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OXIDATIVE STRESS RESPONSES IN *Drosophila melanogaster* FOLLOWING EXPOSURE TO A COMMONLY USED CULINARY SEASONING

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ABSTRACT
Oxidative stress is a primary driver of cellular damage and various chronic pathologies. This study investigates the impact of Lasor seasoning on oxidative stress biomarkers in Drosophila melanogaster. Adult fruit flies (2–3 weeks old) were exposed for seven days to varying concentrations of the seasoning (0.025 g/mL, 0.05 g/mL, and 0.1 g/mL) incorporated into a standard cornmeal-agar diet, with an untreated group serving as a control. Post-exposure analysis focused on key oxidative stress markers (superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), reduced glutathione (GSH), malondialdehyde (MDA), hydrogen peroxide (H_2O_2), and nitric oxide (NO)), were analyzed. The results demonstrated a reduction in SOD and CAT activities, suggesting an impaired antioxidant defense system. The depletion in GSH levels, accompanied by a marked increase in GST activity ($p < 0.05$) in the group administered 0.1 g/mL of the commonly used culinary seasoning, is indicative of oxidative stress. Increased H_2O_2 and NO levels also point to oxidative stress and possible inflammatory responses. Unexpectedly, MDA levels were lower in the treatment groups compared to the control, suggesting potential non-interference with lipid peroxidation pathways. The findings suggest that Lasor seasoning did not induce oxidative stress significantly in Drosophila melanogaster; however, the mild elevations seen in this study may potentially predispose cells to oxidative damage if consumed at higher concentrations and for a longer time duration. Hence, further toxicological studies are recommended to assess the long-term effects of Lasor seasoning in higher organisms and for a longer exposure time, as well as determine its implications for human health.

KEYWORDS: *Lasor seasoning, Drosophila melanogaster, Oxidative stress, Cell damage, Antioxidant enzymes, Food safety*

INTRODUCTION
The global food system is increasingly reliant on ultra-processed foods (UPFs), which are characterized by high concentrations of non-nutritional ingredients, including a plethora of food additives such as flavour enhancers, stabilizers, colorants, and preservatives (Henney *et al*, 2023). Food additives, including seasonings, enhance flavour and preservation but raise health concerns due to the potential induction of oxidative

stress (Witkowski *et al*., 2022). Lasor seasoning, widely used in Nigeria, contains salt, spices, monosodium glutamate (MSG), and preservatives. While these additives are subject to regulatory approval, ensuring food safety and extended shelf-life, mounting evidence from toxicological and epidemiological studies suggests that chronic, low-dose exposure may disrupt physiological homeostasis, particularly by inducing oxidative stress and systemic inflammation (Tola, 2025). Oxidative stress results from an imbalance between reactive oxygen species (ROS) and antioxidants, and is implicated in diseases such as cancer and neurodegeneration (Houldsworth, 2024). A higher consumption of UPFs is associated with an increased risk of adverse health outcomes, particularly concerning cardiometabolic health and mortality (Mambrini *et al*., 2023). This highlights a critical need to rigorously investigate the cellular and molecular mechanisms by which individual; widely consumed food additives exert their sub-lethal or chronic toxicity. Monosodium Glutamate (MSG), the sodium salt of the non-essential amino acid glutamic acid, is one of the world's most widely used food flavour enhancers (E621) (Utume *et al*., 2020). While generally recognized as safe (GRAS) at standard dietary levels by regulatory bodies, its increasing use in UPFs has prompted serious toxicological scrutiny regarding its chronic effects (Klatt, 2025). Recent research, especially in animal models, has revealed that excessive consumption of MSG is associated with systemic disorders and the alteration of signaling pathways, particularly through the induction of oxidative stress and inflammatory responses (Asejeje *et al*., 2023), Lasor seasoning functions similarly to other additive-rich seasonings by enhancing the sensory experience of food (Kilcast and Angus, 2007). Its composition typically includes salt, spices, herbs, flavour enhancers, preservatives, and colorants. Salt, a major ingredient, not only boosts flavour but also serves as a preservative. Common spices like garlic powder, paprika, and pepper lend unique taste and aroma, while MSG is added to heighten flavour and overall appeal (Sharma *et al.,* 2018).

Drosophila melanogaster, due to its genetic homology with humans and ease of handling, serves as a viable model for toxicological studies (Edene and Iriah, 2025). The fruit fly, *D. melanogaster*, has emerged as an invaluable and highly translatable *in-vivo* model for assessing the toxicity of dietary compounds and xenobiotics (Victor-Atoki *et al*., 2025). *Drosophila* shares approximately 75% gene homology with humans, and the basic metabolic, detoxification (e.g., GST and Nrf2 pathways), and signaling pathways are remarkably conserved (Li *et al*., 2025). The fly possesses the fundamental enzymatic defense mechanisms (SOD, CAT, GST, GSH system) that mirror those in mammals. Due to their genetic similarities with humans, discoveries made using Drosophila are often applicable to human health, including conditions such as cancer and neurodegeneration (Casas-Tintó *et al.,* 2024). Advances in genome editing and high-throughput screening further strengthen its role in research (Van Der Velden *et al.,* 2022). The fruit fly continues to be a cornerstone in biological research, with tremendous potential for future discoveries (Morgan and Bridges, 2022).

