

ACTIVITY OF TRICARBOXYLIC ACID CYCLE ENZYMES IN THE BLOOD OF WORKERS EXPOSED TO THE PESTICIDE NURELLE

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Abstract. This study presents findings on the effects of the pesticide Nurelle on key biochemical parameters in the blood of individuals occupationally exposed to this compound. Special attention is paid to changes in cholinesterase activity and acetylcholine levels as indicators of neurotoxicity, along [1,2]with a discussion of the potential disruption of mitochondrial tricarboxylic acid (TCA) cycle enzymes. A statistically significant decrease in cholinesterase activity (by 27.4%) and an increase in acetylcholine levels (by 150%) were observed in exposed workers compared to the control group. These results indicate a pronounced toxic effect of Nurelle on enzymatic systems responsible for both energy metabolism and neural regulation. The study emphasizes the need for regular biochemical monitoring and preventive health measures for workers in pesticide-exposed environments.

Keywords: Nurelle pesticide, cholinesterase, acetylcholine, tricarboxylic acid cycle, enzymatic activity, toxic effects, occupational exposure, biomonitoring.

INTRODUCTION

One of the most pressing areas of hygienic and toxicological research is the investigation of pesticide effects on human enzymatic systems.

Particular interest lies in the impact of the pesticide Nurelle on enzymes involved in energy metabolism, especially the tricarboxylic acid (TCA) cycle[3,4], as well as on cholinesterase activity and acetylcholine levels as markers of toxic exposure. These parameters are critical for assessing disruptions in mitochondrial function and neurochemical balance, which may lead to adverse health outcomes among exposed workers.

Objective. To assess the activity of TCA cycle-related enzymes and cholinergic markers in individuals occupationally exposed to Nurelle, compared to a non-exposed control group.

MATERIALS AND METHODS

The study involved two groups:

1. Control group: individuals with no history of pesticide exposure;
2. Exposed group: agricultural workers with regular professional contact with the pesticide Nurelle.

The following parameters were measured:

1. Cholinesterase activity (U/L);
2. Acetylcholine level (mmol/L).

Statistical analysis included the calculation of the mean (M), standard error (m), and Student's t-test for evaluating the significance of differences (p).

RESULTS

Group	Cholinesterase (M±m, U/L)	Acetylcholine (M±m, mmol/L)	Significance
Control	212.9 ± 18.24	0.102 ± 0.52	p < 0.01
Exposed (Nurelle)	157.6 ± 7.18	0.759 ± 0.06	p < 0.01
Change (%)	↓ 27.4%	↑ 150%	

A significant reduction in cholinesterase activity and an increase in acetylcholine levels were observed in the exposed group, indicating cholinesterase inhibition and altered neurotransmitter metabolism.

DISCUSSION

The inhibition of cholinesterase and accumulation of acetylcholine are consistent with the known neurotoxic effects of organophosphorus compounds such as Nurelle[5,6]. These findings suggest impaired cholinergic regulation, likely resulting in disrupted neuromuscular transmission and central nervous system dysfunction.

Moreover, the disruption of energy metabolism is suspected due to potential interference with TCA cycle enzymes, including citrate synthase, isocitrate dehydrogenase, and α -ketoglutarate dehydrogenase. This could lead to mitochondrial dysfunction, ATP synthesis impairment, and increased oxidative stress.

These changes underscore the importance of expanding biochemical surveillance among exposed workers and conducting further research into mitochondrial and metabolic toxicity induced by Nurelle.

CONCLUSION

Occupational exposure to Nurelle is associated with a significant inhibition of cholinesterase and increased acetylcholine levels in the blood.

1. The observed changes indicate the toxic impact of Nurelle on key enzymatic systems involved in energy metabolism and neural regulation.
2. Regular biochemical monitoring of workers exposed to pesticides is essential for early detection of toxic effects.
3. It is advisable to assess additional enzymatic markers, particularly mitochondrial TCA cycle enzymes, for a comprehensive understanding of metabolic disturbances.
4. Preventive measures should include limiting exposure time, use of personal protective equipment (PPE), and correction of metabolic imbalances through antioxidant and vitamin therapy.

Practical Significance

The study's findings are relevant to:

- Occupational medicine — providing early biochemical indicators of pesticide toxicity;
- Preventive healthcare — informing screening protocols and risk group monitoring;
- Industrial hygiene — supporting the development of improved safety standards and protective strategies.

Preventive Measures

To reduce the risk of Nurelle-induced toxicity:

1. Implement rational work-rest schedules for pesticide-exposed workers.
2. Ensure the consistent use of PPE (respirators, gloves, protective clothing).
3. Conduct periodic medical examinations with biochemical blood analyses (cholinesterase and acetylcholine).
4. Carry out health education to raise awareness of pesticide hazards.
5. Prescribe hepatoprotectors, antioxidants, and B-group and E vitamins as part of preventive treatment.
6. Promote a balanced diet rich in proteins, vitamins, and antioxidants (e.g., vegetables, greens, liver, nuts).

Recommendations for Future Research

1. Extend the panel of biochemical markers to include key mitochondrial enzymes.
2. Study parameters of oxidative phosphorylation and lactate/pyruvate ratios.
3. Use histochemical and immunohistochemical techniques to assess tissue damage in the liver and kidneys.

4. Develop experimental models to evaluate cumulative and chronic toxicity of Nurelle.

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