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Management of Atherosclerosis: Examining the Synergy between Garlic and Some Antioxidant-Rich Vegetables with Regards to Impact on Lipid and Organ Toxicity Parameters

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ABSTRACT

The numerous antioxidant rich plant food materials have remarkable potentials to fight against nutrition related ailments. A major proportion of research works that supported the above postulation, were precise in terms of recipes, dosages and modes of administration of the materials. The focus of this study is on the impact that garlic will make on lipid and toxicity parameters in synergy with each of some other plant food materials as sources of known antioxidants. From a commercial rat feed (sample A), 100g were collected and thoroughly mixed with 5g of properly crushed garlic lobe to make sample G. Then 5g each of Tomato, Nchanwu, Utazi, Aloe vera and Akiilu were crushed and separately and thoroughly mixed with 100g of sample G, to give samples B, C, D, E and F. Each of the seven samples was fed to a set of three experimental rats making a group of (18) eighteen. The feeding lasted for 21 days after which the blood samples of the rats were harvested for lipid and toxicity analysis. Result highlight was that garlic in synergy with (separate food material) Utazi, aloe vera and bitter kola had the total cholesterol of 4.01, 4.8 and 5.0 respectively and were the highest of the lot in that category. The pattern was almost directly reflected in levels of aspatate amino transaminase as follows: 38, 77 and 35 for aloe vera, tomato and bitter kola, all however within the normal range. Tomato and bitter kola had the highest levels for alani amino tranaminase: 14 and 11 respectively. The samples that reported higher significant levels in terms of total cholesterol, seems to correspond to those that had the significant amounts of weight loss in the first (10) days of feeding the experimental rats.

Keywords
Antioxidants synergy, Organ Toxicity, Atherosclerosis, Lipid parameters.

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 [1]. 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, 2diphenyl-1- picryl hydroxyl) DPPH radical scavenging test indicating high antioxidant activity [2]. The high total phenolic content of 'utazi' (gengronema latifolium) leaf extract is linked with its high DPPH scavenging activity [3].

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 [2-4].

The work of Yaugzh 2022 [5] 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 [4].

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 [5]. Investigations by Aouadi [6] 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]. When garlic is chopped or crushed, allinase enzyme is activated and produces allicin from the allin present in intact bulb [7,8]. 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 [2] among others, put garlic in the class of remarkable antioxidants.

When certain types of cells are damaged, they may leak enzymes into the blood, where they can be measured as indicators of cell damage. Alanine aminotransferase (ALT) is one such enzyme. It is markedly elevated in hepatitis and from other acute liver damage [9,10]. The enzyme, aspartate amino-transferase (AST), has a similar role, but found in other tissues, such as the heart (striated muscle), so it is not as specific to the liver. In viral hepatitis and other forms of liver disease associated with hepatic necrosis, blood levels of ALT and AST are elevated even before the clinical signs and symptoms of disease (such as jaundice) appear.' Therefore, ALT and AST levels are elevated in patients with cardiovascular disease, liver disease and muscle disease.

In one of their works, Uhiara et al. [11] studied the impact of individual antioxidant- rich plant food including Garlic on some lipid parameters. The plant foods were administered as supplements in the feed of experimental rats. The result revealed wide range of data that could be helpful in the management of atherosclerosis and other nutrition related ailments. The spectrum of data and physical observations informed the need to carry out this research; an attempt to study the impact of the synergy between the individual food plant materials and garlic on some lipid parameters, as well as the impact of the supplements on certain parameters of toxicity.

Materials and Methods

A commercial brand (Vital) feed was employed as a control feed (sample A) as well as base for feed supplementation. Garlic lobes (5g) were crushed and thoroughly mixed with 100g of the commercial feed to form sample G. water extracts of the Aloe vera, Utazi and Nchawu leaves were prepared by vigorously shaking crushed 5g of each in 100ml distilled water inside a properly sealed sample bottle. Five (5ml) of the water extract from each of the plant food materials were pippeted out, added to separate 100g of sample G and thoroughly mixed blended to give samples C, D and E corresponding to Nchanwu, Utazi and Akiilu respectively. Five (5g) each of tomato fruit and Akiilu seed were cut and properly crushed. Each was added and thoroughly mixed with 100g of G, yielding samples B and F respectively. The six feed samples, were fed to a group of eighteen (18) winster rats; three in a cage giving six (6) cages. Each feed sample was specific to a cage. The two months old rats were acquired from the Veterinary research institute Jos Nigeria.

The rats were fed for 21 days during which weight gain, weight of droppings and feed consumed were measured at three days intervals. The blood samples of the rats were harvested after 21 days of feeding and analysis for certain lipid parameters as well as organ toxicity indicator [9,11]. Determination of Total Protein and albumin, total bilirubin and conjugated bilirubin were done by the methods of Shrgar and Tolman KC [10,12]. Total cholesterol and Triglyceride were done by the method of Johnson 1999). Alanin aminotransaminase and Aspatate aminotransferase were both done by the methods of Schimidts and others [9,12,13].

