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Evaluation of the Toxic Effects of Some Male Sexual Enhancement Drugs in the Testes of Male Wistar Rats

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ABSTRACT

Testicular damage is one of the most commonly reported adverse effect associated with many herbal drugs in Nigeria. This study evaluated the toxic effects of some male sexual enhancement drugs (ST and DB) in the testis of male Wistar rats. 18 male Wistar rats were randomized into three groups of 6 each. Group I received distilled water only, while others were administered 10 mL/Kg of ST and DB for 14 days respectively. Thereafter, the rats were sacrificed, the testes were harvested and testicular antioxidant concentration was evaluated. Rats treated with ST and DB had significantly ($p<0.05$) high malondialdehyde (MDA) activity compared to the control; catalase activity was significantly ($p<0.05$) low in rats administered ST while those administered DB had significant elevation in catalase concentration; superoxide dismutase (SOD) activity and reduced glutathione concentration (GSH) were was significantly ($p<0.05$) low in rats administered ST and DB; ST significantly increased, while DB significantly decreased the activity of glutathione-S-transferase. Testicular histology showed degenerative and necrotic changes in the seminiferous tubules. The GCMS results identified chemical compounds such as: 2,5-Furandione, 3-(dodecenyl)dihydro and 5-hydroxymethyfurfural which further raises concerns on the safety of DB and ST for oral consumption. These aphrodisiacs caused elevations in activities that are associated with cellular oxidative pathways as well as testicular damage. Thus, providing evidence that the aphrodisiacs may be unsafe for consumption and not strictly medicinal. Therefore a more extensive chronic toxicity testing is recommended.

Keywords: Oxidative Damage, Aphrodisiac, Testicular Toxicity, Herbal Drugs.

Introduction

Male sexuality is a complicated physiological process that is essential to a man's quality of life. Because maintaining optimal sexual function necessitates coordination of the human multi-system, which includes the neurological, circulatory, endocrine, and reproductive systems (Calabrò *et al*., 2019), alterations to any of the aforementioned systems will affect the quality of a typical sexual life, which can result in dysfunctions in penile erection, ejaculation, and male sexual arousal, among other things (Harirugsakul *et al*., 2022).

Men of various ages, ethnicities, and cultural backgrounds frequently struggle with sexual function. It is among the most common and inadequately managed conditions linked to male sexual orientation (Prabhakaran *et al*., 2018).

Numerous widely used medications have been demonstrated to hinder erections, lower libido, and affect sexual function. However, male sexual

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dysfunction can also result from various conditions that impact any aspect of the sexual response cycle, including psychological issues, neurological factors, vascular disorders, trauma, and surgery (Chen *et al*., 2019).

According to Msomi and Simelane (2019), the market for herbal medicine is still growing quickly and has become a multibillion-dollar sector worldwide. Herbal medication is also widely used by consumers in Western nations due to the widespread perception that natural remedies are safe (Ekor, 2014). In most parts of the world, the majority of herbal remedies are accessible without a prescription. Most herbal remedies are safe to use in small doses because their chemical components are what give them their medicinal effects (Karimi *et al*., 2015).

It has been shown, nevertheless, that taking herbal medicine can have unfavorable effects. Many reasons, including adulteration, misidentification or inappropriate usage of the wrong species of the plant, overuse, improper dosage, contamination (toxic metal, microorganisms, microbial toxins, environmental contaminants), and toxic components, can cause these unfavorable effects (Okaiyeto and Oguntibeju, 2021). For example, Aristolochia species, which are frequently found in Chinese medicines, include nephrotoxins called aristolochic acids (Han *et al*., 2019). Interactions between herbal remedies and conventional pharmaceuticals may occur because herbal remedies are known to alter the pharmacokinetic and pharmacodynamic properties of conventional medications (Czigle *et al.,* 2023).

