THE EFFECTS OF ACUTE MALATHION EXPOSURE ON THE CEREBELLUM OF FEMALE RATS

By

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LIST OF ABBREVIATIONS

ACh	Acetylcholine
AChE	Acetylcholinesterase
BChE	Butyrylcholinesterase
DNA	Deoxyribonucleic acid
f	Fraction
LARUSM	Laboratory Animal Research Unit of Universiti Sains Malaysia
LD_{50}	Mean lethal dose
NTE	Neuropathy target esterase
OPICN	Organophosphorus ester-induced chronic neurotoxicity
OPIDN	Organophosphate-induced delayed neuropathy
rRNA	Ribosomal ribonucleic acid
SD	Standard deviation
TUNEL	*In situ* terminal deoxynucleotidyl transferase dUTP nick-end labeling

KESAN PENDEDAHAN JANGKA PENDEK MALATION KE ATAS SEREBELUM TIKUS BETINA

ABSTRAK

Malation ialah sejenis racun pembunuh serangga organofosfat. Di Malaysia, ia digunakan untuk mengawal serangga perosak pertanian dan juga denggi. Penggunaan racun serangga semakin meningkat untuk meningkatkan hasil pertanian di Malaysia. Seiring dengan itu, kes-kes keracunan yang disebabkan oleh racun serangga juga meningkat. Malation menghalang asetilkolinesterase secara kekal menyebabkan pelbagai fungsi tubuh terganggu. Walaupun kesan keracunan saraf yang disebabkan oleh organofosfat telah banyak diketahui, namun maklumat tentang kesan malation ke atas serebelum masih tidak mencukupi. Kajian ini dijalankan untuk mengetahui kesan pendedahan jangka pendek malation ke atas sel Purkinje; dan ke atas ketebalan lapisan granular serta lapisan molekular pada serebelum tikus. Sepuluh ekor tikus Wistar telah disuntik 250 mg/kg malation (bersamaan 0.2 malation LD50) menerusi peritoneum setiap hari selama tujuh hari berturut-turut. Kumpulan tikus kawalan pula disuntik 0.9% larutan salina. Berat badan tikus dipantau setiap hari. Dua puluh empat jam selepas dos malation yang ke tujuh, tikus tersebut dikorbankan dan serebelum mereka diambil untuk dianalisa. Sampel daripada setiap serebelum telah diambil secara sistematik dan rawak dengan menggunakan kaedah fraksionator; dan diwarnakan dengan kresil ungu. Seterusnya, nukleolus sel Purkinje dihitung untuk menganggarkan jumlah sel Purkinje dalam setiap serebelum. Ketebalan lapisan granular dan lapisan molekular pula diukur

dengan menggunakan penganalisa imej. Data yang diperolehi telah dianalisa dengan menggunakan Statistical Package for Social Science, versi 12. Tikus yang didedahkan kepada malation menunjukkan pengurangan berat badan yang ketara berbanding dengan tikus dalam kumpulan kawalan ($t = 4.27$, $p < 0.001$). Anggaran jumlah sel Purkinje pada kumpulan tikus yang didedahkan kepada malation didapati tidak berbeza secara ketara berbanding dengan kumpulan kawalan. Ketebalan lapisan granular dan molekular juga tidak berbeza secara ketara di antara ke dua-dua kumpulan tikus tersebut. Kesimpulannya, dos malation yang digunakan di dalam kajian ini tiada kesan yang signifikan terhadap jumlah bilangan sel Purkinje, dan terhadap ketebalan lapisan granular dan lapisan molecular pada serebelum tikus. Kajian selanjutnya ke atas kesan malation pada serebelum akan dijalankan dengan menggunakan dos malation yang lebih tinggi atau tempoh pendedahan yang lebih lama.

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ABSTRACT

Malathion is an organophosphate pesticide which is used for agricultural pest control and dengue control in Malaysia. As pesticides use is on the rise to augment agricultural productivity in Malaysia, there is also evidence of an increasing trend of pesticide poisoning. Malathion irreversibly inhibits acetylcholinesterase resulting in an impairment of numerous body functions. Even though there is sufficient information about the neurotoxicity of organophosphates , there is limited information on the effects of malathion on the cerebellum. This study is conducted to determine the effects of acute malathion exposure on the estimated total number of Purkinje cells; and the thickness of the granular and molecular layers in the cerebellum of rats. Ten adult female Wistar rats were administered 250 mg/kg intraperitoneal malathion (corresponding to 0.2 of malathion's LD_{50}) daily for seven consecutive days. In the control group, ten rats received equivalent volumes of 0.9% sodium chloride instead. Body weight was monitored daily. Twenty-four hours after the seventh dose of malathion, the rats were sacrificed and their cerebellum taken for analyses. Each cerebellum was sampled systematically and randomly by applying the fractionator method and stained with cresyl fast violet. Subsequently, Purkinje cells nucleoli were counted to obtain an estimation of the total number of Purkinje cells in each cerebellum. The thicknesses of the granular and molecular layers were measured using an image analyser. Data obtained were

analysed using the Statistical Package for Social Science, version 12. Rats exposed to malathion showed significant deficits in body weight compared to rats in the control group ($t = 4.27$, $p < 0.001$). There is no statistically significant difference in the estimated total number of Purkinje cells between the malathion-exposed group and the control group. The thickness of the granular and molecular layers was also not significantly different between the two groups. It is concluded that the dose of malathion used in this experiment did not have any significant effect on the total numbers of Purkinje cells and the thickness of the granular and molecular layers in the cerebellum of rats. Further studies on the effects of malathion on the cerebellum will be conducted by applying a higher dose of malathion or a longer duration of malathion exposure.