera and utazi mixed; was mixed into 100g of normal rat feed with each of the resulting feed samples fed to a set of three rats out of a second group of 9 (nine). Yet the third stage of the experiments, involved fresh Carrots and fresh Tomatoes. (i) Five (5g) grams of tomatoes paste gotten from crushed fresh tomatoes (ii) 5g of carrot paste prepared in similar manner (iii) 5g mixed paste (2.5g each of tomatoes and carrot paste) were each thoroughly mixed with 100g of normal rat feed. Each of the resulting feed was fed to a set of three rats out of a third group of (9) nine. There was a preliminary stage where (i) 5g of fresh garlic lobes blended with 100g normal rat feed and (ii) 100% (non-supplemented) normal rat feed sample, were each fed to separate set of three albino rats.

During each of the rat feeding experiments, the rats were weighed at three days intervals. Feed consumption and weight of droppings were also assayed at 3 – day's intervals. After 21 – days of feeding, the blood of the rats were harvested and lipid analysis carried out for the following parameters: total cholesterol, triglycerides, low density lipoprotein (LDL), and high density lipoproteins (HDL) employing the methods of Schmidst [9] and Tolsman [11].

3. Results and Discussions

Three normal rat feed samples respectively supplemented with Utazi, Nchawu and Aloe vera leafs' water extract showed significantly higher capability ($p \leq 0.05$) in terms of lowering impact on total cholesterol and triglycerides according to the results from analysis of blood of the experimental rats. The scores of 2.7 and 2.9 respectively for Utazi and Aloevera supplemented feeds regarding total cholesterol are significantly lower than 5.5Mmol/L (Table 1) scored by carrot supplemented feed.

The normal range for triglyceride in the (human) blood is 0.7 – 1.7 Mmol/L. Feed supplemented with Utazi, Scent leaf and bitter leaf water extracts respectively had triglyceride scores of 1.9, 1.9 and 1.7 Mmol/L. these figures are respectively lower compared to 3.2 of the Carrot feed.

In terms of lowering of Low density lipoproteins (LDL), 'Utazi' and Aloe vera feeds were significantly more impactful

compared to Tomatoes and carrot feeds. The two respectively scored 0.3 and 0.39 (Table 1) while carrot and tomatoes had 2.3 and 1.0 respectively. Low density lipoproteins cause atherosclerotic cardiovascular diseases. Evidence of this abound from genetic, epidemiologic and clinical studies; in addition, it is a consensus statement from the European atherosclerosis consensus panel [4]. There is a remarkable lowering of concentrations of High density lipoproteins, by a combination of utazi and Aloe vera. The combination gave result of 0.5, compared to 1.5 and 1.6 respectively scored by each as single supplement. The three feed samples (Utazi/aleovera, tomatoe/carrot and bitter leaf/scent leaf) that combined two vegetables rich in same or different antioxidants, all reflected significantly lower weight gains in their results with remarkable collaborations (significantly lower scores) in their lipid parameters. The weight gains (Table 2) are respectively 20.9g, 20.9g and 27g respectively; weight gain for the control was 36.7g. Their corresponding scores with regards to low density lipids (LDL) are respectively 0.3, 1.8 and 1.1 Mmol/l. the normal range for LDL is (2.51 - 3.55) Mmol/l, while the control had LDL of 2.3Mmol/l.

Utazi and Nchawu leaves are two food ingredients of plant origin, generally regarded as safe (GRAS). They were not just major parts of food ingredients of traditional southern Nigeria communities; they were perennial components of home gardens; this postulation might not be true for the present generation. A study carried out by Ezeh et al (2002) [3], provides credence and insight to the above postulations. The study recorded that mortality in a medical emergency room in Abakaliki, Ebonyi state of Nigeria had stroke and heart failure as major contributors, making up as much as 24.4 and 14.7% respectively. A return to application of these natural sources of antioxidants, through further research on precision and potential synergy (upon combinations) among the categories employed in this research or with other (generally regarded as safe -GRAS) natural phyto-components is hereby recommended.