Sexual enhancement drugs are intended to increase the length of time that men engage in sexual activity by increasing sexual potency, sexual pleasure, or libido (Brunetti *et al.*, 2020). These drugs are often sold under various brand names marketed as "herbal" supplements, they contain undisclosed pharmaceutical ingredients or synthetic analogues of prescription of drugs (Jairoun *et al.*, 2022). These substances can pose serious health risk to individuals who use them. One of the major toxicity effects associated with these drugs on the testis is decrease in the production of sperm, however, the potential toxicity can vary depending on the specific herbal drug and its ingredients (Igweze *et al.*, 2019). The effects observed with most of the plant and plant-based products have been attributed to the antispermatogenic and/or antisteroidogenic properties of one or more active ingredients (Baffoe *et al*., 2021). In fact, their general acceptability has been limited by lack of dose regimen and adequate toxicity data to evaluate their safety (Brunetti *et al*., 2020).

Damage to cells occur when reactive oxygen species overwhelm this natural antioxidant defense (Wang *et al*., 2018). One of the main antioxidant systems in cells that is in charge of deactivating reactive oxygen species (ROS) and guarding against oxidative damage is the natural defense system, which includes endogenous antioxidant enzymes like catalase, glutathione peroxidase, and superoxide dismutase. Both superoxide anion and peroxide radicals are converted into oxygen and water by superoxide dismutase and catalase, which are also found in seminal plasma and sperm (Roy *et al*., 2023).

Catalase is a common enzyme found in nearly all organisms exposed to oxygen. This enzyme catalyzes the decomposition of hydrogen peroxide to water and oxygen (Ighodaro and Akinloye, 2018). It is a very important enzyme that protects the cell from oxidative damages caused by reactive oxygen species (ROS).

In animals, bacteria, fungus, and plants, glutathione (GSH) plays a significant role as an antioxidant. This antioxidant can stop harmful ROS such heavy metals, lipid peroxides, and free radicals from destroying vital cell components (Aaseth *et al*., 2021). GSH is a tripeptide with a gamma peptide linkage between the carboxyl group of the glutamate side chain and the amine group of cysteine and the carboxyl group of cysteine is attached by normal peptide linkage to a glycine (Giustarini *et al*., 2023).
Furthermore, glutathione-s-transferase (GST), refers to a group of enzymes which employ glutathione in

many reactions that help metabolize many different chemicals, including pharmaceuticals, carcinogens, and items related to oxidative stress (Howie *et al*., 2019.) The microsomal, cytosolic, and mitochondrial proteins included in the glutathione-s-transferase (GST) family of detoxifying enzymes play a crucial role in the structure of the enzyme body (Strange *et al*., 2001; Hu *et al*., 2022). They exist in prokaryotes and eukaryotes where they catalyze several processes and take xenobiotic and endogenous substrates simultaneously (Tralau and Luch, 2022).

On the other hand, Lipid peroxidation is the oxidative degradation of lipids. It is used as a biochemical measure of oxidative stress and describes the process by which free radicals "steal" electrons from the lipids in cell membranes, causing cell damage (Nabi, 2014).

Total serum protein is a rough measure of all of the proteins in the plasma portion in the blood. It provides important information about the general protein status and can help in diagnosing various medical conditions (Sabatino *et al*., 2017). The total protein test can be used to measure blood protein levels and track any variations or abnormalities that might point to underlying illnesses or conditions (Aitekenov *et al*., 2021).

In Nigeria, herbal drugs that claim to improve sexual erection include DB and ST. This study therefore measures the effects of oral administration of these two poly herbal drugs or 14 days on testicular antioxidants and histoarchitecture of male *Wistar* rats.

Materials and Methods

Drugs and Chemicals

The aphrodisiac herbs, ST and DB were obtained from street vendors. Assay kits for total protein, catalase, superoxide dismutase, malondialdehyde, reduced glutathione, glutathione-S-transferase were products of Randox Laboratories, Shanghai, China.

Experimental Animals

Eighteen (18) adults male Wistar rats (175g ± 10) were obtained from the animal breeding unit, University of Ibadan and transported to animal house of the Department of Biochemistry, Lead City University, Ibadan. The rats were acclimatized in the new environment for 14 days prior to the experiment. The animals had unrestricted access to rat pellets (Top Feed, Old Jebba Road, Sango, Ilorin, Kwara State, Nigeria) and water. The rats were housed in a clean plastic cage under room temperature and a relative humidity of 50-55%. The experiments were carried out in line with institution guidelines for Laboratory Animal Care and Use.

