

Prevalence of Agro-chemical Poisoning; with special reference to Organophosphates and Carbamate Insecticide Poisoning among Hospital Admissions of Nuwaraeliya District General Hospital, Sri Lanka from 2014 to 2018

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Abstract- In year 2016, there were 12,629 pesticide poisoning cases and 348 (2.75% of admissions) deaths were reported in government hospitals in Sri Lanka. Institution based descriptive study was carried out in District General Hospital, Nuwaraeliya, Sri Lanka to identify the prevalence (2018) and trends (2014-2018) of organophosphates and carbamate poisoning among hospital admissions. The study revealed that mean age of patients poisoning with organophosphate and carbamate was 31.36 (SD = 15.20) and highest number of the poisoning patients were identified in the 17- 49 years group. Proportion of male intoxication with organophosphate and carbamate was very highly significance than females ($p = 0.000$). There were 210 (93%) live discharges from the hospital, 6 (2.6%) transferred out for further treatments and 10 (4.4%) deaths. These deaths accounted for 1.4% of total hospital deaths ($n = 677$) in 2018. The average number of days of hospital admission was 3.2 per person. Trend of females admitted following intoxication of organophosphate and carbamate was reduced from 2014 to 2018 whereas trend of male was slightly increased. Not much fluctuation observed in the trends of variation with respect to gender and deaths. Collaboration among field health service and agriculture extension service is urgently required to prevent or control this situation in the country.

Index Terms- Agrochemical Poisoning, Organophosphates, Carbamate, Insecticide, Hospital Admissions, Nuwaraeliya, Sri Lanka

I. INTRODUCTION

With the advancement of intensive agriculture, use of agro-chemicals was remarkably increased worldwide. From those, more than 75 active ingredients are used as pesticides. With that, [exposure](#) to pesticides can occur and it can be through [inhalation](#), [ingestion](#), and dermal contact ⁽¹⁾. According to UN data, an average of about 200,000 people dies from the toxic exposure of pesticides per year across the world ⁽²⁾. The world health organization declared that pesticides-related intoxications in developing countries, have the highest percentages of acute

human intoxications either intentional suicidal or occupational exposures, as well as chronic intoxications ⁽³⁾. Occupational exposure can be occurred when preparing for use, storing, application and handling equipments such as sprayers.

In year 2016, there were 12,629 pesticide poisoning cases and 348 (2.75% of admissions) deaths were reported in government hospitals in Sri Lanka ⁽⁴⁾. On the other hand, it represents 0.2% of total hospital admissions and 0.72% of total deaths.

Pesticides are commonly used to commit [suicide](#) globally and locally, since they are inexpensive, widely available, and effective. It is estimated that two-thirds of all pesticide-related deaths worldwide are the result of suicide ⁽¹⁾. In Sri Lanka, organophosphates and carbamates are used as pesticides in agriculture and those have been identified as popular compounds to be ingested by community for suicides.

Organophosphates are chemical substances acted as cholinesterase inhibitors which affect on neuromuscular transmission of animal. Those are available in the forms of liquid, aerosols and or dusts and widely used in global agricultural sector as pesticides. In human, it can be absorbed through digestive system, mucous membranes and even through skin ⁽⁵⁾. Carbamates are mechanically and structurally similar to organophosphates and widely used as an insecticide. Exposure to carbamate is also similar to the organophosphate.

“Over the counter” availability of organophosphate and carbamate become a common modality of poisoning among the agricultural community ⁽⁶⁾.

Although agricultural extension workers are well educated to enable farmers to improve their crops using pesticide, they are unable to provide adequate knowledge on protective techniques, safe use and health hazard ⁽⁷⁾. The act no 33 of 1980 and amendment act no 6 of 1994 regulate the process of licensing, importing, packaging, labeling, storing, formulating, transporting, sale and use of pesticides in Sri Lanka.

Although it is well recognized that acute pesticide poisoning is a major public health problem in developing countries, surveillance of this condition in developing countries is scarce. The data available are not adequate to address the nature of the

problem and are usually limited to ad hoc studies that are neither compatible nor comparable with each other, making estimates and evaluations difficult to undertake ⁽⁸⁾.

An island wide study conducted in 1988, revealed that hospital admissions due to agro-chemical poisoning, stood at around 11 000 – 15 000 each year and the number of deaths during the same period varied from 900 to 1500 each year. About 75% of poisoning were due to self ingestion while accidental and occupational poisoning formed the balance. ⁽⁹⁾ In 2016, total number of hospital admissions due to toxic effects of pesticide was 12,629 (59.8% - male, 40.2% -female). The majority (70.5%) was in 17-49 years age group. There were 348 total deaths ⁽⁴⁾.