By using this model, the present study aims to provide a rapid, integrated

physiological assessment of the cellular and sub-organismal effects of a short-term exposure to supranormal dietary levels of Lasor seasoning. Given the rise in synthetic additive usage, evaluating the safety of food additives requires toxicological assessments to reduce health risks (Kumar *et al*., 2021). Using *Drosophila melanogaster* to study additive impact provides key insights into their effects on living systems.

MATERIALS AND METHODS

Chemicals and Reagents

All chemicals and reagents utilized in this study were of analytical grade. Key components included: Monosodium Glutamate (E621, >99% purity, Sigma-Aldrich, St. Louis, MO, USA), Sodium Chloride (>99% purity, Merck, Darmstadt, Germany), Tris-HCl, EDTA, Triton X–100, TCA, DTNB (5,5'-Dithiobis (2-nitrobenzoic acid)), CDNB (1-chloro-2,4-dinitrobenzene), Thiobarbituric Acid (TBA), Pyrogallol, and DNTB.

Fly Strain and Culture Conditions

Wild-type *Drosophila melanogaster* (Harwich strain) were utilized for all experiments. Flies were maintained in standard plastic vials (25 mm × 95 mm) in a climate-controlled incubator at a temperature of 25 ± 2°C with a constant relative humidity of 60 ± 5% and a 12:12 hour light: dark photoperiod (Abolaji *et al*., 2020). The standard control medium was a cornmeal-yeast-agar diet. Flies were consistently cultured for at least three generations on the standard medium before the experimental setup to ensure genetic and physiological uniformity. The mixed-gender pure *D. melanogaster* was initially obtained from the University of Ibadan's Drosophila Laboratory stock. They were transferred to the Biotoxics laboratory at the University of Benin, Benin City, Edo State, where they were cared for and used for the experiment. Study subjects included 2-3-week-old male and female *D. melanogaster*. They were fed with a cornmeal-agar medium diet treated with Lasor seasoning in separate vials. The control subjects were 2-3 weeks old male and female *D. melanogaster* fed with only a cornmeal-agar medium diet.

Preparation of Experimental Diets

Flies were reared on a standard cornmeal-based diet supplemented with 1% w/v brewer's yeast, 2% w/v sucrose, 1% w/v powdered milk, 1% w/v agar, and 0.08% v/w nipagin. Environmental conditions were strictly maintained at 22–24 °C and 60–70% relative humidity under a 12-hour light/dark photoperiod (Abolaji *et al*., 2020).

Experimental design

Flies were collected and separated into three (3) experimental/ treatment groups of varying concentrations and one (1) control group. For each group, there were three replicates (3) containing 50 flies in each vial. The groups are: Group A: Control (distilled water + cornmeal), Group B: 0.025 g/mL Lasor seasoning + cornmeal, Group C: 0.05 g/mL Lasor seasoning + cornmeal, Group D: 0.1 g/mL Lasor seasoning + cornmeal.

The flies were placed inside solidified cornmeal-agar medium jars, where they fed and reproduced. Every 5-7 days, the meal was changed to prevent the accumulation of waste products in the jars and thus prevent microbial growth, and to ensure nutrients don't become depleted, leading to nutritional deficiencies in the flies.

Toxicity Testing

A pilot study (acute toxicity test) was first conducted, where the food seasoning

was administered as treatments into the cornmeal feed of the fruit flies. The concentrations administered in this experiment were 0.1 g/mL, 0.5 g/mL, and 1 g/mL. The purpose of this experiment was to find out how flies would respond to the concentrations and what concentrations of the treatments should be used for the survival and main study. The total number of flies placed per treatment tube was fifty (50).

Oxidative stress responses in Drosophila melanogaster Exposed to Lasor Seasoning

The same groupings were employed for the study of oxidative stress responses in the flies in the main study: Group A: Control (distilled water + cornmeal), Group B: 0.025 g/mL (Lasor seasoning + cornmeal), Group C: 0.05 g/mL (Lasor seasoning + cornmeal), Group D: 0.1 g/mL (Lasor seasoning + cornmeal).

After seven (7) days of exposure, the flies were transferred into empty falcon tubes with appropriate labels corresponding to the experimental group and were immobilized at -4^0 C for 4 minutes. After that, empty Eppendorf tubes were labeled and weighed using a weighing balance, and then the immobilized flies were added to each tube with appropriate labels to calculate the exact weight of flies in each group. After calculating the exact weight of flies, the flies were crushed inside the eppendorf tubes, then phosphate buffer (PO_4) was added in microliters at a proportion of ten (10) times the calculated weight of flies in milligrams in the eppendorf tube. The eppendorf tubes were placed inside a centrifuge and set to run at 4000 rpm for seven (7) minutes. Then the supernatant was collected and utilized for analysis.