Animal Grouping

The rats were randomly assigned into three groups (n=6). Group I (control) was administered the vehicle (distilled water) only. Group II rats received ST herbal mixture (10 mL/kg body weight) orally (*per os*) while Group III rats received DB herbal mixture (10 mL/kg body weight) orally for 14 days. After which the rats were fasted 8 hours over night, and the testis was harvested for biochemical and morphological analysis.

Preparation of Testicular Supernatants

After the rats were sacrificed humanely under inhaled diethyl ether, the testis was excised, rinsed in 1.15% KCl, blotted, weighed and homogenized in 100mM phosphate buffer, pH 7.4. The procedures described by Gornall *et al*. (1949), Claiborne (1985), Varshney and Kale (1990), Beutler (1963), Misra and Fridovich (1972), and Habig *et al.* (1974) were adopted for determination of testicular total protein, catalase activity, malondialdehyde concentration, concentration of reduced glutathione, superoxide dismutase activity, and glutathione-S-transferase activity respectively.

Gas Chromatography-Mass Spectrometry Analysis

A GC-MS analysis was carried out to elucidate the

molecular weight and structure of compounds present in DB and ST. The components of DB and ST were identified based on direct comparison of the retention times and mass spectral data with those for standard compounds, and by computer matching with the Wiley and Nist Libraries (Adams, 2001).

Histopathological Studies

The testicular samples underwent conventional protocols described by Krause (2001), through which they were processed and stained using haematoxylin and eosin (H&E). Morphological alterations were observed and recorded and histologic pictures were taken as micrographs.

Data Analysis

Data were expressed as the mean of six determinations ± standard deviation (mean ± SD). The normally distributed data were analysed using both the one-way analysis of variance and Duncan's new multiple range test at ($P < 0.05$) All the analyses were done with SPSS version 20.0 software (SPSS Inc, Chicago, IL, USA).

Results and Discussion

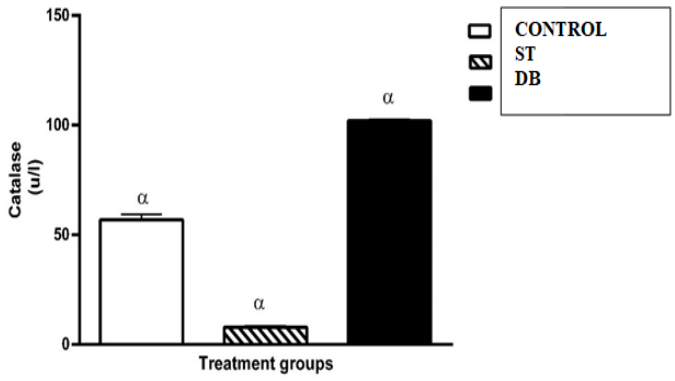

Figure 1. Effect of the administration of ST and DB herbal mixture on testicular catalase concentration. Bars represent ± standard deviation α= means significant when value is compared to the control group.

While there was significant ($p < 0.05$) decrease in the catalase level of ST-treated animals (Figure 1), there was a significant ($p < 0.05$) increase in catalase activity in the testis homogenate of rats treated with DB when compared to the control. Only, the latter is similar to the report of Akinola *et al*. (2022) and those of many other researchers based on herbal aphrodisiacs and antioxidant activity. In addition, ST and DB both caused about five-fold decrease in superoxide dismutase activity when compared to control (Figure 2). This diminution further negates existing reports which support the trend that aphrodisiac effect may be traceable to the ability of a drug or herb to maintain the ROS/antioxidant balance (Alombong *et al*., 2022).

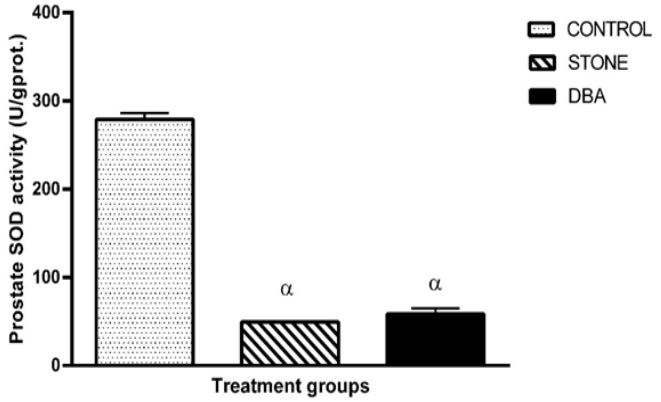

Figure 2. Effect of the administration of ST and DB herbal mixture on supe oxide dismutase (SOD) activity in the testis homogenate in male *Wistar* rats. Bars represent ± standard deviation α= means significant when value is compared to the control group.