Table 1. *Impact of antioxidants-rich vegetables on lipid profile (LP) of albino rats.*

Vegetables (rich in)	LIPD parameters (Mmol/L)			
	Total Cholesterol) (NR: Up to 5.17)	**Triglyceride NR = 0.7 – 1.7**	**LDL 2.51 – 3.55**	**HDL 1.04 – 1.5**
Carrot (CD)	5.5 ±.31[a]	3.2 ±.66[a]	2.3 ±.36[a]	1.6 ±.60[a]
Tomato (CD)	3.7 ±.41[b]	2.1 ±.19[b]	1.0 ±.7[b]	1.8 ±.71[a]
Carrot + Tomato (CD)	4.7 ±.51[b]	2.5 ±.51[b]	1.8 ±.76[a]	1.8 ±.66[a]
Utazi (SN)	2.7 ±.66[c]	1.9 ±.91[b]	0.3 ±.56[c]	1.5 ±.26[a]
Utazi + A. vera (SN)	2.7 ±.71[c]	1.9 ±.8[b]	0.3 ±.55[c]	0.5 ±.11[b]
Aloe Vera (SN)	2.9 ±.65[c]	2.0 ±.45[b]	0.39 ±.59[c]	1.6 ±.72[a]
Scent Leave (HUV) + Bitter Leave (SN)	4.1 ±.91[b]	2.7 ±.71[b]	1.1 ±.51[b]	1.8 ±.26[a]
Scent Leave (HUV)	3.7 ±.19[b]	1.9 ±.39[b]	1.1 ±.51[b]	1.8 ±.17[a]
Bitter Leave (SN)	4.4 ±.75[b]	1.7 ±.61[c]	1.7 ±.91[a]	2.0 ±.79[a]
LP before EXPT.	3.1 ±.21[b]	2.2 ±.57[b]	0.4 ±.37[c]	1.7 ±.55[a]
LP (100% feed)	4.6 ±.9[b]	3.1 ±.71[a]	1.4 ±.31[b]	1.8 ±.17[a]
LP (feed + GH)	5.2 ±.11[a]	2.9 ±.59[b]	2.3 ±.15[a]	1.6 ±.21[a]

Means± Standard deviation, down the same column with same superscripts are not significantly different.
CD = Carrotenoids; SN = Saponins; GH = Garlic honey; HUV = highly unsaturated and volatile Oil; NR= normal range; HDL= high density lipids; LDL= low density lipids; expt. = experiment.

Table 2. *Feed intake, Weight gain and Droppings of experimental Rats.*

Feed sample	Ave. wt. gain (g)	Ave. feed intake (g)	Droppings (g)
FdCE Bitter leaf	25.9 ± 1.10[d]	42.2 ± 2.17[a]	10.9 ± 1.8[a]
FdCE Scent leaf	22.6 ± 1.94[a]	58 ± 2.07[b]	12 ± 1.9[a]
FdCE Bitter leaf/scent leaf	27 ± 0.30[b]	55.7 ± 2.31[b]	11.2 ± 1.10[a]
FdCE Carrot	20.3 ± 1.69[c]	67 ± 0.81[c]	9.3 ± 1.01[b]
FdCE Tomato	33. 2 ± 1.8[d]	64.3 ± 0.92[c]	11.0 ± 1.77[a]
FdCE Carrot/Tomato	20.9 ± 1.7[b]	34.6 ± 2.61[d]	10.5 ± 0.9[a]
FdCE Utazi	27.5 ± 0.6[b]	64.3 ± 1.0[c]	9.0 ± 0.96[a]
FdCE Aloe Vera	27.7 ± 0.57[b]	59.7 ± 2.50[b]	8.4 ± 0.77[b]
FdCE Utazi /Aloevera	20.9 ± 1.88[c]	63.7 ± 1.61[c]	9.6 ± 1.10[b]
FdCE Garlic/Honey	27 ± 0.37[b]	60.2 ± 1.98[b]	12.1 ± 1.90[a]
Normal Feed (control)	36.7 ± 1.99[d]	60.2 ±1.39[b]	11.9 ± 1.76[a]

Means ± standard deviation down the columns with same superscripts are not significantly different ($p \leq 0.05$).
FdCE = 'feed containing extract of', AVE. = average, WT = weight.

4. Conclusion

References have deliberately been made to some active components (saponins, carotenoids, eugenols etc) of these vegetables. They are variously termed anto-0xidants, anti-inflammatory, anti-cancer etc. these components are believed to be largely responsible for the impacts observed on the investigated lipid parameters [1, 12]. There is therefore room created for even non food experts to get empowered and be able to take informed decisions on diverse food and therapeutic applications of these natural food ingredients a

step in the direction of having more people employing their foods as their medicines.

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