ABSTRACT
There is increased evidence that hypertension is associated with increased levels of oxidative stress markers. The current work aimed to estimate blood pressure, vitamins A, C, and E levels in 54 hypertensives attending the outpatient clinic of the Usman Danfodiyo University Teaching Hospital, Sokoto, Nigeria and the results compared with those of apparently healthy non-hypertensive volunteers of comparable age and social status. Blood pressure and serum levels of vitamins A, C, and E were 161.3±23.0/104±14.0 mmHg, 25.8±6.6 µg/dL, 0.40 ± 0.2 mg/dL, 0.40 ± 0.1 mg/dL and 123.1 ± 12.3/82.9 ± 9.2 mmHg, 40.3 ± 6.3 µg/dL, 0.7 ± 0.2 mg/dL and 1.0 ± 0.4 mg/dL in hypertensives and non-hypertensives respectively. There was significantly (P<0.05) increased levels of blood pressure and significantly (P<0.05) decreased levels of antioxidant vitamins in hypertensives. Most (80%) of the hypertensives have deficient serum levels of the vitamins. The results suggest that the hypertensives in the study area have low serum levels of antioxidant vitamins, an indication that the hypertensives are predisposed to increased oxidative onslaught.

Keywords: Hypertension, blood pressure, serum vitamins A, C, and E.

INTRODUCTION
Hypertension and other cardiovascular diseases rank among the leading causes of mortality in industrialized nations (Stekelings et al., 2007), the leading and increasing contributor to the global disease burden and are responsible for one third of global deaths (Kidiri, 2005). Hypertension is the most threatening risk factor for stroke, myocardial infarction, heart failure, aneurysms of the arteries, peripheral arterial disease and chronic kidney disease (O’Brien et al., 2007). Increase in the generation of reactive oxygen species and decreased antioxidant activities have been shown to be two or more of the mechanisms of the pathogenesis of hypertension (Dhalla et al., 2000). Oxidative stress may account for endothelial dysfunction, but it is unknown whether this abnormality is a primary event or a consequence of increased blood pressure (John and Schemieder, 2003).

Epidemiological evidence suggests that serum vitamins A, C, and E are potent antioxidants and may play a protective role in the development of chronic diseases including cardiovascular diseases, diabetes, cancers and inflammatory diseases (Coyne, 2002). Hypertension being a degenerative disease, therefore, may be initiated as a result of peroxidation caused by free radicals. Vitamins A, C, and E posses antioxidant properties. Deficiency of these may thus increase susceptibility to the disease and its attendant complications (Packer, 2002). It is expected that this study will stimulate interests, discussion and further studies on the role of antioxidant vitamins vis-à-vis complications of hypertension.

In this study blood pressure and serum vitamins A, C, and E were estimated in hypertensives in Sokoto, Nigeria and the results compared with those of apparently healthy non-hypertensives of comparable socio-economic status.

MATERIALS AND METHODS
Participants: - The subjects randomly employed for this study were 54 hypertensive patients of both sexes who were attending the out patient clinic of the Usman Danfodiyo University Teaching Hospital Sokoto, Nigeria. Also 42 apparently healthy non-hypertensive participants of both sexes were recruited to serve as control. The consents of all the subjects were sought for and obtained. Ethical committee approval was also obtained for the study.

Blood samples: Blood samples were collected by venipuncture and delivered into clean dry tubes and allowed to clot at room temperature. The samples were centrifuged at 3000rpm for 5 minutes using bench top centrifuge and the serum separated and kept in labeled sample bottles at - 20°C until required.

Reagents: - All chemicals and reagents were of analytical grade and purchased from Sigma Chemical Company, USA.

Analytical Methods: - Serum vitamin A level was determined by method of Bassey et al. (1946), vitamin C level was determined by method of Roe and Kuether (1943), and vitamin E level was determined by method of Nield and Pearson, (1967). Blood pressure (Bp) was measured by method of Pickering and White (2008).

Statistical Analysis: - Values were expressed as mean ± standard deviation and separated on the basis of gender. The biochemical parameters were analysed statistically using one way analysis of variance (ANOVA), followed by Turkey Kramer multiple comparison test using Graphpad Instat software. Differences were considered as significant when P<0.05.
**RESULTS**

The results of the current work showed significant difference ($P<0.05$) between blood pressure (Bp) and serum antioxidant vitamins of the hypertensives and non-hypertensive participants (Table 1). Gender appears not to have significant ($P<0.05$) effect on serum antioxidant vitamin.

**Table 1: Blood Pressure (BP) and Serum Anxiodant vitamins of Hypertensives in Sokoto, Nigeria.**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Hypertensives</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male 27</td>
<td>Female 27</td>
</tr>
<tr>
<td>BP (mmHg)</td>
<td>162±18.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>161±25.6&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Vit. A (µg/dL)</td>
<td>0.34±0.2&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.30±0.2&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>Vit. C (mg/dL)</td>
<td>0.48±0.3&lt;sup&gt;g&lt;/sup&gt;</td>
<td>0.42±0.3&lt;sup&gt;h&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Values are means ± SD. Values bearing same superscript differ significantly ($P<0.05$) using ANOVA, followed by Turkey Kramer Multiple Comparison test using Graphpad Instat software.

**DISCUSSION**

Hypertension is a consequence of the interaction of genetic and environmental factors. Antioxidant vitamins play critical role in the regulation of blood pressure and subsequent target organ damage. Endothelial and vascular smooth muscle dysfunction initiates and perpetuates essential hypertension. The optimal combination of vitamins and minerals may impact significantly in the prevention and treatment of cardiovascular complications of hypertension (Weder, 1999).

The results of the current study indicate that serum vitamins A, C, and E of the hypertensive patients, in the study area were significantly ($P<0.05$) lower than the values obtained for the non-hypertensive subjects (controls). The results further reveal no significant difference in levels of vitamins between male and female hypertensive subjects ($P>0.05$). The implication of this finding cannot be overemphasized. Increased oxidative stress in hypertensive patients result in higher utilization of these vitamins and consequently their deficiencies (Yusuf et al., 2012). Thus, increased intake of synthetic or natural antioxidant vitamins could help to reduce or avert hypertension and its attendant complications (Yusuf et al., 2012).

Significant ($P<0.05$) increased blood pressure in hypertensive subjects compared to controls were as a result of oxidative stress. It has been suggested that oxidative stress plays a critical role in the pathogenesis of endothelial dysfunction and hypertension (Esper et al., 2006). The results further revealed that most (80%) of the hypertensives had deficient antioxidant vitamins. This may be connected to increase production of free radicals in hypertension (Sies, 1997). This phenomenon may result into increased utilization of the antioxidant vitamins A, C, and E, which have been used in scavenging the excess amount of free radicals produced which therefore explain the depletion of the vitamins in hypertensive subjects (Sies, 1997).

**CONCLUSION**

In conclusion, there were significantly higher blood pressure and lower serum antioxidant vitamins in hypertensive subjects, an indication that the hypertensives are predisposed to increased oxidative onslaught. Gender has no significant effect on antioxidant vitamins.

**Recommendation**

It may therefore be critical to suggest the inclusion of dietary supplementation of these vitamins in the management of hypertensive subjects in the study area.

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REFERENCES