Furthermore, malondialdehyde (MDA) concentration (a product of lipid peroxidation) was significantly ($p < 0.05$) raised in rats administered ST and DB. This appears to corroborate the report that some herbal extracts can induce lipid peroxidation, a conclusion that Baffoe *et al*. (2021) arrived at after using the hydroethanolic root extracts of *Caesalpinia benthamiana, Sphenocentrum jollyanum,* and *Paullinia pinnata*. The animals administered DB had lowered concentration of MDA (Figure 3) and this

may contribute to the efficacy of DB as an aphrodisiac since lowered concentration of MDA seems to be associated with methanolic extract of *Carpolobia rutea* root, a well-established herbal aphrodisiac (Akinola *et al*., 2022).

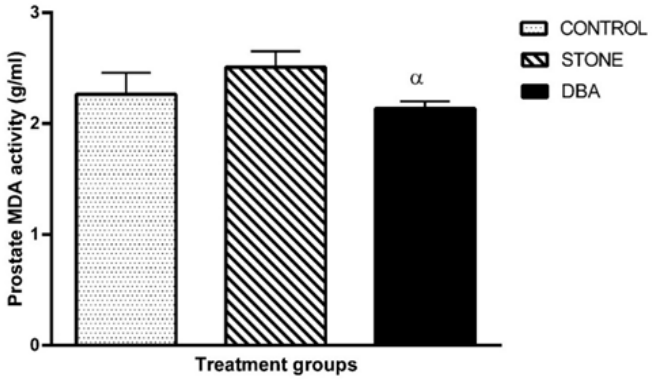

Figure 3. Effect of the administration of ST and DB herbal mixture on testicular malondialdehyde concentration. Bars represent ± standard deviation α is means significant when value is compared to the control group.

In addition, the rats that were administered with ST and DB both showed significant ($p < 0.05$) decrease in reduced GSH level (Figure 4). This contradicts the result of Rajendar *et al*. (2011) who established that elevation in concentration of reduced glutathione conferred on *Tribulus terrestris Linn*. the ability to prevent cadmium-induced testicular damage and may have contributed to the use of the plant as an aphrodisiac (Neychev and Mitev, 2016; Ara *et al*., 2023; Petre *et al*., 2023).

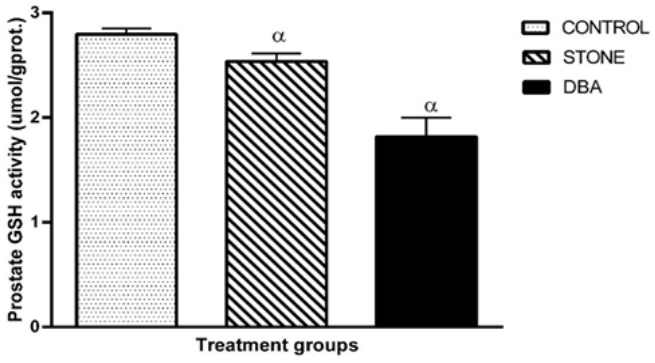

Figure 4. Effect of the administration of ST and DB herbal mixture on reduced Glutathione activity in the testis homogenate in male *Wistar* rats. Bars represent ± standard deviation α= means significant when value is compared to the control group.

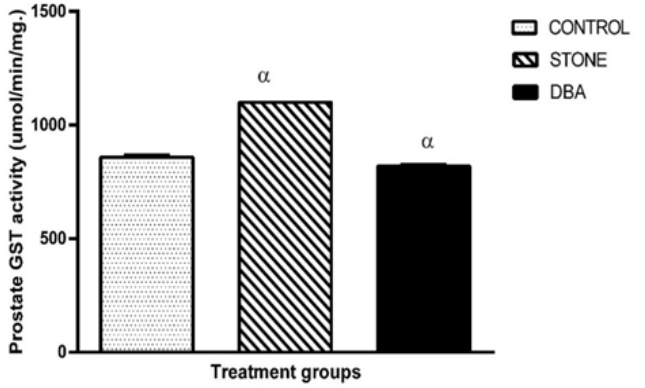

Figure 5. Effect of the administration of ST and DB herbal mixture on the Glutathione S- transferase activity (GST) activity in the testis homogenate in male *Wister* rats. Bars represent ± standard deviation α= means significant when value is compared to the control group.