Preparation of Whole-Fly Homogenate

For each treatment group, approximately 50 mg of whole flies were pooled and homogenized in 1.0 mL of cold phosphate-buffered saline (PBS) (50 mM PBS, pH 7.4) containing 0.1% Triton X–100 and 1 mM EDTA. Homogenization was performed using a Teflon-coated pestle in a glass homogenizer submerged in an ice bath to minimize protein denaturation and enzyme activity loss. The resulting homogenates were then centrifuged at 12,000×g for 20 minutes at 4°C. The clear supernatant, representing the whole-body cytosolic extract, was carefully collected and used immediately for all subsequent biochemical assays. The total protein concentration in the supernatant was determined using the method of Bradford, with bovine serum albumin (BSA) as the standard, to normalize all enzyme activity and biomarker concentrations.

Superoxide Dismutase (SOD) Activity

SOD activity was measured based on its ability to inhibit the auto-oxidation of pyrogallol, which produces a color change monitored at 420 nm. The reaction mixture contained 50 mM Tris-HCl buffer (pH 8.2), 1 mM EDTA, and the fly homogenate. The reaction was initiated by adding 2.5 mM pyrogallol. One unit of SOD activity was defined as the amount of enzyme required to inhibit the rate of pyrogallol auto-oxidation by 50% in one minute. The activity was expressed as U/mg protein (Marklund and Marklund, 1974).

Catalase (CAT) Activity

Catalase activity was determined by monitoring the decomposition of H_2O_2 at 240 nm over two minutes. The assay mixture included 50 mM PBS (pH 7.0) and the homogenate. The reaction was started by adding 10 mM H_2O_2. The

decrease in absorbance due to H_2O_2 consumption was recorded. CAT activity was calculated using the molar extinction coefficient of H_2O_2 (0.043 mM^{-1} cm^{-1}) and expressed as U/mg protein (Claiborne, 1985).

Reduced Glutathione (GSH) Content

The content of GSH was quantified using the Ellman's reagent (DTNB) assay. GSH reacts with DTNB to form the yellow product 5-thio-2-nitrobenzoic acid (TNB), which is measured at 412 nm. Homogenates were first precipitated with 5% TCA to remove proteins. After centrifugation, the supernatant was mixed with PBS (pH 8.0) and DTNB solution. GSH content was determined against a standard curve of known GSH concentrations and expressed as µmol/mg protein (Ellman, 1959).

Glutathione S-Transferase (GST) Activity

GST activity was measured based on the enzyme's ability to catalyze the conjugation of GSH with the model substrate 1-chloro-2,4-dinitrobenzene (CDNB). Formation of the GS-CDNB conjugate is monitored by an increase in absorbance at 340 nm. The reaction mixture contained 100 mM PBS (pH 6.5), 1 mM GSH, 1 mM CDNB, and the fly homogenate. GST activity was calculated using the molar extinction coefficient of the GS-CDNB conjugate (9.6 mM^{-1} cm^{-1}) and expressed as U/mg protein (Habig *et al*., 1974).

Lipid Peroxidation (Malondialdehyde, MDA)

The level of Malondialdehyde (MDA), a principal end product of lipid peroxidation, was determined by the thiobarbituric acid reactive substances (TBARS) assay. The MDA in the homogenate reacts with TBA at high temperature (95°C) under acidic conditions to form a pink chromogen (MDA-TBA adduct), which is measured spectrophotometrically at 532 nm. The concentration was calculated using a standard curve of tetraethoxypropane (TEP) and expressed as nmol/mg protein (Ohkawa *et al*., 1979).

Hydrogen Peroxide (H_2O_2) Content

The cellular H_2O_2 content was measured using a modified version of the xylenol orange method. The principle relies on the oxidation of Fe^{2+} to Fe^{3+} by H_2O_2 in the presence of sorbitol, followed by the complexation of Fe^{3+} with xylenol orange to produce a purple-colored complex, which is detected at 560 nm. Concentrations were determined against a standard curve of known H_2O_2 solutions and expressed as nmol/mg protein (Gay *et al*., 1999).

Nitric Oxide (NO) Content

The content of NO was indirectly estimated by measuring the total accumulation of its stable end products, nitrite (NO_2^-) and nitrate (NO_3^-), using the Griess reagent assay. The assay involves the reduction of nitrate to nitrite using nitrate reductase, followed by the reaction of the nitrite with the Griess reagent (sulfanilamide and N-(1-Naphthyl) ethylenediamine dihydrochloride) to produce a colored azo compound, which was measured at 550 nm. Total NO was calculated against a standard curve of sodium nitrite and expressed as µmol/mg protein (Green *et al*., 1982).

Data Analysis

All data are presented as the mean ± Standard Error of the Mean (SEM) of three (3) independent biological replicates. Statistical significance was determined using a one-way analysis of variance (ANOVA), followed by Tukey's post-hoc test to identify specific differences between treatment groups.

