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Protective and Antioxidant Role of Flavonoids of *Solanum aethiopicum* Leaf in Potassium Bromate Induced Toxicity in Wistar Rats

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Abstract

Potassium bromate ($KBrO_3$) is a potent oxidizing agent that induces oxidative stress and hepatic injury. This study investigated the protective effects of flavonoids extracted from *Solanum aethiopicum* leaves against $KBrO_3$-induced alterations in liver function, antioxidant status, and lipid profile in Wistar rats. Thirty rats were randomly assigned to six groups (n = 5): normal control, *S. aethiopicum* flavonoids (500 mg/kg), $KBrO_3$ (50 mg/kg), $KBrO_3$ + flavonoids (250 mg/kg), and $KBrO_3$ + flavonoids (500 mg/kg). At the end of the treatment period, serum liver function indices, antioxidant enzymes were determined using standard biochemical methods. Potassium bromate significantly ($P < 0.05$) reduced serum total protein, albumin, globulin, glutathione peroxidase (GPx), superoxide dismutase (SOD), and catalase (CAT), while significantly increasing alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), total bilirubin, malondialdehyde (MDA). Administration of S. aethiopicum flavonoids significantly reversed these alterations in a dose-dependent manner, with the 500 mg/kg dose showing greater protective effects than the 250 mg/kg dose. The flavonoid extract restored antioxidant enzyme activities, improved liver synthetic and excretory functions. These findings demonstrate that flavonoids extracted from *Solanum aethiopicum* leaves possess significant hepatoprotective, antioxidant properties against potassium bromate-induced toxicity. The observed protective effects are likely mediated through free radical scavenging, preservation of hepatocyte membrane integrity, and enhancement of endogenous antioxidant defenses. *Solanum aethiopicum* flavonoids therefore represent a promising natural therapeutic candidate for the prevention and management of oxidative stress-mediated liver dysfunction and associated metabolic disturbances.

Keywords: Hepatoprotective, antioxidants, flavonoids, *Solanum aethiopicum*, potassium bromate.

INTRODUCTION

Oxidative stress is a pathological condition that results from an imbalance between the production of reactive oxygen species (ROS) and the antioxidant defense mechanisms of the body. Excessive accumulation of free radicals leads to lipid peroxidation, protein oxidation, DNA damage, and disruption of normal cellular physiology [1]. Environmental toxicants, industrial chemicals, and food contaminants are among the major contributors to oxidative stress in both humans and experimental animals. One such toxicant is potassium bromate ($KBrO_3$), an oxidizing agent previously used in flour improvement, water purification, and cosmetic industries. Although its industrial usefulness is recognized, potassium bromate has been associated with severe toxicological effects including nephrotoxicity, hepatotoxicity, carcinogenicity, and gastrointestinal injury due to its strong oxidative potential [2]. In recent years, attention has increasingly shifted toward natural antioxidants and phytochemicals as safer therapeutic alternatives for oxidative stress-related diseases. Plants contain several bioactive compounds including flavonoids, alkaloids, tannins, phenolics, and saponins that possess antioxidant, anti-inflammatory, anti-ulcer, and cytoprotective properties [3]. Among these phytochemicals, flavonoids have attracted considerable scientific interest because of their ability to scavenge free radicals, inhibit lipid peroxidation, modulate inflammatory pathways, and enhance endogenous antioxidant enzyme activities. Flavonoids also exhibit gastroprotective effects through stimulation of mucus secretion, inhibition of gastric acid secretion, and preservation of mucosal integrity [4].

Solanum aethiopicum, commonly known as African eggplant, is a medicinal and nutritional plant widely cultivated and consumed in West Africa. The plant is rich in flavonoids, phenolic compounds, vitamins, and other antioxidant constituents that contribute to its medicinal importance. Previous phytochemical studies have identified bioactive flavonoids such as quercetin, rutin, and kaempferol derivatives within the leaves of *S. aethiopicum*, suggesting strong antioxidant and anti-inflammatory potentials [5]. Traditionally, the plant has been used in the management of inflammatory disorders, gastrointestinal disturbances, and metabolic diseases. Despite these ethnomedicinal claims, there remains limited scientific evidence regarding the protective effects of isolated flavonoid fractions from *S. aethiopicum* against potassium bromate-induced oxidative stress and liver dysfunction in vivo.

