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Modulation of hydrogen peroxide-induced oxidative stress in rats by Deep Root Herbal Mixture® - a Nigerian branded polyherbal drug

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- **Abstract**
- **Background**: Oxidative stress has been implicated in many chronic diseases and the use of natural antioxidants has been suggested to be beneficial in the prevention and management of some chronic diseases. Deep Root® herbal mixture (DRHM) is a branded Nigerian polyherbal drug. The potential of DRHM in modulating hydrogen peroxide (H_2O_2)-induced oxidative stress in rats was assessed in this study.
- **Methods**: Healthy Wistar rats were divided into six groups (n = 5): group 1 served as normal control while groups 2-6 were intoxicated (3 ml/kg b.w of 5% v/v of H_2O_2, i.p). Group 2 served as H_2O_2 control, groups 3-5 received 1, 2 and 3 ml/kg/d b.w. p.o of DRHM, respectively while group 6 received silymarin (100 mg/kg/d. b.w. p.o) for 14 days.
- **Results**: H_2O_2 elevated aspartate and alanine aminotransferases activities, and malondialdehyde and total bilirubin levels ($p < 0.05$). Conversely, H_2O_2 decreased superoxide dismutase, catalase and glutathione peroxidase activities, and antioxidant vitamins and reduced glutathione levels ($p < 0.05$). However, DRHM dose-dependently attenuated oxidative damage to hepatic tissues likely by enhancing antioxidant defense system. DRHM was tolerable up to 10 ml/kg. b.w. dose.
- **Conclusion**: DRHM has hepatoprotective, antioxidant and anti-lipid peroxidation properties that may be attributed to its phytoconstituents.

- **Keywords:** Oxidative stress; hepatotoxicity; polyherbal drug; antioxidant; lipid peroxidation

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RESULTS

- The presence of important secondary metabolites such as alkaloids (3.50%), steroids (1.00%), terpenoids (1.00%), glycosides (0.50%), anthocyanins (0.46%), anthraquinones (0.43%), saponins (0.40%), flavonoids (0.18%), tannins (0.03%), phenols (0.22%) and carotenoids (0.11%) were detected in DRHM (data not shown).

- DRHM was tolerable up to 10 ml/kg oral dose in mice; there was no significant behavioral and body weight change within the toxicity study period (data not shown).

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Table 1: Effect of DRHM on the liver status of H_2O_2-intoxicated rats

Groups	AST (IU/L)	ALT (IU/L)	Total Bilirubin (mg/dl)
Normal control (NC)	86.75 ± 2.87^{b}	54.25 ± 2.75^{a}	1.38 ± 0.15^{b}
H_2O_2 control (HC)	108.75 ± 7.89^{c}	93.25 ± 3.10^{d}	2.23 ± 0.17^{c}
H_2O_2 + 1 ml/kg DRHM	89.50 ± 4.80^{b}	70.00 ± 4.32^{c}	1.45 ± 0.13^{b}
H_2O_2 + 2 ml/kg DRHM	88.50 ± 3.11^{b}	61.50 ± 2.75^{b}	1.08 ± 0.10^{a}
H_2O_2 + 3 ml/kg DRHM	87.50 ± 3.56^{b}	53.00 ± 3.37^{a}	1.00 ± 0.18^{a}
H_2O_2 + 100 ml/kg silymarin	81.50 ± 3.42^{a}	54.00 ± 2.16^{a}	1.23 ± 0.13^{a}

Data are mean ± standard deviation (SD) (n = 5). Values with different superscripts in a column are significantly different at $p < 0.05$. AST = Aspartate aminotransferase; ALT = alanine aminotransferase

Table 2: Effect of DRHM on antioxidant and lipid peroxidation status of H_2O_2-intoxicated rats

Groups	SOD (IU/L)	CAT (IU/L)	GPx (IU/L)	MDA (mmol/l)	GSH (mmol/l)
Normal control (NC)	10.53 ± 0.26^{c}	0.93 ± 0.15^{b}	12.50 ± 0.88^{c}	4.70 ± 0.70^{a}	6.73 ± 0.17^{c}
H_2O_2 control (HC)	7.00 ± 0.29^{a}	0.59 ± 0.28^{a}	5.53 ± 0.49^{a}	7.85 ± 0.43^{d}	2.68 ± 0.78^{a}
H_2O_2 + 1 ml/kg DRHM	9.58 ± 0.81^{b}	1.11 ± 0.07^{b}	8.71 ± 1.21^{b}	5.98 ± 0.10^{c}	5.65 ± 0.21^{b}
H_2O_2 + 2 ml/kg DRHM	10.85 ± 0.53^{c}	1.32 ± 0.08^{c}	12.28 ± 0.99^{c}	5.33 ± 0.17^{b}	8.80 ± 0.37^{d}
H_2O_2 + 3 ml/kg DRHM	12.25 ± 0.10^{d}	1.45 ± 0.08^{d}	15.05 ± 0.94^{d}	4.77 ± 0.08^{a}	9.48 ± 0.46^{e}
H_2O_2 + 100 ml/kg silymarin	10.88 ± 0.48^{c}	0.98 ± 0.07^{b}	11.21 ± 1.08^{c}	5.10 ± 0.56^{a}	6.05 ± 0.93^{c}

Data are mean ± standard deviation (SD) (n = 5). Values with different superscripts in a column are significantly different at $p < 0.05$. SOD = superoxide dismutase; GPx = glutathione peroxidase; CAT = catalase, GSH = reduced glutathione; MDA = malondialdehyde

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Table 3: Effect of DRHM on reduced glutathione and antioxidant vitamins concentrations of H_2O_2-intoxicated rats

Groups	Vitamin A (mg/dl)	Vitamin C (mmol/l)	Vitamin E (mmol/l)
Normal control (NC)	8.88 ± 0.51^{d}	3.90 ± 0.08^{d}	0.51 ± 0.01^{d}
H_2O_2 control (HC)	4.03 ± 0.33^{a}	1.90 ± 0.08^{a}	0.12 ± 0.01^{a}
H_2O_2 + 1 ml/kg DRHM	5.88 ± 0.51^{b}	2.30 ± 0.52^{b}	0.47 ± 0.02^{c}
H_2O_2 + 2 ml/kg DRHM	7.33 ± 1.12^{c}	3.18 ± 0.24^{c}	0.83 ± 0.01^{e}
H_2O_2 + 3 ml/kg DRHM	8.50 ± 0.86^{d}	4.70 ± 0.18^{e}	1.15 ± 0.03^{f}
H_2O_2 + 100 ml/kg silymarin	5.70 ± 0.46^{b}	2.45 ± 0.21^{b}	0.40 ± 0.01^{b}

Data are mean ± standard deviation (SD) (n = 5). Values with different superscripts in a column are significantly different at $p < 0.05$.

Conclusions

- The results of the present study support the existing knowledge that hydrogen peroxide (H_2O_2) induces cellular oxidative stress via enhancing the production and attack of free radicals on cells and weakening of body's antioxidant defense system.

- The results further added that treatment of H_2O_2-intoxicated rats with Deep Root® herbal mixture (DRHM) reverses the associated biochemical aberrations.

- The above beneficial bioactivities might be attributed to wide varieties of phytochemicals detected in DRHM. This makes the herbal drug a potential candidate for the treatment/management of oxidative-stress related conditions.

- The polyherbal formulation was not toxic up to 10 ml/kg b.w. dose. However, further studies are needed to evaluate the long-term effects of using this polyherbal formulation, especially at the molecular level.

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