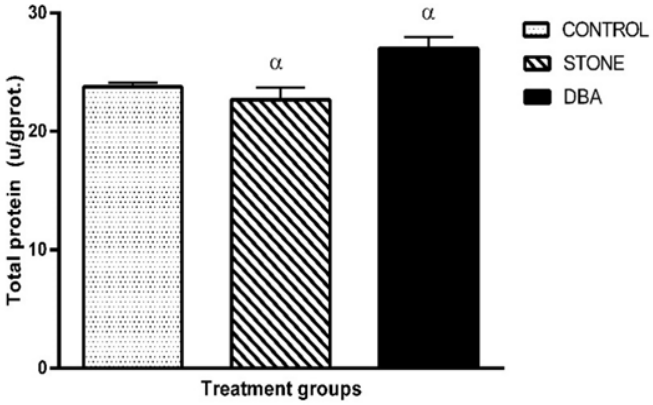

Figure 6. Effect of the administration of ST and DB herbal mixture on the total protein concentration in male *Wistar rats*.
Bars represent ± standard deviation α= means significant when value is compared to the control group

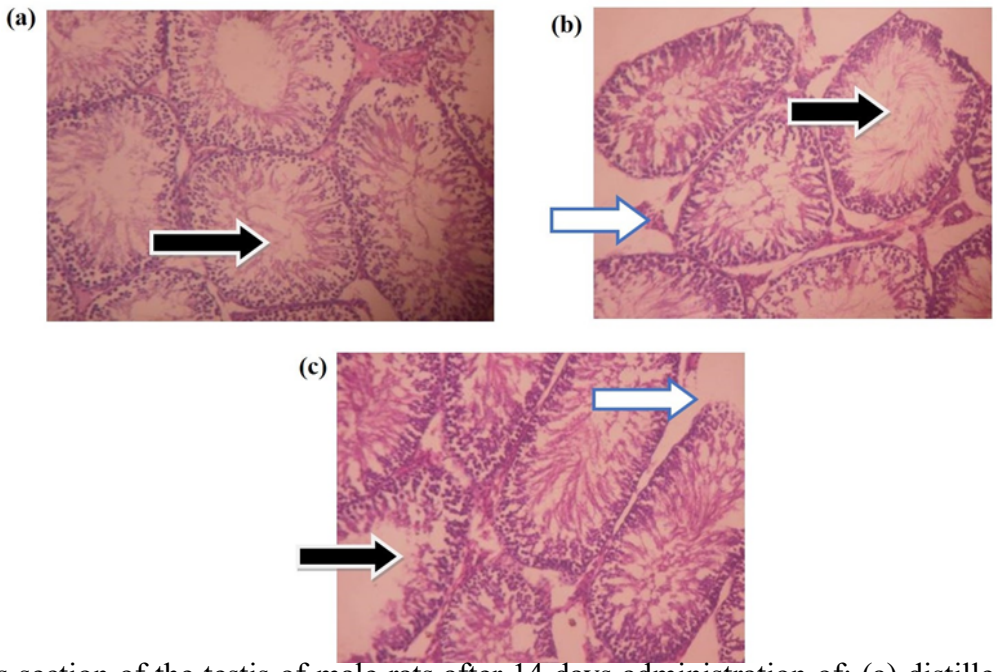

Figure 7. Cross section of the testis of male rats after 14 days administration of: (a) distilled water (x 100; H & E). Black arrow indicates that the germinal epithelium lining of the seminiferous tubules are within normal histology with different stages of spermatogenesis. There is active cell division and maturation of the germ cells as evidenced in abundance of terminally differentiated cells (spermatozoa); **(b)** ST (x 100; H & E). Black arrow indicates degenerative and necrotic changes in the seminiferous tubules, vacuoles in the germinal epithelium, suggesting spermatogenic arrest. White arrow suggests mild interstitial oedema; **(c)** DB (x 100; H & E). Black arrow indicates degenerative and necrotic changes in the seminiferous tubules with vacuoles in the germinal epithelium and scanty spermatocytes. White arrow suggests mild interstitial oedema.