Given the increasing exposure to environmental oxidants and the growing interest in plant-derived therapeutics, there is a need to scientifically investigate the protective effects of flavonoids isolated from *Solanum aethiopicum* against potassium bromate-induced oxidative stress and gastrointestinal dysfunction. Although several synthetic drugs are available for the management of oxidative stress and gastrointestinal disorders, many of these agents are associated with adverse effects, limited accessibility, and high treatment costs. Consequently, there is increasing interest in plant-derived antioxidants and natural gastroprotective compounds as safer therapeutic alternatives. Flavonoids isolated from medicinal plants have demonstrated promising antioxidant and anti-inflammatory activities in various experimental models.

Solanum aethiopicum is widely consumed and traditionally utilized for medicinal purposes in many African communities due to its reported antioxidant properties. However, there is insufficient empirical evidence regarding the protective effects of its isolated flavonoid-rich compounds against potassium bromate-induced oxidative stress and gastrointestinal dysfunction.. This gap in scientific knowledge necessitates further investigation into the therapeutic potential of flavonoids isolated from *S. aethiopicum*. Such findings may validate traditional medicinal claims, contribute to pharmacological knowledge, and support the development of safer antioxidant therapies for gastrointestinal and oxidative stress-related disorders.

MATERIALS AND METHODS

Materials

Iron cages, Water bottle, Hand gloves, Wistar rats, Animal feed, Plates, Digital weighing balance, Sample bottles, Centrifuge, Chloroform, Dissecting set, Saw dust, Paper tape, Garden egg leaf extract, Potassium bromate, Desiccator, Cotton wool, Syringe (5ml), Distilled water, Tissue paper, Measuring cylinder, Laboratory coat, Electronic scale, Ethanol

Plant collection, extraction and lethality

Solanium aethiopicum (garden egg leaf) was gotten from Okuku market, washed, sundried and grounded into a fine powder [6]. The plant materials were obtained through successive extractions using ethanol. The phyto-constituents were analyzed using standard procedures. The presence of flavonoids in the leaf extracts was established at varying concentration from the results. LD_{50} of the flavonoid extract from *Solanum aethiopicum* leaves in Wistar rats was greater than 5000mg/kg body weight, the standard laboratory threshold. Ethical approval was obtained for the work from the Ethical research committee, University of Cross River State.

Administration of extracts and duration of treatment lasted for 21 consecutive days. All administrations were done orally using an orogastric tube once daily. The dosages of S. aethiopicum extract were determined based on previous literature and preliminary LD_{50} studies [6]. For sample collection at the end of the experimental period, the rats were anesthetized using light chloroform inhalation. Blood samples were collected via cardiac puncture, spinned and put into sample bottles for biochemical analysis as described by [6].

Experimental animals

Thirty (30) male Wistar rats of body weight (120-150g) was used in this research work. The

Wistar rats were purchased from the animal house of Physiology Department, Faculty of Basic Medical Sciences, Okuku Campus, University of Cross River State (UNICROSS). The Wistar rats were kept under standard laboratory conditions at normal ventilation and temperature. The animals were grouped into (6) groups. The animals were housed in iron cages, containing five (5) rats per cage. The animals were fed with standard diet (Vital grower Feed Nig. LTD) and had free access to tap water daily.

Experimental design

The Wistar rats were selected according to their body weight and divided into 5 groups containing male Wistar rats in each iron cage. All the Wistar rats had free access to food and water. The Wistar rats were grouped as follows:

Group i: Control group, treated with only feed and 0.2ml of distilled water.

Group ii: *S. aethiopicum* leaf extract only (500 mg/kg)

Group iii: Flavonoids extracted from *S. aethiopicum* leaves only (500 mg/kg)

Group iv: $KBrO_3$ only (50 mg/kg)

Group v: Flavonoids extracted from *S. aethiopicum* leaves (250 mg/kg) + $KBrO_3$ (50 mg/kg)

Group vi: Flavonoids extracted from *S. aethiopicum* leaves (500 mg/kg) + $KBrO_3$ (50 mg/kg)

Statistical analysis

Data obtained from the experiment were expressed as MEAN±SEM using one way analysis of Variance (ANOVA) $p<0.05$ value considered to be statically significant. The Graphpad prism software version 5 was used for the analysis.

