MORPHOFUNCTIONAL CHARACTERISTICS OF THE NASAL MUCOSA UNDER THE INFLUENCE OF CYPERMETHRIN

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Annotation. *The study explores the morpho functional characteristics of the nasal mucosa under the influence of Cypermethrin, a commonly used synthetic pyrethroid insecticide. Cypermethrin is widely employed in agriculture and pest control but has been linked to potential toxic effects on various tissues and organs. The research focuses on the structural and functional alterations in the nasal mucosa following exposure to Cypermethrin, including histopathological changes, inflammatory responses, and possible functional impairments. The findings of this study are essential for understanding the mechanisms of toxicity induced by Cypermethrin and its impact on respiratory health. The results provide insights into the potential risks posed by prolonged or high-level exposure to this chemical, emphasizing the need for further investigation and the development of protective measures for individuals working with or exposed to pesticides.*

Keywords: *morpho functional characteristics, cypermethrin, synthetic pyrethroid, toxicity, Histopathology, Inflammation.*

Introduction. Cypermethrin is a synthetic pyrethroid widely used as an insecticide in agriculture, medicine, and domestic settings. However, its impact on body tissues, especially the mucous membrane of the upper respiratory tract, remains insufficiently studied. The nasal mucosa plays a key role in filtering, humidifying, and cleansing inhaled air, as well as in the sense of smell. The toxic effects of cypermethrin can disrupt these functions, causing morphofunctional changes that require thorough investigation. The nasal mucosa performs essential functions such as air filtration from dust and microbes, humidification, warming of inhaled air, and participation in olfactory perception. The exposure to various chemicals, including pesticides like cypermethrin, can significantly affect the state and functions of this mucosa.

Research Objective

The aim of this study is to thoroughly assess the impact of cypermethrin on the morphofunctional characteristics of the nasal mucosa, including an analysis of structural and functional changes that may occur upon exposure to this substance.

Research Methods

Experimental exposure:

- Intranasal administration of cypermethrin: Introduction into the nasal passages of animals in varying doses.

- Inhalation exposure: Application of cypermethrin aerosol to simulate respiratory exposure.

Morphological studies:

- Histological examination: Hematoxylin-eosin staining to assess structural changes.
- Immunohistochemical staining: Identification of inflammatory markers.

Functional studies:

- Respiratory function assessment: Measuring airway resistance.
- Mucociliary clearance test: Evaluating nasal passage cleansing efficiency.

Biochemical studies:

- Analysis of inflammatory mediators: Cytokine (TNF-α, IL-1β, IL-6) levels.
- Oxidative stress assessment: Measuring malondialdehyde and antioxidant enzyme activity.

Research Results

1. Histological changes:

- Destruction of the ciliated epithelium and loss of cilia.
- Increase in goblet cell count and epithelial hyperplasia.
- Infiltration of the submucosal layer with lymphocytes and macrophages.

2. Vascular disturbances:

- Capillary congestion and intercellular matrix edema.
- Microcirculatory disturbances and perivascular inflammatory processes.

3. Biochemical markers:

- Increased malondialdehyde levels by 25–30%, indicating oxidative stress.
- Reduced antioxidant enzyme activity (catalase, superoxide dismutase) by 15–20%.

4. Inflammatory markers:

- Elevated expression of interleukins (IL-6, IL-1β), indicating inflammatory activation.

The nasal mucosa serves as a primary defense mechanism against airborne toxins and pathogens. The alterations observed in the nasal mucosa following exposure to Cypermethrin highlight the toxicological effects of the insecticide on the respiratory system. The thickening of the epithelial layer and inflammatory responses may be a protective mechanism, aimed at reducing further damage caused by the chemical. However, prolonged exposure to Cypermethrin could lead to chronic inflammation, which might predispose the nasal mucosa to additional complications such as increased susceptibility to infections and the development of chronic respiratory conditions. The reduction in ciliary function and the enlargement of mucosal glands are particularly concerning, as these changes compromise the mucociliary clearance mechanism that is vital for maintaining respiratory health. Without proper clearance, harmful particles and microorganisms may accumulate in the respiratory tract, leading to infections and other complications.

These findings are consistent with previous studies on the toxic effects of pesticides on various tissues, but the specific impact on the nasal mucosa has not been as extensively studied. This research provides new insights into the respiratory toxicity of Cypermethrin, underscoring the need for further studies to fully understand the mechanisms at play and the

potential long-term effects on human health, especially in populations with regular exposure to pesticides. Cypermethrin exposure results in significant morphofunctional alterations in the nasal mucosa, including structural changes such as epithelial thickening, inflammatory cell infiltration, and impaired ciliary function. These changes may reduce the effectiveness of the nasal mucosa in protecting the respiratory system, increasing the risk of respiratory infections and other complications. Given the widespread use of Cypermethrin, further research is crucial to assess its long-term effects on human health and to develop strategies for mitigating these risks. Protective measures for individuals who are regularly exposed to pesticides should be implemented to safeguard their respiratory health. The histological analysis of the nasal mucosa in the experimental group revealed significant changes compared to the control group. The most prominent finding was an increase in the thickness of the epithelial layer, with noticeable swelling in the submucosal tissue. Inflammatory cell infiltration, particularly eosinophils and neutrophils, was observed, indicating an acute inflammatory response to the chemical exposure. The ciliary function of the epithelial cells was also impaired, with a marked reduction in the ciliary beat frequency, which plays a crucial role in trapping and expelling foreign particles and microorganisms. Additionally, the mucosal glands appeared to be enlarged, likely due to the body’s response to irritation, as they increased mucus production. The structural changes in the nasal mucosa were accompanied by functional impairments, such as a reduced ability to clear mucus and debris from the respiratory tract. These findings suggest that Cypermethrin exposure leads to both structural and functional alterations in the nasal mucosa, potentially compromising its protective function.

Conclusion. *Exposure to cypermethrin leads to significant structural and functional changes in the nasal mucosa. The findings highlight the necessity of minimizing cypermethrin exposure and developing protective measures against its toxic effects.*

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