Table 1: Bioactive Component Analysis Result for DB (GCMS)

S/N	Retention Time (min)	Area	Height	Area/ Height	Formula	Molecular Weight	Compound Name
1	5.950	896493	251919	3.56	$C_4H_6O_3$	210	2-Hydroxy-gamma-butyrolactone
2	6.167	194104	129789	1.50	$C_6H_8O_4$	144	2,4-Dihydroxy-2,5-dimethyl-3(2H)-furan-3-one
3	6.790	811170	330586	2.45	$C_5H_8O_3$	116	Pentanoic acid, 4-oxo-
4	7.120	430716	200402	2.15	C_4H_8O	72	Cyclopropyl carbinol
5	7.559	683505	323466	2.11	$C_7H_{12}O_3$	144	Butanoic acid, 2-methyl-3-oxo-, ethyl ester
6	7.689	1309300	338705	3.87	$C_2H_6N_2O$	74	O-Methylisourea
7	7.9486	605024	336928	1.80	$C_6H_8O_4$	144	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl
8	8.311	33091841	5292515	6.25	$C_7H_6O_2$	122	Benzoic acid

9	8.514	2580264	747229	3.45	$C_7H_8O_3$	140	4H-Pyran-4-one, 2-ethyl-3-hydroxy-
10	8.620	17191639	7863433	2.19	$C_6H_6O_3$	126	5-Hydroxymethylfurfural
11	9.285	1343496	811840	1.65	C_6H_9NOS	143	5-Thiazoleethanol, 4-methyl-
12	11.556	39641943	2912836	13.61	$C_6H_{12}O_6$	180	D-Allose
13	12.740	36450713	2131942	17.10	$C_6H_{10}O_5$	162	1,6-Anhydro-.alpha.-d-galactofuranose
14	13.120	3363971	355872	9.45	$C_6H_{12}O_6$	180	3-Deoxy-d-mannonic acid
15	13.680	2805578	132392	21.19	$C_{10}H_{19}NO_6$	249	alpha.-D-Galactopyranoside, methyl 2-(acetyla
16	13.969	809568	352300	2.30	$C_{15}H_{22}O$	218	Tumerone
17	16.265	516406	236683	2.18	$C_{11}H_{18}N_2O_2$	210	Pyrrolo[1,2-a]pyrazine-1,4-dione, hexahydro-3-
18	16.549	16.549	298192	1.72	$C_{17}H_{34}O_2$	270	Hexadecanoic acid, methyl ester
19	16.647	1394211	421407	3.31	$C6H_{10}N_2O$	126	1-Ethyl-2-hydroxymethylimidazole
20	16.809	948254	512230	1.85	$C_{16}H_{32}O_2$	256	n-Hexadecanoic acid
21	17.569	2728028	467903	5.83	$C_{16}H_{14}N_2O_2$	266	3,5(2H)-Dihydroindazol-5-one, 2-acetyl-3-methyl-3-phenyl
22	17.921	1391721	440745	3.16	$C_{19}H_{34}O_2$	294	9,12-Octadecadienoic acid, methyl ester
23	18.258	1075046	308868	3.48	$C_{15}H_{18}O_2$	230	2-Norbornene, 7-methoxy-7-(p-methoxyphenyl)- stereoisomer
24	18.527	1785794	482321	3.70	$C_{11}H_{20}N_2O$	196	Piperidine, 1-(4-piperidinylcarbonyl)-
25	18.948	1258778	345672	3.64	$C_{16}H_{26}NO_5P$	343	Butylphosphonic acid, isohexyl 3-nitrophenyl ester
26	19.188	1115184	153083	7.28	$C_{13}H_{20}O_5$	256	3,7-Dimethyl-8-oxo-1,5-dioxa-spiro[5.5]undecane-3-carboxylic acid, methyl ester
27	19.526	1970096	189431	10.40	$C_{23}H_{25}NO_8$	443	Benzeneethanamine, 4,5-diacetoxy-N-[[4-acetoxy-5-methoxyphenyl] acetyl]-
28	20.520	2004514	188468	10.64	$C_{23}H_{25}NO_6$	411	(-)-Coreximine diacetate
29	20.755	1505766	312816	4.81	$C_{19}H_{38}O_4$	330	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester
30	21.123	1126925	151399	7.44	$C_{19}H_{36}O_3$	312	Octadecanoic acid, 9-oxo-, methyl ester
31	21.799	1244303	279650	4.45	$C_{19}H_{35}NO_3$	325	Adipic acid, monopiperidide, octyl ester