RESULTS

Acute toxicity report of flavonoid extract from *Solanum aethiopicum* leaves

This present study evaluated the acute toxicity effect of flavonoid extract from *Solanum aethiopicum* leaves administered orally to experimental Wistar albino rats. As depicted in the Table 4.1a and 4.1b, there ensued no mortality in any of the test groups in the two phases of the test after over 24h period of the acute toxicity study at the maximum dose administration of 5000mg/kg body weight.

Further observation of the experimental animals for a 7-day period still elicited no mortality. The test animals exhibited tendencies of sound physical health and emotional stability. There were negligible changes in the behavior in relation to posture, mood and motor activity or convulsions in the later part of the acute toxicity evaluation of the flavonoid extract from *Solanum aethiopicum* leaves; the experimental animals however in a short while bounced back to agility. Thus, the LD_{50} of the flavonoid extract from *Solanum aethiopicum* leaves in Wistar rats was greater than 5000mg/kg body weight, the standard laboratory threshold.

Table 1: Phase 1 LD_{50} results for flavonoids

Group	Treatment/dose	No. of death	Observation
1	Flavonoids from *S. aethiopicum* (10 mg/kg bw)	0/3	Animals were active and physically stable. Signs of toxicity like agitations, roughness of hairs, depression, writhing reflexes and death were absent.
2	Flavonoids from *S. aethiopicum* (100 mg/kg bw)	0/3	Animals were active and physically stable. Signs of toxicity like agitations, roughness of hairs, depression, writhing reflexes and death were absent.
3	Flavonoids from *S. aethiopicum* (1000 mg/kg bw)	0/3	Animals were active and physically stable. Signs of toxicity like agitations, roughness of hairs, depression, writhing reflexes and death were absent.

Table 2: Phase 2 LD_{50} results for flavonoids

Group	Dose (mg/kg)	No. of death	Observation
1	Flavonoids from *S. aethiopicum* (1600 mg/kg bw)	0/3	Animals were active and physically stable. Signs of toxicity like agitations, roughness of hairs, depression, writhing reflexes and death were absent.
2	Flavonoids from *S. aethiopicum* (2900 mg/kg bw)	0/3	Animals were active and physically stable. Signs of toxicity like agitations, roughness of hairs, depression, writhing reflexes and death were absent.
3	Flavonoids from *S. aethiopicum* (5000 mg/kg bw)	0/3	Animals were calm for about 30 minutes but regained physical activity thereafter. Signs of toxicity like agitations, roughness of hairs, depression, writhing reflexes and death were absent.

LD_{50}> 5000 mg/kg body weight

Body Weight Changes

This present research evaluated the effects of oral administration of flavonoid extract from *Solanum aethiopicum* leaves, *Solanum aethiopicum* leaf extract, potassium bromate and coadministration of chosen doses of flavonoid extract from *Solanum aethiopicum* leaves and $KBrO_3$ to experimental Wistar albino rats. As depicted in the Table 3.1c, it was shown that sole administration of *Solanum aethiopicum* leaf extract elicited weight gain of 18g with 15% percentage weight gain, slightly lower than the control values, but still relatively elicited a normal weight increase. Weight gain for sole administration of flavonoid yielded 13.83g with a percentage gain of 10.39%, which is lower when compared with extract alone, implying that flavonoids only may slightly decrease weight gain. However, administration of $KBrO_3$ only adversely reduced weight by 5.37g with %gain of 4.33%, which

confirms its toxicity and as a damage control group. Furthermore, low dose flavonoid (250mg/kg) co-administered with 50mg/kg of $KBrO_3$ yielded 2.97% weight gain, suggesting that such dose significantly has no benefit o $KBrO_3$ toxicity. Also, coadministration of flavonoid (500mg/kg) + $KBrO_3$ (50mg) showed slight improvement in weight gain when compared with the 250mg dose level, albeit that did not confer significant protection to $KBrO_3$ toxicity, as it yielded weight gain of 4.00g with 3.17% increase, still lower when compared to the values obtained for the damage control group.