Differences were considered statistically significant at $p < 0.05$. Data analysis was performed using GraphPad Prism version 9.0.

RESULTS AND DISCUSSION

Oxidative stress refers to a physiological state caused by an imbalance between the production of reactive oxygen species (ROS) and the antioxidant defense systems within an organism (Jomova *et al*., 2023). The consumption of food seasonings has been associated with oxidative stress as one of their potential health effects (Guan *et al.,* 2021). In this study, the effects of varying concentrations of Lasor seasoning (0.025 g/mL, 0.05 g/mL, and 0.1 g/mL) on oxidative stress and detoxification biomarkers were evaluated in *Drosophila melanogaster*. Results indicated that exposure to moderately low concentrations of Lasor seasoning did not induce statistically significant changes in any of the measured parameters. The short-term exposure may be responsible for the statistically insignificant changes ($p > 0.05$), recorded in this study, as shown in Table 1.

Table 1: Oxidative stress assays in *Drosophila melanogaster* exposed to Lasor seasoning concentrations

Parameters	Control	0.025g/mL LSC	0.05g/mL LSC	0.1g/mL LSC	p-Value
SOD (U/g Prot)	3.15 ± 0.13	2.63 ± 0.20	2.85 ± 0.23	2.84 ± 0.10	0.2766
CAT (U/g Prot)	1.62 ± 0.26	1.26 ± 0.08	1.54 ± 0.09	1.37 ± 0.14	0.4385
GPx (U/g Prot)	8.62 ± 0.95	7.44 ± 0.32	8.77 ± 0.35	8.58 ± 0.79	0.4986
MDA (mol/g Prot)	0.25 ± 0.03	0.23 ± 0.01	0.22 ± 0.02	0.21 ± 0.03	0.6963
GSH (µg/mL)	20.52 ± 4.45	17.97 ± 0.84	15.65 ± 0.93	15.94 ± 0.77	0.4734
GST(µmol/min/g Prot.)	1.51 ± 0.31	1.91 ± 0.16	1.77 ± 0.21	2.35 ± 30	0.2087
H_2O_2 (µg/mL)	17.15 ± 0.44	20.17 ± 1.20	21.77 ± 3.32	22.22 ± 0.74	0.2655
Nitric oxide (µg/mL)	29.73 ± 1.93	35.76 ± 2.00	35.14 ± 1.81	35.53 ± 4.28	0.3910

Values are given as Mean ± SEM where, n=3. Statistical significance set at $p< 0.05$

Graphically, there were visible changes in these parameters, indicating minor perturbations in redox status, but these changes were not statistically significant. Superoxide dismutase (SOD) is a key enzyme in antioxidant defense, responsible for converting superoxide anions (O_2^-) into hydrogen peroxide (H_2O_2) and molecular oxygen (O_2). Results from this study showed a decline in SOD activity across all treatment groups (Figure 1), though this decrease was not statistically significant ($p = 0.2766$), indicating a potential suppressive effect of Lasor seasoning on this enzyme's activity. A reduction in SOD function implies a build-up of superoxide radicals, which can intensify oxidative stress and promote cellular injury through mechanisms such as lipid peroxidation and protein oxidation (Islam *et al*., 2022). This diminished activity may be due to the interaction between bioactive constituents of Lasor seasoning and the metal cofactors essential for SOD function (e.g., Cu^{2+}, Zn^{2+}, Mn^{2+}), potentially resulting in conformational changes or enzyme deactivation (Wang *et al*., 2018).

Additionally, elevated ROS levels have been shown to trigger feedback inhibition of SOD expression in certain biological systems, a phenomenon well-documented in toxicological research involving dietary additives and synthetic chemicals (Jomova *et al.,* 2023).

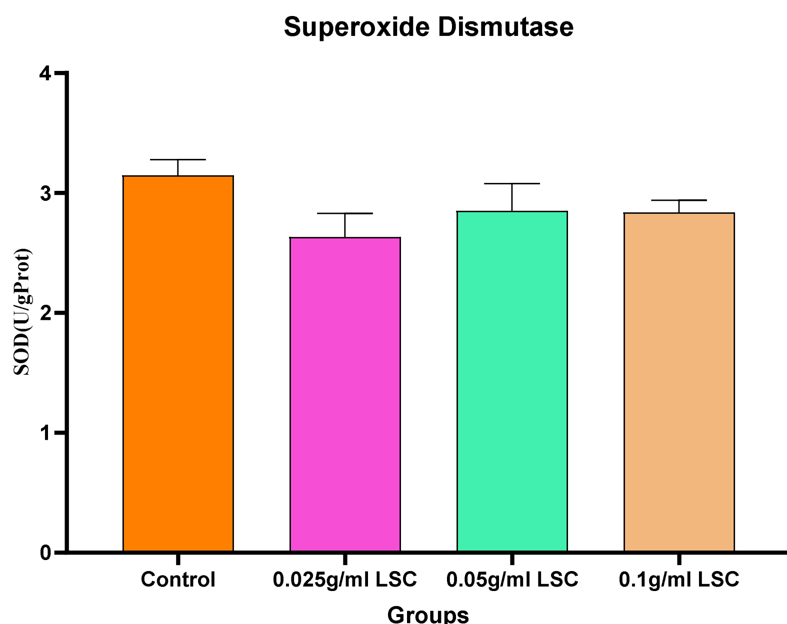

Fig. 1: Superoxide dismutase (SOD) activity in *D. melanogaster* exposed to Lasor seasoning Values are given as Mean ± SEM where, n=3. Statistical significance set at $p < 0.05$

