Original Article



# Role of Paraoxonase-1 Enzyme in Prediction of Severity and Outcome of Acute Organophosphorus Poisoning: A Prospective Study

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# ABSTRACT

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**Background:** Human serum paraoxonase-1 (PON-1) hydrolyzes organophosphate

compounds (OPC) and so significantly alters an individual’s susceptibility to the toxicity of these chemicals. **Aim:** The study was designed to assess the serum PON- 1 activity in patients with OPC poisoning and to correlate its level with the severity and outcome of acutely organophosphate poisoned patients. **Patients and methods:** This was a prospective clinical study that was performed at Benha Poison Treatment and Toxicological Research Unit (BPTTRU), Benha University Hospitals, Egypt, for one year, from 1 August 2020 till 31 July 2021. Patients were divided into case and control groups. Socio-demographic information of patients, clinical findings, treatments given, length of hospital stay and outcome were collected into datasheets. Patients were classified according to degree of toxicity according to Peradeniya Organophosphorus Poisoning (POP) scale. Blood samples were collected from patients to assess pseudocholiesterase and PON-1 activities. **Results:** Reduction of serum pseudocholinesterase and paraoxonase-1 (PON-1) activities in poisoned patients and patients can be graded according to (POP) scale into: mild, moderate and severe cases. **In conclusion:** This study concluded that serum paraoxonase-1 (PON-

1) activity was significantly lower in patients with severe organophosphorus compounds (OPC) poisoning as compared to patients with moderate poisoning. Lower PON-1 activity was significantly associated with lower serum cholinesterase and poorer outcomes. PON-1 activity may be considered as an indicator of prognosis in OPC poisoning.

# Keywords: Pseudocholinesterase; Organophosphorus compounds; POP Scoring; Paraoxonase-1

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# Introduction

Pesticides refer to a wide range of

chemicals that are employed to increase agricultural output. Several pesticides have been shown to have severe negative impacts on human health, including acute toxicity (accidental poisoning deaths, particularly in impoverished nations) and chronic toxicity (even at low concentrations) (Trellu et al., 2021). In the central nervous systems of mammals and insects, organophosphate compounds (OPC) inhibit acetylcholinesterase irreversibly by inhibiting acetylcholine breakdown during nerve impulse transmission. Continuous neuronal excitation causes a variety of hazardous symptoms in mammals and insects, **including slowed heart rate, pinpoint e**ye pupils, and seizures and respiratory failure (RF) which is the leading cause of OPC poisoning morbidity and fatality (Zhai et al., 2021).

The diagnosis is based on the individual's medical history, physical examinations, and toxidromes of acute poisoning. Predicting the severity, prognosis, and complications related to poisoning requires a variety of clinical observations, electrocardiography, and blood or urine sample results. Electrolytes, the complete blood count, and arterial blood gas are virtually always tested (Kim et al., 2022).

Acetylcholine is found to be considerably in almost whole of the autonomic preganglionic fibers which consists of the enite postganglionic fibers along with the peripheral parts of the ANS (Autonomic nervous system. In addition it also comprises of the cholinergic fibers which are the sympathetic post ganglionic nerve fibres (Kaur et al., 2019).

The paraoxonases family consists of three enzymes: Paraoxonase-1 (PON-1), paraoxonase-2 (PON-2) and paraoxonase-3 (PON-3), all having antioxidant and hydrolase

activities. Despite the fact that PON enzymes are found throughout the human body, they are mostly generated in the liver. They are found in a variety of tissues and are mostly linked to cell membranes and certain lipoproteins, while a free enzyme has been discovered in the blood (Reichert et al., 2021).

Analyzing PON-1 activity in those who have ingested OPC would be helpful in: (I) evaluating the severity of poisoning, (II) estimating the capability of the patient to detoxify OPC, and (III) recognizing PON-1's prognostic significance due to interindividual differences in PON-1 activity (Samy et al., 2019).

# Aim of work:

The aim of this work is to evaluate serum

paraoxonase-1 (PON-1) activity in patients with organophosphorus poisoning and to correlate serum PON-1 with the severity and outcome of acutely organophosphate poisoned patients admitted to the Benha Poison Treatment & Toxicological Research Unit (BPTTRU).