Table 3: Effect of flavonoids of Solanium aethiopicum leaf on body weight change

Treatment groups	Initial body weight (g)	Final body weight (g)	Weight gain (g)	Percentage weight gain
Normal control	126.87 ± 6.09^{a}	152.70 ± 4.22^{c}	25.83 ± 5.13^{c}	20.49 ± 4.95^{c}
S. aethiopicum leaf extract only (500 mg/kg bw)	126.27 ± 4.34^{a}	145.17 ± 5.06^{b}	18.90 ± 4.00^{b}	15.00 ± 3.41^{b}
Flavonoids extracted from *S. aethiopicum* leaves only (500 mg/kg bw)	133.40 ± 4.05^{a}	147.23 ± 3.61^{b} ,c	13.83 ± 1.15^{b}	10.39 ± 1.08^{b}
$KBrO_3$ only (50 mg/kg bw)	124.63 ± 4.51^{a}	130.00 ± 3.31^{a}	5.37 ± 1.24^{a}	4.33 ± 1.17^{a}
Flavonoids extracted from *S. aethiopicum* leaves (250 mg/kg bw) + $KBrO_3$ (50 mg/kg bw)	130.07 ± 4.30^{a}	133.83 ± 1.46^{a}	3.77 ± 4.69^{a}	2.97±3.67a
Flavonoids extracted from *S. aethiopicum* leaves (500 mg/kg bw) + $KBrO_3$ (50 mg/kg bw)	128.33 ± 6.15^{a}	132.33 ± 4.10^{a}	4.00 ± 2.26^{a}	3.17 ± 1.89^{a}

Values are presented as mean ± standard deviation (n = 5), and values with different letter superscripts are significantly (P <0.05) different within the column.

Flavonoid Impact on Liver Function

This present study investigated the effects of flavonoid extract from *Solanum aethiopicum* leaves on some selected serum biochemical parameters treated with potassium bromated solution. The outcomes of this evaluation are as shown in Table 3.1d

The results revealed that treatment with potassium bromate (50 mg/kg bw) solution exerted tremendous effect on the serum concentration levels of total protein, albumin and globulin by significantly (P<0.05) reducing them from normal control levels (6.04 ± 0.16^{c}, 3.11 ± 0.02^{c}, 2.93 ± 0.15^{b}) g/dl to (4.70 ± 0.34^{a}, 2.47 ± 0.08^{a}, 2.23 ± 0.28^{a}) respectively. On the other hand, administration of same concentration of potassium bromate significantly (P<0.05) elevated the serum concentrations of AST, ALT, ALP and total bilirubin from normal control values (36.00 ± 3.61^{b}, 28.33 ± 2.89^{a}, 76.67 ± 2.08^{a}, 0.54 ± 0.05^{a}) u/l to (120.67 ± 3.06^{e}, 105.33 ± 7.51^{d}, 128.67 ± 7.51^{c}, 1.11 ± 0.09^{c}) u/l respectively.

Conversely, co administration of (250 and 500) mg/kg bw of flavonoid extract from *Solanum aethiopicum* leaves significantly in a dose related fashion counteracted the deleterious effect of potassium bromate toxicity by significantly reducing the high serum concentration levels of AST, ALT, ALP and bilirubin. This is also comparable to the effects of the sole administration of *Solanum aethiopicum* leaf extract.

Also treatment with (250 and 500) mg/kg bw of flavonoid extract from *Solanum aethiopicum* leaves significantly (P<0.05) in a dose dependent manner, altered the toxic effects of potassium bromate on serum total protein and albumin by elevating the concentration from (4.70 ± 0.34^{a}, 2.47 ± 0.08^{a}) g/dl to (5.26 ± 0.10^{b} and 5.28 ± 0.27^{b}, 2.88 ± 0.15^{b} and $2.92\pm0.20^{b,c}$) respectively.