Catalase (CAT) plays a vital role in breaking down hydrogen peroxide into water and oxygen, thereby preventing its accumulation and the subsequent formation of hydroxyl radicals (-OH), which are extremely reactive and damaging to cells (Anwar *et al*., 2024). The findings from this study indicated a decline in catalase activity following exposure to Lasor seasoning, with the greatest reduction noted in the 0.025 g/mL treatment group (Figure 2). Nonetheless, these changes were not statistically significant ($p = 0.4385$), hence we can say CAT activity remained statistically stable ($p = 0.4385$). In toxicology, significant decreases in these enzymes are typically observed under acute, high-level stress that overwhelms the system (Zhao *et al*., 2022). The stability observed here is comparable to recent studies evaluating the safety of food ingredients at realistic consumption levels, where the organism's homeostatic mechanisms effectively buffer the mild introduction of exogenous compounds (Batool *et al*., 2023).

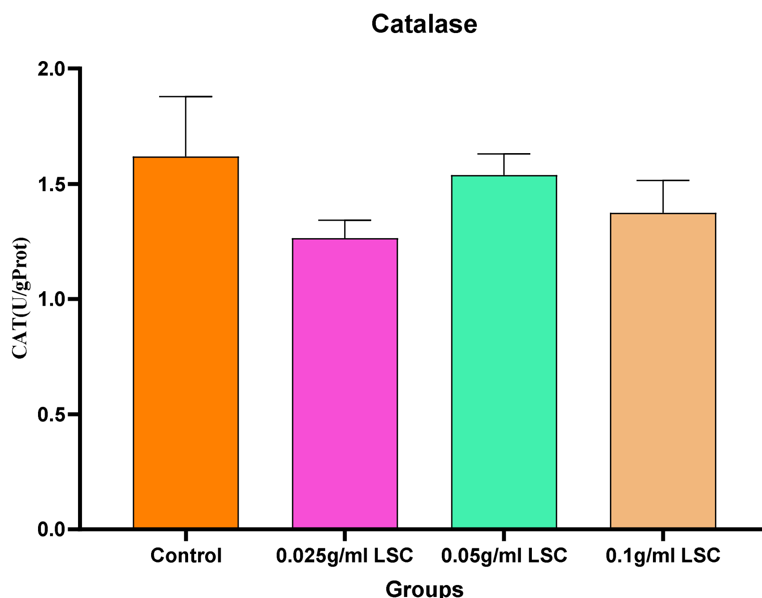

Fig. 2: Catalase activity in *D. melanogaster* exposed to Lasor seasoning
Values are given as Mean ± SEM where, n=3. Statistical significance set at $p < 0.05$

Glutathione peroxidase (GPx) functions by reducing hydrogen peroxide and organic hydroperoxides through the use of glutathione (GSH) as a reducing agent (Pei *et al*., 2023). In this study, GPx activity remained relatively unchanged across all tested concentrations, though a slight reduction was observed in the 0.025 g/mL group (Figure 3). The sustained GPx activity may reflect an adaptive response to the diminishing functions of SOD and CAT, helping to stabilize redox status even in the face of elevated reactive oxygen species levels.

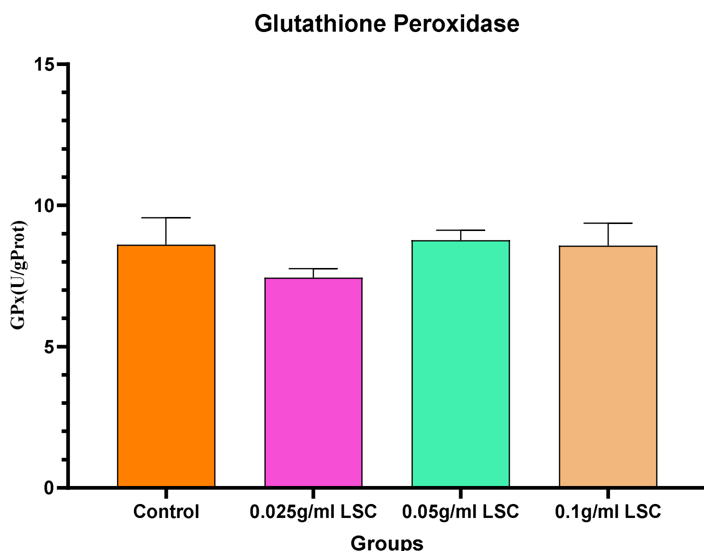

Fig. 3: Glutathione peroxidase activity in *D. melanogaster* exposed to Lasor seasoning
Values are given as Mean ± SEM where, n=3. Statistical significance set at $p < 0.05$

