

ANTIOXIDANT EFFECT OF HIBISCUS SABDARIFFA AQUEOUS EXTRACT IN MICE BRAINS EXPOSED TO MONOSODIUM GLUTAMATE- INDUCED ALTERATIONS

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INTRODUCTION & AIM

Monosodium glutamate (MSG), a widely used flavor enhancer, is associated with neurotoxicity and oxidative stress in the brain, potentially contributing to neurodegenerative diseases (Solomon et al., 2015). *Hibiscus sabdariffa* aqueous extract (HSAE), rich in polyphenols and anthocyanins, is known for its antioxidant properties (Bernardes et al., 2023) and may mitigate MSG-induced brain damage.

This study aimed to evaluate the antioxidant and neuroprotective effects of HSAE on MSG-induced alterations in mice brains, focusing on oxidative stress markers, antioxidant enzyme levels, acetylcholinesterase activity, and histological changes in the hippocampal dentate gyrus.

METHOD

Swiss male mice weighing 20-25g were obtained and divided into six groups (n=6): control, MSG (2.5 g/kg), fluoxetine (Flx, 200 mg/kg), and HSAE (50, 100, and 200 mg/kg) co-treated with MSG. The extract, standard and MSG were prepared freshly and administered daily for 14 days. MSG was administered via subcutaneous route while the extract and standard was administered via intraperitoneal route. Treatments were given 30 minutes prior to the commencement of the test. 30 minutes after administration, behavioural tests were carried out then sacrificed to extract brain samples for the antioxidant assays. Samples were extracted, homogenised and supernatants were decanted and kept for further use.

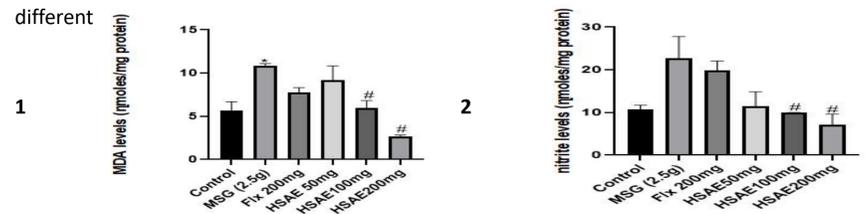
A portion of brain tissues was homogenised and the supernatant was assayed for malondialdehyde (MDA), nitrite, reduced glutathione (GSH), catalase (CAT), superoxide dismutase (SOD) and acetylcholinesterase activities (AChE) activities using spectrophotometric methods.

Some sections were stained with Hematoxylin and Eosin to demonstrate general histology of the hippocampal dentate gyrus region of mice brains using the method of Eltony and Elgayar (2014). Thereafter, images were acquired using the eyepiece of binocular research microscope.

Data obtained from the behavioral studies were expressed as the mean \pm standard error of mean (SEM) and analysed with GraphPad Prism software (version 8.5). Statistical differences between the treatments and control groups were evaluated using one-way analysis of variance (ANOVA) and turkey multiple comparison. Differences were considered significant if $P < 0.05$.

RESULTS & DISCUSSION

EFFECT OF HIBISCUS SABDARIFFA AQUEOUS EXTRACT (HSAE) ON CONCENTRATION OF MALONDIALDEHYDE AND NITRITES IN BRAINS OF MICE ADMINISTERED WITH MONOSODIUM GLUTAMATE (MSG). As shown in Figures 1 & 2, the effect of HSAE on the concentration of malondialdehyde (MDA) and nitrites in mice exposed to MSG is shown. Elevated brain levels of MDA and nitrites concentration induced by MSG administration were significantly reversed by HSAE (100 and 200mg/kg, i.p) in mice. Also, similar effects were observed in the group that were given the standard fluoxetine (Flx) (200 mg/kg, i.p) although not significantly different



EFFECT OF HIBISCUS SABDARIFFA AQUEOUS EXTRACT (HSAE) ON THE LEVELS OF ACETYLCHOLINESTERASE IN BRAINS OF MICE ADMINISTERED WITH MONOSODIUM GLUTAMATE (MSG). As shown in Figure 3, THE effect of HSAE on the levels of acetylcholinesterase in mice exposed to MSG is shown. Elevated brain levels of acetylcholinesterase induced by MSG administration were significantly reversed by HSAE (100 and 200mg/kg, i.p) in mice. Also, similar effects were observed in the group that were given the standard fluoxetine (Flx) (200 mg/kg, i.p) not significantly different.

