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Modulation of oxidative stress associated with experimentally-induced benign prostatic hyperplasia in rats by *Zapoteca portoricensis* root extracts

^{1,2}Adachukwu P. Ikeyi *, ²Innocent U. Okagu. and Nonyelum C. Igwe

¹Institute of Management and Technology, Enugu, Enugu State, Nigeria

²Medical Parasitology, Toxicology and Drug Discovery Unit, Department of Biochemistry, University of Nigeria.

³Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Nigeria, Nsukka, Nigeria.

*Address all correspondence to: Phone number:+2349019813440.

E-mail: adachukwuikeyi@gmail.com

ABSTRACT:

Background: The existence of oxidative stress in the pathogenesis of benign prostatic hyperplasia (BPH), and the use of natural antioxidants from phyto-therapeutic preparations has been documented. Thus, in this study, the effect of crude methanol extract (CME) of *Zapoteca portoricensis* root and its methanol (MF) and ethyl acetate (EAF) fractions on the antioxidant status of experimentally-induced BPH was investigated.

Methods: Forty-five Wistar albino rats used in this study were divided into nine groups (n = 5). Group 1 served as normal control. BPH was induced in groups 2-9 by daily subcutaneous administration of dihydrotestosterone (400 µg/ml) and estradiol (80 µg/ml) for 28 days. Group 2 served as BPH-control (was left untreated) while group 3 received dutasteride (Avodart®). Groups 4 and 5, 6 and 7, and 8 and 9 received, by gavage 200 and 400 mg/kg/d b.w. of CME, 200 and 400 mg/kg/d b.w. of MF, and 200 and 400 mg/kg/d b.w. of EAF, respectively for 14 days.

Results: There was a significant (p<0.05) decrease in PSA levels, ACP activities and malondialdehyde and a significant (p<0.05) and non-significant (p > 0.05) increase in antioxidant status in BPH test groups.

Conclusion: The extracts and fractions of the plant *Zapoteca portoricensis* root exhibited some protective effect against the development of BPH, in addition to oxidative stress/lipid peroxidation and antioxidant capacity.

Keywords: *Zapoteca portoricensis*; prostatic specific antigen; benign prostatic hyperplasia; oxidative stress; antioxidant.

RESULTS

The results obtained showed a significant ($p < 0.05$) decrease in PSA levels and ACP activities for all the test groups at different concentrations (Table 1). The decrease in PSA levels by the extract is comparable to that obtained from the standard drug-Dutasteride (Avodart). This is an indication of its protective effect against the development of BPH.

A significant ($p < 0.05$) decrease in malondialdehyde concentration, a significant ($p < 0.05$) increase in superoxide dismutase activity and a non-significant ($p > 0.05$) increase in catalase activity and glutathione concentration was observed in all the test groups. However, there was no significant difference in vitamin C concentration in all the test groups (Table 2).

These results are indicative of the oxidative stress/lipid peroxidation and antioxidant potentials of *Zapoteca portoricensis* root extracts and thus its protective effect against BPH.

Table 1: Effect of crude methanol extract and fractions of *Zapoteca portoricensis* roots sample on Prostatic specific antigen (PSA) of BPH induced rats.

Group	PSA BF	PSA AF	ACP (U/L)
Group 1	2.47±0.18 ^b	2.97±0.10 ^e	2.24 ± 0.33 ^a
Group 2	2.54±0.03 ^a	3.06±0.05 ^{cd}	3.81 ± 0.37 ^c
Group 3	2.50±0.08 ^b	1.03±0.07 ^{a*}	2.78 ± 0.59 ^{bc*}
Group 4	2.74±0.12 ^c	1.15±0.04 ^{d*}	3.04 ± 0.22 ^{bc*}
Group 5	2.54±0.09 ^b	1.12±0.03 ^{cd*}	2.91 ± 0.20 ^{bc*}
Group 6	2.72±0.16 ^c	1.11±0.03 ^{bcd*}	2.71 ± 0.15 ^{bc*}
Group 7	2.52±0.08 ^b	1.07±0.05 ^{abc*}	2.70 ± 0.19 ^{bc*}
Group 8	2.81±0.07 ^c	1.04±0.05 ^{ab*}	2.62 ± 0.36 ^{ab*}
Group 9	2.52±0.06 ^b	1.09±0.03 ^{abcd*}	2.64 ± 0.23 ^{abc*}

Data represent mean ±SD (n=5); Values with ‘*’ are significantly different compared to BPH-control while values with letter ‘a’ are significantly different compared to normal control (p<0.05).