Similarly, the depletion seen in the concentration of reduced glutathione (GSH) levels may account for the resilience of the antioxidant defense system, especially in the 0.05 g/mL and 0.1 g/mL treatment groups (Figure 5). GSH functions as a key non-enzymatic antioxidant that directly scavenges reactive oxygen species (ROS) and also serves as an essential cofactor for glutathione peroxidase (GPx) activity (Irato and Santovito, 2021; Liu *et al*., 2023). The depletion of the enzymes in the first line of defense against generated free radicals and further radical production may have been taken care of by GSH, accounting for the depletion in this enzyme, as shown in Figure 4.5. The non-significant decrease in GSH (20.52±4.45 µg/mL in control vs. 15.65±0.93 µg/mL at 0.05 g/mL LSC) suggests that GSH is being marginally utilized to conjugate and neutralize compounds present in the seasoning. Also, the depletion in GSH may be the result of it being used up by the glutathione-S-transferase (GST) enzyme, with a significant peak in the groups administered 0.1 g/mL of Lasor seasoning (Figure 4). Elevated levels of GST are indicative of oxidative stress, as observed in the study of Temiz *et al*. (2021) on exposure of *Oreochromis niloticus* to thiamethoxam.

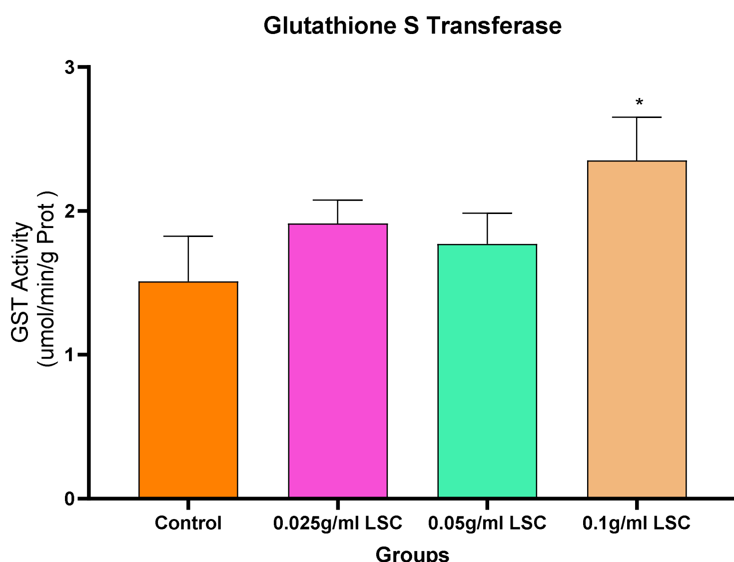

Fig. 4: Glutathione-S-Transferase activity in *D. melanogaster* exposed to Lasor seasoning
Values are given as Mean ± SEM, where n=3. Statistical significance set at $p < 0.05$

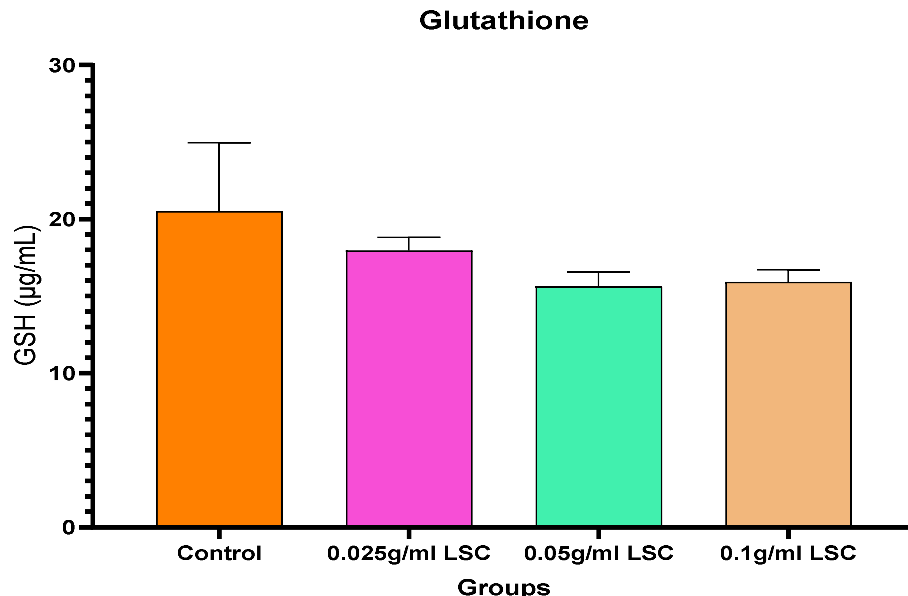

Fig. 5: Glutathione concentration in *D. melanogaster* exposed to Lasor seasoning
Values are given as Mean ± SEM, where n=3. Statistical significance set at p< 0.05