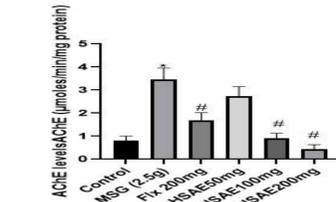
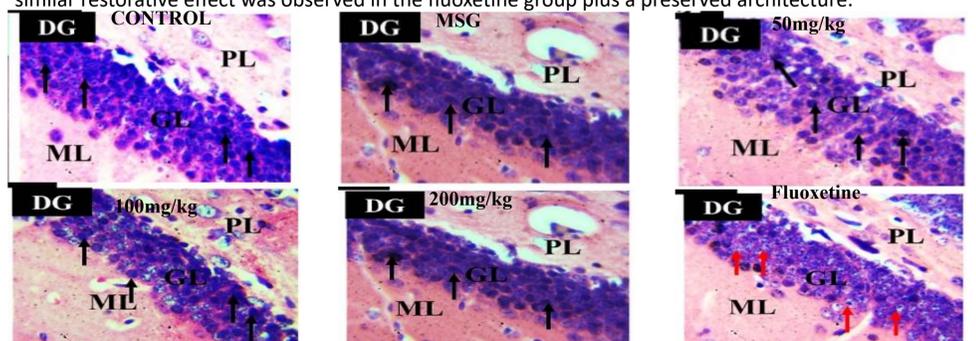


Table 1

Treatment	GSH concentration (μmol/g tissue)	CAT levels (units/mg protein)	SOD levels (units/mg protein)
Control	49.93 \pm 0.88	60.12 \pm 6.67	3.75 \pm 0.82
MSG(2.5g)	31.15 \pm 0.80*	49.22 \pm 1.50	2.82 \pm 0.53
Fluoxetine 200mg/kg	63.01 \pm 3.07#	92.91 \pm 13.08#	4.84 \pm 0.72
HSAE 50mg/kg	37.51 \pm 1.44	86.73 \pm 15.91	3.74 \pm 0.86
HSAE 100mg/kg	43.82 \pm 3.75	64.30 \pm 2.98	3.27 \pm 0.26
HSAE 200mg/kg	55.86 \pm 2.92#	88.53 \pm 1.08	3.52 \pm 0.73

EFFECT OF HIBISCUS SABDARIFFA AQUEOUS EXTRACT (HSAE) ON MONOSODIUM GLUTAMATE (MSG)-ALTERATION IN LEVELS OF ANTIOXIDANTS IN MICE BRAIN. As shown in table 1, the effect of HSAE on the concentration of glutathione (GSH), catalase (CAT) and superoxide dismutase (SOD) in mice exposed to MSG is shown. Decreased brain levels of GSH, SOD and CAT concentration induced by MSG administration were increased by HSAE and fluoxetine in mice, with the HSAE 200mg/kg and flx group alone showing significant increase in the GSH concentration.

EFFECTS OF HSAE ON HISTOLOGICAL ALTERATIONS OF THE DENTATE GYRUS OF MICE BRAINS SUBJECTED TO MSG TREATMENT. Plates 1 show the effect of HSAE treatment and MSG exposure on neuronal cells in mice brain. Control shows a well defined and normal morphology and organization while the MSG group shows some disruption in cell organization and reduced granule cell density with mild signs of degeneration. The HSAE treatment groups show some slight restoration with the HSAE 200 mg/kg group showing a better preservation of the dentate gyrus (DG) compared to the lower doses and compared with MSG group. A similar restorative effect was observed in the fluoxetine group plus a preserved architecture.



CONCLUSION

Increased lipid peroxidation, nitrosative stress, AChE activity, and histological damage in the mice's brains provides evidence that MSG causes oxidative stress and neurotoxicity *Hibiscus sabdariffa* aqueous extract (HSAE), particularly at **200mg/kg** demonstrated its antioxidative and neuroprotective properties. HSAE can minimize MSG-induced neurotoxicity such as by lowering oxidative stress, boosting antioxidant defense, and preventing cholinergic disruption. It may also be used to treat oxidative stress-related neurodegenerative diseases.

FUTURE WORK / REFERENCES

Solomon Umukoro, Gabriel Oluwafemi Oluwole, Henry Egbewunmi Olamijowon, Adrian Itiviere Omogbiya, Anthony Taghgho Eduviere (2015), [Effect of Monosodium Glutamate on Behavioral Phenotypes, Biomarkers of Oxidative Stress in Brain Tissues and Liver Enzymes in Mice](#), *World Journal of Neuroscience*, 5(5)

Bernardes AL, Moraes LFS, Cruz BCDS, da Conceição LL, de Oliveira LL, Sarandy MM, Gonçalves RV, Peluzio MDCG. (2023), *Hibiscus (Hibiscus sabdariffa L.) supplementation increases butyrate synthesis and reduces inflammatory cells, attenuating the formation of aberrant crypt foci in BALB/c mice induced to pre-neoplastic lesions*, *Br J Nutr.*, 129(2):352-363.