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# يبرعلا صخلملا

**داحلا ممستلا ةجيتنو ةدشب ؤبنتلا يف 1-زينوسكوأارابلا ميزنا رود ةيلبقتسم ةسارد :ةيوضعلا ةيروفسفلا تابكرملاب**

**دبع دمحم يدياهو 4لودأ وراكناش تنشاربو 3نيدلا فرش باهولا دبع ريبعو 2يعفاشلا نابعش بابرو 1يسمارتلا ركبوبأ رون**

**5رخف نمحرلا**

اهنب ةعماج -بطلا ةيلك -ةيكينيلكلإا مومسلاو ىعرشلا بطلا ديعم 1

اهنب ةعماج -بطلا ةيلك - ةيكينيلكلإا مومسلاو ىعرشلا بطلا دعاسم ذاتسأ 2

اهنب ةعماج -بطلا ةيلك - مومسلاو يعرشلا بطلا ذاتسأ 3

دنهلا ،يريشيدنوب ،جرختلا دعب يبطلا ثحبلاو ميلعتلل للارهاوج دهعم -ةيويحلا ءايميكلا دعاسم ذاتسأ 4

اهنب ةعماج -بطلا ةيلك -ةيكينيلكلإا مومسلاو يعرشلا بطلا سردم 5

.ةيئايميكلا داوملا هذه ةيمسل درفلا ةيلباق ريبك لكشب ريغي يلاتلابو ةيوضعلا ةيروفسفلا تابكرملا للحي 1-زينيسكوا ارابلا ميزنا **:ةيفلخلا** ةيوضعلا ةيروفسفلا تابكرملا ممست نم نوناعي نيذلا ىضرملا نم ةلسلس يف 1-زينيسكوا ارابلا ميزنا طاشن مييقتل ةساردلا ميمصت مت ةيلبقتسم ةيريرس ةسارد هذه تناك **:قرطلاو ىضرملا** .يوضعلا تافسوفلاب داحلا ممستلاب نيباصملا ىضرملا جئاتنو ةدش عم هاوتسم طبرو 31 ىتح 2222 سطسغأ 1 نم ، دحاو ماع ةدمل ، رصمب اهنب ةعماج تايفشتسم يف ممستلا ثاحبأو مومسلا جلاع ةدحو يف اهؤارجإ مت ةيريرسلا جئاتنلاو ، ىضرملل ةيجولويمدبلاا تانايبلا عمج مت .ةطباضلا ةعومجملا و تلااحلا ةعومجم ىلإ ىضرملا ميسقت مت .2221 ويلوي بسح ةيمسلا ةجرد بسح ىضرملا فينصت مت .تانايبلا قاروأ يف جئاتنلاو ىفشتسملا يف ةماقلإا ةدمو ، ةمدقملا تاجلاعلا ططخو ،

**:جئاتنلا** .1-زينيسكوا ارابلا زيرتسنيلوكلا يميزنإ ةطشنأ مييقتل ىضرملا نم مدلا تانيع عمج مت .)اينيداريب( يوضعلا روفسفلا ممست سايقم ممست سايقمل اًقفو ىضرملا فينصت نكميو ممستلاب نيباصملا ىضرملا يف 1-زينيسكوا ارابلا زيرتسنيلوكلا يميزنإ ةطشنأ ضافخنا

-زينيسكوا ارابلا مادختسا نكمي هنأ ىلإ ةساردلا هذه تصلخ **:جاتنتسلاا** .ةديدشو ةطسوتمو ةفيفخ تلااح :ىلإ )اينيداريب( يوضعلا روفسفلا

.ةيوضعلا ةيروفسفلا تابكرملاب داحلا ممستلاب نيباصملا ىضرملا جئاتنب ؤبنتلاو صيخشتلل 1

# تايصوتلا

:يلي امب ةيصوتلا نكمي ،ةيلاحلا ةساردلا جئاتن نم

تابكرمب داحلا ممستلا نم نوناعي نيذلا ىضرملا نم اهيلع لوصحلا مت يتلا ةيفارغوميدلا تانايبلل لماكلا قيثوتلا نم دكأتلا بجي .1 ةيئاقو ةطخ ريوطتب حمست يتلاو ىرخأ ىلإ ةنس نم ةلكشملا روطتو ، طمنو ،ثودح يف تاريغتلا ةبقارمب حامسلل يوضعلا روفسفلا