Malondialdehyde (MDA), a well-established indicator of lipid peroxidation, is produced during the oxidative breakdown of polyunsaturated fatty acids (Mas-Bargues *et al*., 2021). In this study, there was a dose-dependent decrease in MDA levels, though the decrease was insignificant when treatments were compared with the control group ($p > 0.05$; P-value = 0.6963). This unexpected reduction in MDA levels may result from a variety of factors. One plausible explanation is that certain constituents of Lasor seasoning might disrupt the lipid peroxidation pathway by altering the structural integrity of cellular membranes, owing to the mild antioxidant components it contains, which can provide slight protection against basal lipid oxidation (Valgimigli, 2023). Another possibility is that an adaptive physiological response resulting from the depletion of GSH (which plays a detoxification role), may have truncated the generation of MDA as seen in Figure 6, The role of GSH includes, serving as a conjugate to the free radicals that would have led to the peroxidation of the lipid components of the cellular membrane, as well as the needed molecule for the activity of the glutathione-S-transferase (GST) enzyme that was elevated (Figure 4). This suggests that lipid peroxidation may not be a mechanism of toxicity for this compound.

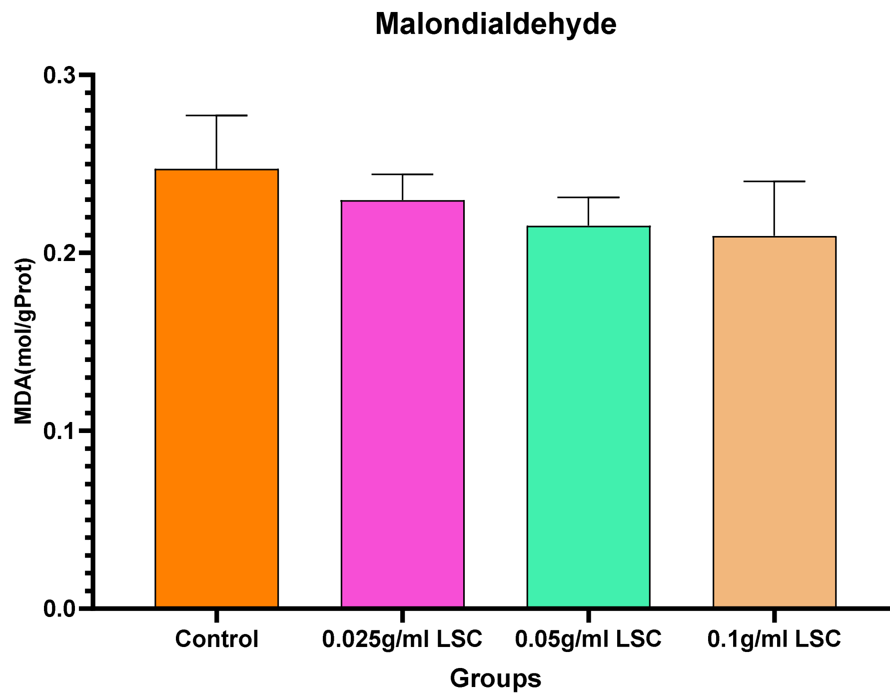

Fig. 6: Malondialdehyde concentration in *D. melanogaster* exposed to Lasor seasoning
Values are given as Mean ± SEM, where n=3. Statistical significance set at $p< 0.05$

Hydrogen peroxide functions not only as a signaling molecule but also as a precursor to highly reactive hydroxyl radicals. The recorded elevation in H_2O_2 concentrations across all treatment groups (Figure 7) indicates a buildup of reactive oxygen species (ROS), although the concentrations observed were insignificant ($p > 0.05$) when compared with the control group. This accumulation, if sustained under a longer exposure duration, has the potential to intensify oxidative stress, potentially initiating pro-apoptotic signaling pathways and promoting inflammatory reactions.