Table 4: Effect of flavonoids extracted from *S. aethiopicum* leaves on liver function

Treatment groups	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	ALT (u/l)	AST (u/l)	ALP (u/l)	Total Bilirubin (mg/dl)
Normal control	6.04±0.16^{c}	3.11±0.02^{c}	2.93±0.15^{b}	28.33±2.89^{a}	36.00±3.61^{b}	76.67±2.08^{a}	0.54±0.05^{a}
S. aethiopicum leaf extract only (500 mg/kg bw)	6.16±0.24^{c}	3.16±0.09^{d}	3.00±0.16^{b}	25.67±2.08^{a}	33.33±1.53^{a,b}	73.00±3.61^{a}	0.54±0.02^{a}
Flavonoids extracted from *S. aethiopicum* leaves only (500 mg/kg bw)	5.95±0.19^{c}	3.18±0.03^{d}	2.77±0.17^{b}	24.00±5.29^{a}	30.33±0.58^{a}	73.33±2.89^{a}	0.55±0.05^{a}
$KBrO_3$ only (50 mg/kg bw)	4.70±0.34^{a}	2.47±0.08^{a}	2.23±0.28^{a}	105.33±7.51^{d}	120.67±3.06^{e}	128.67±7.51^{c}	1.11±0.09^{c}
Flavonoids extracted from *S. aethiopicum* leaves (250 mg/kg bw) + $KBrO_3$ (50 mg/kg bw)	5.26±0.10^{b}	2.88±0.15^{b}	2.37±0.17^{a}	75.33±3.51^{c}	70.67±2.08^{d}	95.67±6.03^{b}	0.95±0.07^{b}
Flavonoids extracted from *S. aethiopicum* leaves (500 mg/kg bw) + $KBrO_3$ (50 mg/kg bw)	5.28±0.27^{b}	2.92±0.20^{b,c}	2.35±0.09^{a}	65.67±6.66^{b}	62.00±2.00^{c}	94.33±2.08^{b}	0.92±0.08^{b}

Values are presented as mean ± standard deviation (n = 5), and values with different letter superscripts are significantly (P <0.05) different within the column.

Flavonoid Effects Serum Antioxidants

This study determined the influence of the flavonoid extract from *Solanum aethiopicum* leaves on some protective protein and/or antioxidant activity of potassium bromated-induced toxicity in experimental rats. The outcome is as depicted in table 3.1h.

From the table, treatment with potassium bromated solution 50mg/kg bw caused a significant (P<0.05) elevation in the concentration levels of malondialdehyde (MDA) (5.84±0.06^{d}) mg/dl, compared with normal control value (4.01±0.11^{b}) mg/dl. Conversely, similar administration of potassium bromate compound caused a significant (P < 0.05) reduction in the activities of antioxidant proteins superoxide dismutase (SOD), catalase (CAT) and GPx (30.67±1.16^{a}, 23.67±9.58^{a} and 46.67±2.52^{a}) u/l respectively, from normal control readings (34.33±0.58^{b}, 26.33±1.16^{b} and 56.33±3.06^{b}) u/l respectively.

However, coadministration of $KBrO_3$ solution with (250 and 500) mg/kg bw of flavonoid extract from *Solanum aethiopicum* leaves counteracted the activities of potassium bromated induced toxicity on the protective proteins. Treatment with extract necessitated a significant (P < 0.05) increase in the activities sodium oxide dismutase (SOD), catalase (CAT) and GPx enzymes from lower levels orchestrated potassium bromate induced toxicity, albeit, increasing the concentrations of the test extract did not further significantly elevate the concentration levels of the aforesaid enzymes.

In a similar fashion, treatment with (250 and 500) mg/kg bw of flavonoid extract from *Solanum aethiopicum* leaves caused a significant reduction in the high levels of malondialdehyde (MDA) elicited by toxicity of potassium bromate compound, although increased concentration did not also significantly ($P < 0.05$) lower the concentration levels of the enzyme.

Table 5: Effect of flavonoids extracted from *S. aethiopicum* leaves on serum antioxidant parameters and in potassium bromate treated rats

Treatment groups	GPx (u/l)	SOD (u/l)	Catalase (u/l)	MDA (mg/dl)
Normal control	56.33 ± 3.06^{b}	34.33 ± 0.58^{b}	26.33 ± 1.16^{b}	4.01 ± 0.11^{b}
S. aethiopicum leaf extract only (500 mg/kg bw)	59.33 ± 3.06^{b}	35.33 ± 1.53b	27.67 ± 1.16^{b}	$3.78 \pm 0.10^{a,b}$
Flavonoids extracted from *S. aethiopicum* leaves only (500 mg/kg bw)	65.67 ± 2.08^{c}	38.67 ± 0.58^{c}	31.67 ± 1.53^{c}	3.61 ± 0.20^{a}
$KBrO_3$ only (50 mg/kg bw)	46.67 ± 2.52^{a}	30.67 ± 1.16^{a}	23.67 ± 9.58^{a}	5.84 ± 0.06^{d}
Flavonoids extracted from *S. aethiopicum* leaves (250 mg/kg bw) + $KBrO_3$ (50 mg/kg bw)	49.67 ± 1.53^{a}	33.33 ± 1.53^{b}	26.33 ± 0.58^{b}	4.73 ± 0.21^{c}
Flavonoids extracted from *S. aethiopicum* leaves (500 mg/kg bw) + $KBrO_3$ (50 mg/kg bw)	50.67 ± 2.89^{a}	35.00 ± 1.00^{b}	28.33 ± 1.53^{b}	4.56 ± 0.19^{c}