Results and Discussions

From the Results,while the impact of the synergy between plant food materials containing common phytochemicals (like carotenoid saponin euginols etc) was significant with respect to total cholesterol at $p \leq 0.05$ [11], the synergy between allicin rich garlic and phytochemicals of other plant plants was significant at $p \leq 0.001$. The impact of garlic and Utazi, akiilu and Aloe vera having good content of Saponins; scent leaf or nchanwu and tomato, for Euginol and carotenoids respectively were significant at $p \leq 0.001$. in other words, the impact of the synergy between garlic and bitter kola, garlic and aloe vera, garlic and utazi, garlic and tomato, garlic and nchanwu were much higher or significant than those between carrot and tomato; utazi and aloe vera etc. which still were higher than those of individual plant food materials such as carrot alone, tomato alone akiilu alone etc. The pattern was almost the same for other parameters like total triglycerides, blood proteins etc (Table 2).

Table 1: Average Feed Intake, Weight gain and weight of Dropping of experimental rats.

Feed samples	Feed intake	Weight gain	Weight of droppings
A	86.3 ± 0.1[a]	1.4 ± 0.1[a]	6.8 ± 0.98[a]
B	91 ± 0.11[a]	3.7 ± 0.11[b]	9.1 ± 1.01[b]
C	83.6 ± 0.2[a]	0.7 ± 0.3[d]	1. 3 ± 1.22[c]
D	89.4 ± 0.31[a]	1.1 ± 0.23[d]	9.1 ± 0.89[b]
E	98.7 ± 0.6[b]	1.9 ± 0.01[c]	13.1 ± 0.99[d]
F	81 ± 0.11[c]	2.1 ± 0.26[c]	5.1 ± 1.09[a]
G	98.1 ± 0.21[b]	2 ± 0.33[c]	5.2 ± 1.19[d]

A = control (100% feed); G = 5% Garlic supplemented feed; B = G+ 5% Tomato; C = G+ 5% Nchanwu (scent leaf); D = G+ 5% Utazi; E = G+ 5% Aloe vera; F = G+ 5% Akilu (Bitter Kola).

The above stated results could translate to the following stipulations (a) most of the antioxidants have significant impact on the total cholesterol and fatty deposits as well as plaques (b) the impact of the individual food plant materials as well as the studied supplementations could vary from individual fat deposit, plaques etc. it will therefore take more research efforts to identify these specifics. This task will be easier when the patients and genetic families are involved. With reference to table 1, one notable point about weight gain is that they all took place within the first 10 days of feeding. For bitter kola, aloe vera and Utazi supplemented feeds, there actually were significant weight losses in several individual rats after the first week. These observations were clearly reflected in the total cholesterol of the blood samples: 5.0, 4.88, 4.01 respectively for bitter kola, aloe vera and Utazi. The same trend was reflected in Astimin transaminase (AST) level – an indicator of intoxication on organs (the liver and kidney). Aloe vera, bitter kola and tomato respectively scored 38, 35 and 77 all however, within the safe range (45.7 – 80.8), in terms of standard (Schmidt 1963). For Alanin transaminase (ALT), tomato and bitter kola had the highest scores of 14 and 11 respectively.

Table 2: Results of Laboratory analysis for blood samples of experimental rats.

Samples	Total Protein (g/dl)	ALBUMIN (g/dl)	Total Bilirubin (Umol/l)	Conjugated Bilirubin (Umol/l)	AST (IU/L)	ALT (IU/L)	Triglycides (mmol/l)	Total (mmol/l) Cholestrol
Control	6.4 ± 0.9[a]	3.0 ± 0.11[a]	15.8 ± 1.1[a]	4.6 ± 0.31[a]	18 ± 1.1[a]	10 ± 0.1[a]	0.86 ± .01[a]	2.74 ± 0.12[a]
Utazi + G	8.2 ± 0.3[b]	3.9 ± 0.19[b]	15.6 ± 0.97[a]	5.0 ± 0.97[a]	7 ± 0.99[b]	6 ± 0.17[b]	1.25 ±0.11[b]	4.01 ± 0.71[b]
Bitter Kola +G	8.2 ± 0.29[b]	3.8 ± 0.9[b]	14.5 ± 1.3[b]	5.7 ± 0.61[a]	35 ± 1.2[c]	11 ± 0.11[a]	1.19 ± 0.02[b]	5.0 ± 0.41[b]
Aloe Vera + G	8.2 ± 1.0[b]	3.6 ± 0.12[b]	13.8 ± 0.88[b]	3.8 ± 0.19[b]	38 ± 1.2[c]	8 ± 0.39[b]	1.09 ± 0.023[c]	4.88 ± 0.36[b]
Garlic	8.2 ± 0.7[b]	3.7 ± 0.3[b]	7.7 ± 1.4[c]	4.2 ± 0.37[b]	7 ± 1.34[b]	8 ± 0.39[b]	1.21 ± 0.10[b]	3.47 ± 0.79[c]
Tomato + G	6.5 ± 0.11[a]	3.2 ± 0.6[a]	9.5 ± 0.93[b]	2.7 ± 0.18[c]	77 ± 1.4[a]	14 ± 0.29[c]	0.864 ± 0.001[a]	2.37 ± 0.29[a]
Scent Leaf + G	8.4 ± 0.6[b]	3.5 ± 0.36[ab]	13.7 ± 1.1[b]	3.7 ± 0.14[b]	3.2 ± 0.1[c]	9.0 ± 0.7[b]	1.9 ± 0.01[b]	3.81 ± 0.23[b]
Normal Range	56 – 76	38 – 48	25 – 30	2 – 5	45 – 80	17.5 – 30	0.7 – 1.7	Up to 5.17

Means ± standard deviation with same superscript are not significantly different p≤ 0.01. G = Garlic containing feed.

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