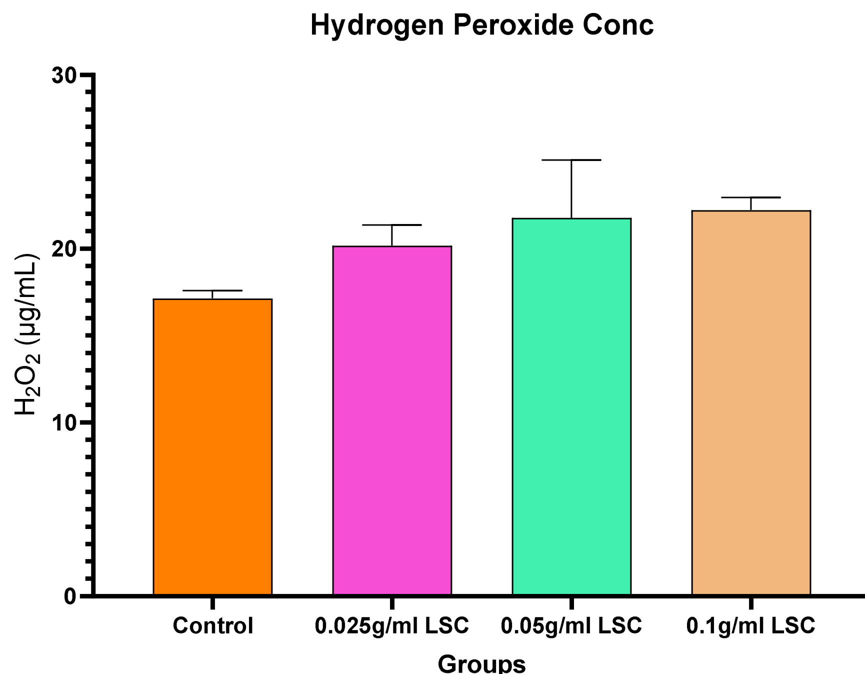

Fig. 7: Hydrogen peroxide concentration in *D. melanogaster* exposed to Lasor seasoning
Values are given as Mean ± SEM where, n=3. Statistical significance set at $p < 0.05$

Nitric oxide (NO is an important signaling molecule that, at high concentrations, acts as a pro-oxidant, reacting with superoxide to form the potent radical peroxynitrite ($ONOO^-$), a powerful oxidizing agent known to damage proteins, lipids, and DNA through nitration. As a free radical, nitric oxide plays a complex role in cellular systems, serving as a signaling agent at normal physiological levels while contributing to oxidative injury when produced in excess (Pérez de la Lastra, 2022). The elevated NO concentrations observed in this study (Figure 8) point toward a possible inflammation-mediated toxicity if exposure is prolonged. Although the increase seen in our short-term study of exposure to Lasor seasoning is insignificant ($p > 0.05$), the elevations observed may carry far-reaching toxicological implications on long-term exposures.

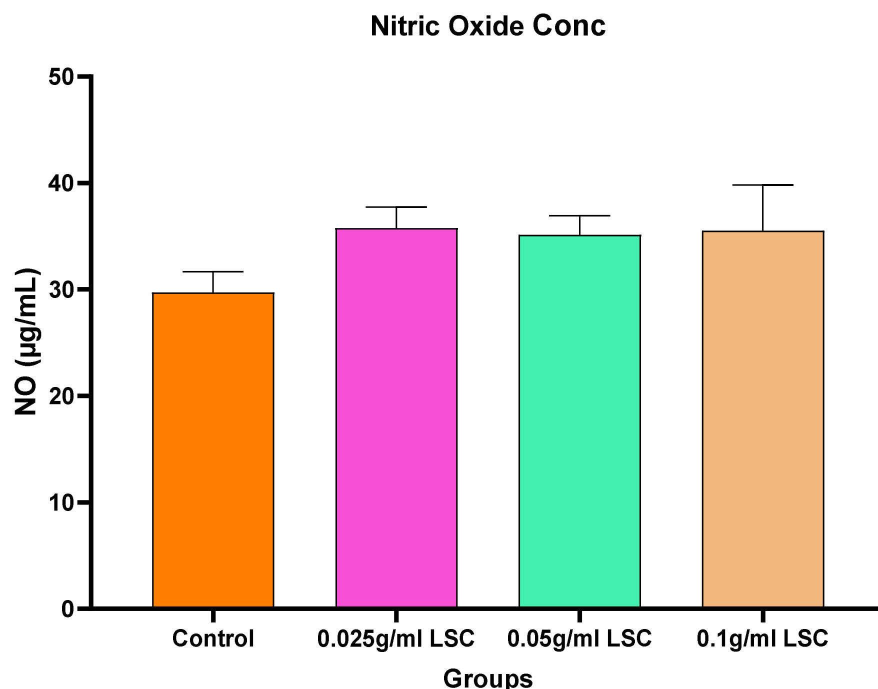

Fig. 8: Nitric oxide concentration in *D. melanogaster* exposed to Lasor seasoning
Values are given as Mean ± SEM where, n=3. Statistical significance set at $p < 0.05$

The overall results of this research demonstrate that varying concentrations of Lasor seasoning may disrupt the oxidative mechanisms in *Drosophila melanogaster*. The noted changes in both enzymatic and non-enzymatic antioxidant biomarkers imply an elevated oxidative load, which could undermine cellular stability and proper physiological functioning. The decline in GSH levels, along with decreased activities of SOD and CAT, points to a diminished capacity to detoxify reactive oxygen species (ROS), thereby increasing the likelihood of oxidative injury to cells.

CONCLUSION

From a toxicological standpoint, the results obtained from our study may not be significantly dangerous, but our concern is drawn to its effect at higher concentrations and longer exposure times. Sustained oxidative stress is known to be associated with numerous health disorders, including cancer development, cardiovascular disease, and neurodegenerative conditions. Should comparable responses be observed in higher organisms, extended dietary intake of Lasor seasoning may lead to widespread oxidative harm, emphasizing the need for further studies using mammalian experimental models and genetic studies.

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