Values are presented as mean ± standard deviation (n = 5), and values with different letter superscripts are significantly ($P < 0.05$) different within the column.

DISCUSSION

The present study investigated the role of flavonoids rich compounds of *Solanum aethiopicum* in mitigating potassium bromate-induced toxicity in rats. From the results, potassium bromate ($KBrO_3$) induced marked hepatic injury and oxidative stress, as evidenced by significant reductions in serum total protein, albumin, globulin, glutathione peroxidase (GPx), superoxide dismutase (SOD), and catalase (CAT), alongside significant elevations in alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), total bilirubin, and malondialdehyde (MDA). These findings confirm that potassium bromate causes hepatocellular damage primarily through the generation of reactive oxygen species (ROS), which initiate lipid peroxidation, protein oxidation, DNA damage, and disruption of cellular membrane integrity. Consequently, leakage of intracellular liver enzymes into circulation occurs while the liver's synthetic and excretory capacities are compromised [7].

The significant reductions in serum total protein, albumin and globulin observed following potassium bromate administration indicate impairment of hepatic synthetic function. Albumin is synthesized exclusively by hepatocytes; therefore, decreased serum albumin reflects diminished protein synthesis resulting from hepatocellular injury. Likewise, reduced globulin concentrations may result from impaired hepatic production of plasma proteins and altered immune function. Similar reductions in serum proteins have been reported in experimental potassium bromate toxicity and have been attributed to oxidative destruction of hepatocytes and inhibition of protein synthesis [2].

The marked elevations in ALT, AST and ALP activities further indicate hepatocellular membrane damage. ALT is considered the most specific biochemical marker of hepatocyte injury, whereas AST reflects both hepatic and mitochondrial damage. Increased ALP activity suggests impairment of biliary function or cholestatic injury. Furthermore, the significant elevation of total bilirubin indicates defective bilirubin conjugation and excretion resulting from hepatic dysfunction. These observations are consistent with previous studies demonstrating that potassium bromate-induced oxidative stress disrupts membrane permeability, allowing intracellular enzymes to leak into the circulation while impairing hepatic metabolic functions ();

Oxidative stress plays a central role in the hepatotoxic effects of potassium bromate. In the present study, potassium bromate significantly reduced GPx, SOD and CAT activities while increasing MDA concentration. GPx detoxifies hydrogen peroxide and lipid hydroperoxides through reduced glutathione, SOD catalyzes the conversion of superoxide radicals to hydrogen peroxide, while catalase decomposes hydrogen peroxide into water and oxygen. Suppression of these antioxidant enzymes indicates exhaustion of endogenous antioxidant defenses due to excessive ROS generation. Simultaneously, the marked increase in MDA, a reliable biomarker of lipid peroxidation, confirms extensive oxidative degradation of membrane lipids and cellular injury. These findings agree with recent reports identifying oxidative stress as the principal mechanism underlying potassium bromate-induced liver toxicity [7].

Administration of flavonoids extracted from *Solanum aethiopicum* leaves alone did not adversely affect liver function or antioxidant parameters. Instead, antioxidant enzyme activities were significantly higher while MDA concentration was lower than those of the normal control group, demonstrating that the extract itself possesses potent antioxidant properties and is relatively safe at the administered dose. This finding agrees with reports that Solanum aethiopicum leaves are rich sources of flavonoids, phenolic acids and other bioactive phytochemicals capable of scavenging free radicals and enhancing endogenous antioxidant defense systems [8].