.ةلكشملا هذه لحل ةلاعف ةدحو نم رصنعك " مومسلا تامولعم زكرم" ءاشنإ نإف اذل ،ةجيتنلاو ممستلا ةدش نم لك ىلع رثؤي ضرعلا يف ريخأتلا نأ ةقيقح .2 تامولعملا ميدقت ةمدخ اضياو ةعاسلا رادم ىلع هميدقتل فورعم بيو عقومو سكافو فتاه مقرب ممستلا ثاحباو مومسلا جلاع

.ةفلتخملا ممستلا عاونأ جلاع لوح ءابطلأل ةعيرسلا حئاصنلاو

:للاخ نم تابكرملا هذهل يراحتنلااو يضرعلا ضرعتلا نم دحلا نكمي .3 رثكأ تابيكرت ريفوتو ؛ةيعارزلا تايواميكلا هذه نيزختو عيزوتو عيب نأشب ةمراص تاعيرشت ؛كلذ يف امب ىدملا ةريصق ةطخ 

.قاوسلأا نم ةيمسلا ةديدش تافلآا تاديبم بحسو اًنامأ

لحم لحتل اهريوطتو اهعيسوت يغبني يتلاو تافلآا ةحفاكمل ةيئايميك ريغ ةليدب قرطل جيورتلا ؛كلذ يف امب ىدملا ةليوط ةطخ 

.يوضعلا روفسفلا تابكرم نم ةيمسلا ةديدش تافلآا تاديبم مادختسا

ءاقبإ كلذكو تاميلعتلا مادختساو رطاخملا نع تامولعم ىلع يوتحت يتلاو ةفوصوملا ةيلصلأا تاوبعلا يف تابكرملا هذه نيزخت 

.لافطلأا لوانتم نع ةديعب ةيلزنملا تاديبملا نيمدختسملل اهؤارجإ متي يتلا ةيميلعتلا جماربلا للاخ نم اهقيقحت نكمي يتلاو عمتجملا ىوتسم ىلع ةمزلالا ةيئاقولا ريبادتلا لك  دنع ةيلولأا تافاعسلإا حرش ةيمسلا ضارعأو ، اهل ضرعتلا بنجت ةيفيكو ،تابكرملا هذه ةيمسب يعو قلخل ماعلا روهمجلاو

.اهل ضرعتلا

سايقلا ةمظنأ نم ماظن وهو )اينيداريب( يوضعلا روفسفلا ممست سايقم كلذ يف امب ةيكينيلكلاا تارشؤملا مادختساب ةدشب ىصوي .4 يف ةصاخ تامولعملاب اندمي هنا ثيح ةيوضعلا ةيروفسفلا تابكرمـلاب داحلا ممستلا جئاتنو ضارعأب طبترت يتلا ةعيرسلاو ةطيسبلا كلذو ازيكرت رثكأ ةقدب مهتعباتمب حمسي امم ةديدشلا ةيمسلا يوذ ىضرملا ديدحت نم تاضرمملاو ءابطلأا نيكمتو ئراوطلا مسق

.كلذ دعب ثدحت ىتلا تافعاضملا ىدافتل

.جئاتنلاب ؤبنتلل ةملاعو ةدشلا مييقتو صيخشتلل ةادأك 1-زينوسكوأارابلا ميزنلإ ةركبملا تاسايقلا مادختسا نكمي .5 ةساردلا جئاتن ديكأتل ريبك ةنيع مجح يف 1-زينوسكوأارابلا ميزنلإ ةيلسلستلا تاسايقلا كلذ يف امب تاساردلا نم ديزم ءارجإب ىصوي .6

.ممستلا ةدش مييقتلو صيخشتلا ديكأتل ةينيتورلا تاصوحفلا نم اءً زج 1-زينوسكوأارابلا ميزنإ سايق نوكي نأ بجي .ةيلاحلا