32	22.270	1387835	280919	4.94	$C_{11}H_{20}O$	168	1-Naphthalenol, decahydro-4a-methyl-
33	23.234	431988 164607379	173959 27755900	2.48	$C_{16}H_{26}O3$	266	2,5-Furandione, 3-dodecyl-

Table 2. Bioactive Component Analysis Result for ST (GCMS)

S/N	Retention Time	Area	Height	Area/ Height	Formula	Molecular Weight	Compound Name
1	5.652	554916	399659	1.39	$C_5H_8O_2$	100	2(3H)-Furanone, dihydro-5-methyl-
2	5.853	344131	149929	2.30	$C_6H_8O_2$	112	2-Furanmethanol, 5-methyl-
3	5.961	295820	186593	1.59	$C_4H_6O_3$	102	2-Hydroxy-gamma-butyrolactone
4	6.343	392618	254274	1.54	$C_6H_{14}O_2$	118	2,5-Hexanediol
5	7.122	624391	388552	1.61	C_4H_8O	72	Cyclopropyl carbinol
6	7.679	340774	162246	2.10	$C_5H_{10}O$	86	Pentanal
7	8.142	438364	234560	1.87	$C_7H_6O_2$	112	Benzoic acid
8	8.507	766307	331012	2.32	$C_6H_8O_4$	144	1,4:3,6-Dianhydro-.alpha.-d-glucopyranose
9	8.602	1911492	645642	2.96	C_6H_6O3	126	5-Hydroxymethylfurfural
10	8.753	402911	166794	2.42	$C_7H_{10}O_3$	142	2,7-Dioxabicyclo[4.1.0]heptan-3-one, 5,5-dimethyl
11	8.916	1067336	142477	7.49	$C_7H_{14}O_3$	146	1,3-Dioxane-5-methanol, 5-ethyl-
12	10.079	167763	74747	2.24			Glutamine, L-
13	10.920	456544	61090	7.47	$C_{12}H_{22}O_{11}$	342	Sucrose
14	11.428	18312046	1966453	9.31	$C_6H_{12}O_6$	180	D-Allose
15	11.862	197597	84829	2.33	$C_8H_{16}O_2$	144	Acetic acid, hex-3-yl ester

16	12.089	278750	111640	2.50	$C_{13}H_{24}O_4$	244	Acetoxyacetic acid, nonyl ester
17	12.248	212549	76970	2.76	$C_8H_{10}O_5$	186	1,6:2,3-Dianhydro-4-O-acetyl-.beta.-d-gulopyran
18	12.641	18295783	1452775	12.59	$C_6H_{10}O_5$	162	1,6-Anhydro-.alpha.-d-galactofuranose
19	12.875	1629297	380673	4.28	$C_{12}H_{14}O_4$	222	Diethyl Phthalate
20	12.990	1559698	232442	6.71	$C_6H_{12}O_5$	164	D-Glucitol, 1,4-anhydro-
21	13.861	481617	138878	3.47	$C_{15}H_{20}O$	216	Ar-tumerone
22	13.970	521832	235741	2.21	$C_{15}H_{22}O$	218	Tumerone
23	14.662	1106250	92545	11.95	$C_{19}H_{15}O_2P$	306	Diphenyl(p-carboxyphenyl) phosphine
24	16.254	504068	130858	3.85	$C_{11}H_{18}N_2O_2$	210	Pyrrolo[1,2-a]pyrazine-1,4-dione, hexahydro-3-
25	16.550	331145	196017	1.69	$C_{17}H_{34}O^2$	270	Hexadecanoic acid, methyl ester
26	16.807	470489	191945	2.45	$C_{16}H_{32}O_2$	256	n-Hexadecanoic acid
27	17.571	1680218	341706	4.92	$C_{16}H_{14}N_2O_2$	266	3,5(2H)-Dihydroindazol-5-one, 2-acetyl-3-meth
28	17.920	471362	261899	1.80	$C_{20}H_{36}O_2$	308	Linoleic acid ethyl ester
29	18.255	741372	240350	3.08	$C_{15}H_{18}O_2$	230	2-Norbornene, 7-methoxy-7-(p-methoxyphenyl)
30	18.541	1706852	245362	6.96	$C_{14}H_{28}O_2$	228	Isovaleric acid, nonyl ester
31	18.948	1088750	253185	4.30	$C_{12}H_9N_3O_4$	259	Benzenamine, 4-nitro-N-(4-nitrophenyl)-
32	19.176	528721	282883	1.87	$C_3H_5N_5O$	127	1,3,5-Triazin-2(1H)-one, 4,6-diamino-
33	19.931	1291690	387001	3.34	$C_{15}H_{30}O_5S$	322	beta.-d-Glucopyranoside, nonyl 1-thio-
34	20.620	3174331	402976	7.88	$C_{12}H_{22}O_{11}$	342	Maltose