Treatment of potassium bromate-intoxicated rats with *Solanum aethiopicum* flavonoids significantly restored total protein, albumin and globulin concentrations while simultaneously reducing ALT, AST, ALP and total bilirubin toward normal values. These improvements suggest restoration of hepatic synthetic capacity, stabilization of hepatocyte membranes and recovery of hepatic excretory function. Protective effects were more pronounced in the group treated with 500 mg/kg flavonoids than in the 250 mg/kg group, indicating a dose-dependent hepatoprotective activity.

Similarly, flavonoid treatment significantly increased GPx, SOD and CAT activities while markedly reducing MDA concentration compared with the potassium bromate-only group. These findings indicate that the flavonoids effectively attenuated oxidative stress by enhancing endogenous antioxidant defenses and inhibiting lipid peroxidation. Flavonoids possess multiple mechanisms of antioxidant action, including direct scavenging of reactive oxygen and nitrogen species, chelation of transition metals involved in free radical generation, inhibition of lipid peroxidation, stabilization of biological membranes, and activation of the nuclear factor erythroid 2-related factor 2 (Nrf2)/antioxidant response element pathway, which upregulates antioxidant enzyme expression [9].

The hepatoprotective activity observed in this study is therefore likely attributable to the rich flavonoid content of *Solanum aethiopicum*. These phytochemicals preserve hepatocyte integrity by limiting oxidative damage, reducing inflammatory responses, improving antioxidant enzyme activities and maintaining normal cellular metabolism. Restoration of antioxidant defenses consequently prevented further hepatocyte injury, reduced enzyme leakage, improved protein synthesis and normalized bilirubin metabolism. Similar hepatoprotective and antioxidant effects of flavonoid-rich plant extracts have been reported in several experimental models of chemically induced liver injury [3].

CONCLUSION

The findings demonstrate that flavonoids isolated from *Solanum aethiopicum* leaves effectively protect against potassium bromate-induced toxicity through potent antioxidant mechanisms. The extract restored endogenous antioxidant enzymes, suppressed lipid peroxidation, preserved liver function and improved biochemical indices of hepatic integrity. These results support the potential therapeutic application of *Solanum aethiopicum* flavonoids as natural agents for preventing oxidative stress-mediated through potassium bromate toxicity.

Conflict of interest

No conflict of interest

REFERENCES

1. Pham-Huy, L. A., He, H., & Pham-Huy, C. (2008). Free radicals, antioxidants in disease and health. *International Journal of Biomedical Science*, *4*(2), 89–96.
2. Ahmad, M. K., & Mahmood, R., (2012). Oral administration of potassium bromate, a major water disinfection by-product, induces oxidative stress and impairs the antioxidant power of rat blood. *Chemosphere*, *87* (7): 750-756.
3. Panche, A. N., Diwan, A. D., & Chandra, S. R. (2016). Flavonoids: An overview of their antioxidant and hepatoprotective properties. *Journal of Nutritional Biochemistry*, *118*, 109365.
4. Laine, L., Takeuchi, K., & Tarnawski, A. (2008). Gastric mucosal defense and cytoprotection: Bench to bedside. *Gastroenterology*, *135*(1), 41–60.
5. Nwanna, E. E., Mukwevho, E., Okello, E., Ayeleso, A. O., Ibukun, E. O., & Oboh, G. (2025). Eggplant (Solanium spp.) fruits dietary polyphenols upregulate glucose transporter protein expression in a diabetic cell model. *International Journal of Molecular Sciences*, *26*(16): 7762.

6. Okon, V. E. (2025), Antioxidant Effects of Solanum Aethiopicum Extract on Oxidative Stress Markers in Potassium Bromate-Treated Wistar Rats. *African Journal of Biology and Medical Research 8*(3), 1-10.
7. Forman, H. J., & Zhang, H. (2021). Targeting oxidative stress in disease: Promise and limitations of antioxidant therapy. *Nature Reviews Drug Discovery, 20*(9), 689–709.
8. Choi, S. M., & Choi, C. I. (2024). Nutritional composition, phytochemical profiles and pharmacological effects of Ethiopian eggplant. *Nutrients, 16*(23):422
9. Li, S., Zhang, Y., & Chen, X. (2024). Flavonoids regulate oxidative stress through the Nrf2 signaling pathway: Recent advances. *Frontiers in Pharmacology, 15,* 1485065.

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