Group 1=Normal control (not BPH-induced and no treatment).

Group 2=BPH-control (BPH-induced but no treatment).

Group 3=Standard control (induced and treated with AvodartR©).

Groups 4 and 5=Induced and treated with 200 and 400 mg/kg of CME, respectively.

Groups 6 and 7=Induced and treated with 200 and 400 mg/kg of MF, respectively.

Groups 8 and 9=Induced and treated with 200 and 400 mg/kg of EAF, respectively.

Table 2: Effect of crude methanol extract and fractions of *Zapoteca portoricensis* roots sample on oxidative stress and antioxidant indices of benign prostate hyperplasia (BPH)-induced rats.

Group	Oxidative stress and Anti- Oxidant Indices				
	MDA Conc (mg/dl)	SOD Activity (IU/L)	Catalase Activity (IU/L)	GSH (mg/dl)	Vit C (mg/dl)
Group 1	3.25 ± 0.21 ^c	81.33 ± 3.91 ^e	1.94 ± 0.14 ^b	24.63 ± 4.65 ^b	0.65 ± 0.09 ^a
Group 2	2.73 ± 0.37 ^b	64.30 ± 8.16 ^a	1.50 ± 0.29 ^a	18.88 ± 4.16 ^a	0.35 ± 0.13 ^a
Group 3	2.91 ± 0.28 ^{bc}	77.16 ± 1.99 ^{de*}	1.75 ± 0.16 ^{ab}	21.37 ± 1.13 ^a	0.55 ± 0.08 ^a
Group 4	2.68 ± 0.21 ^b	70.48 ± 2.61 ^{bc}	1.53 ± 0.11 ^a	18.64 ± 1.92 ^a	0.43 ± 0.09 ^a
Group 5	2.58 ± 0.25 ^{ab}	71.64 ± 4.24 ^{bcd*}	1.66 ± 0.14 ^a	20.46 ± 0.81 ^a	2.25 ± 1.81 ^a
Group 6	2.54 ± 0.13 ^{ab}	72.47 ± 3.10 ^{bcd*}	1.67 ± 0.22 ^a	20.22 ± 1.70 ^a	0.47 ± 0.04 ^a
Group 7	2.71 ± 0.25 ^b	74.44 ± 2.83 ^{cd*}	1.71 ± 0.27 ^{ab}	57.09 ± 6.63 ^a	0.44 ± 0.04 ^a
Group 8	2.18 ± 0.16 ^{a*}	67.58 ± 6.38 ^{ab}	1.48 ± 0.09 ^a	19.05 ± 1.17 ^a	0.30 ± 0.04 ^a
Group 9	2.24 ± 0.51 ^{a*}	72.06 ± 2.18 ^{bcd*}	1.55 ± 0.05 ^a	19.85 ± 0.85 ^a	0.36 ± 0.08 ^a

Data represent mean ±SD (n = 5); Values with ‘*’ are significantly different compared to BPH-control while values with letter ‘a’ are significantly different compared to normal control (p<0.05).

Conclusion

The extracts and fractions of *Zapoteca portoricensis* root exhibited some protective effect against the development of BPH, in addition to anti-oxidative stress/lipid peroxidation and antioxidant capacity as shown in the increased levels of SOD, CAT and GSH and decreased levels of PSA, ACP and MDA.

These observations are indications of modulatory effects of *Zapoteca portoricensis* root extracts on induced benign prostate hyperplasia (BPH) in male albino rats and could be a source of new agent for managing BPH.