35	20.872	2792383	696554	4.01	$C_{12}H_{22}O_{11}$	342	.alpha.-D-Glucopyranose, 4-O-.beta.-D-galactopyranosyl
36	20.997	792639	198751	3.99	$C_{14}H_{28}O_5S$	2538	.beta.-D-Mannothiofuranoside, S-n-octyl-
37	21.508	480695	186015	2.58	$C_{17}H_{21}NO_3$	287	Galanthamine,(3.alpha.-
38	21.797	514848	175116	2.94	$C_{13}H_{28}FO_2P$	266	3,7-Dimethyloctyl isopropylphosphonofluorida
39	23.232	393683	175116	2.66	$C_{23}H_{44}O_2$	352	22-Tricosenoic acid
		67322032	12309034				

This study also revealed that animals administered ST had significantly ($p < 0.05$) increased testicular activity of GST (Fig. 5). However, this does not support the direct proportionality between concentration of reduced gluthathione and GST which reportedly supports the preservation of testicular components as reported by Vyas *et al*., (2022). In addition, animal administered DB had significantly lower GST activity when compared with the control. This further increases the inconsistency in the results and may contribute to toxicity of the herbal drugs. This is similar to the report of Kale and Awodele (2016) who also reported dimunition in cardiac and brain GST activities and concluded that Bon-santé cleanser® (BSC) marketed polyherbal drug manufactured in Nigeria could be toxic to the heart and liver.

This finding revealed that the total protein estimation of rats that were administered with ST had significantly ($p < 0.05$) decreased level of total protein concentration which may be a cause of concern since this occurrence has been linked with organ toxicity/atropy (Yakubu *et al*., 2021). while rats administered DB had significantly increased ($p > 0.05$) total protein concentration (Fig. 6) when compared to the control. This is in agreement with the report of Chukwudoruo *et al.* (2021) who associated the dimunition in serum protein concentration to the presence of toxic phytochemicals in the leaves of *Ficus capensis* and may contribute to liver damage.

The Gas Chromatography-Mass Spectrometry analysis of DB and ST revealed the presence of 33 and 39 chemical constituents respectively. DB was found to include 2,5-furandione and 3-dodecyl, which may be harmful to one's health if ingested. Additionally, the heat breakdown of carbohydrates produces 5-hydroxymethyfurfural (HMF), which was discovered in ST. Significant amounts of HMF, which has been linked to cardiotoxicity, genotoxicity, and other detrimental health effects, can be found in a variety of dietary products (Abdulmalik *et al.,*2005).

These results highlight the necessity of more stringent phytochemical authentication, enhanced regulatory supervision, and thorough safety testing of commercial herbal aphrodisiacs.

Conclusion

Both DB and ST evidently caused an alterations in activities of catalase, SOD, GSH and GST, which are associated with cellular oxidative pathways, however, not all the antioxidant mechanisms of the animals were able to ameliorate the oxidative damage. In addition, the aphrodisiacs contained 2,5-Furandione, 3-(dodecenyl)dihydro- and 5-HMF which implicate them in toxicity.

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