Principal agricultural districts like Kurunegala, Jaffna, Vavuniya, Nuwara-Eliya and Badulla recorded the highest incidence of poisoning ⁽⁹⁾. A study conducted to have time series analysis in Hospital admission data within the period of 1995-2008 showed that Hambantota, Monaragala, Nuwara Eliya and Colombo districts show an increase in the rate of admissions after pesticide poisoning ⁽¹⁰⁾.

Since Nuwaraeliya has been identified as a ‘hot spot’ for agro-chemical poisoning in Sri Lanka in most of the previous studies, analysis of recent hospital data on organophosphate poisoning is a timely need.

Burden of agrochemical poisoning mainly associated with the farming community. Nuwaraeliya is a home for series of food crops including up country vegetables such as Carrots, Beetroot etc. It has been revealed that high input farming practices are commonly available in the district and as a result, the chances for agro-chemical exposure is higher in its’ community.

District General Hospital, Nuwaraeliya (DGHNE) is the largest hospital and only tertiary care hospital in Nuwaraeliya district. It caters it service for people belonged to Nuwaraeliya district and some part of Badulla district ⁽¹¹⁾. As a starting point, analysis of admission data regarding organophosphate and

carbamate poisoning in DGHNE, would be important to understand the extent of poisoning among the community.

The study aimed to identify the Prevalence of Organophosphates and carbamate poisoning among hospital admissions in DGHNE in 2018 and to describe the trend of Organophosphates and carbamate poisoning among hospital admissions in DGHNE from 2014 to 2018.

II. METHODOLOGY

Institution based descriptive study was carried out in DGHNE, which is the biggest hospital in Nuwaraeliya district where primary, secondary and tertiary care provided for its catching population. Study period was 1st to 15th of May 2019. All the existing data of diagnosed patients poisoning with organophosphate and carbamate within the period of 2014 to 2018 were included in the study. Available secondary data of 2014 to 2018 in Indoor Morbidity and Mortality Report (IMMMR) was obtained and analyzed using Microsoft excel spread sheet and SPSS version 20.

Administrative permission was obtained from the Director of DGHNE to collect the data and to conduct the study.

III. RESULTS

Total number of 226 subjects were diagnosed as poisoning with organophosphate and carbamate in DGHNE during 2018. It represented 0.41% of total admissions. Mean age of patients poisoning with organophosphate and carbamate was 31.36 (SD = 15.20) years and range was from 1 year to 83 years. Mean age of female was 29.85 years (SD = 16.29) and it was 31.9years for males (SD = 14.92). There was no significance deference in mean age of two sex (95% CI for age = 29.37-33.35).

Table 1: Distribution of victims according to the age groups

Age (years)	<1	1 - 4	5 - 16	17 - 49	50 - 69	70+	N/Av	Total
Female	1	0	9	37	6	1	0	54
Male	0	2	16	129	20	5	0	172
Total	1	2	25	166	26	6	0	226

Highest number of the poisoning patients were identified in the 17- 49 years group and 2nd was 50-69 years group. Twenty eight (12.4%) poisoning patients were below 16 years of age. Seventy six percent (n= 172) of those 226 patients were males. Proportion of male intoxication with organophosphate and carbamate was very highly significance than females (p = 0.000).

Out of these 226 patients, there were 210 (93%) live discharges from the hospital, 6 (2.6%) transferred out for further treatments and 10 (4.4%) deaths. These deaths accounted for 1.4% of total hospital deaths (n = 677) in 2018.

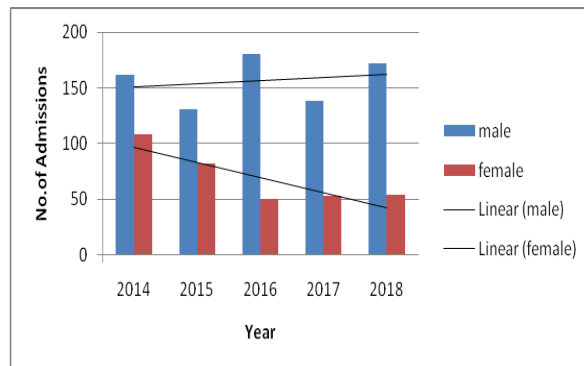
Table 2 : The deaths according to the age group.

Age group	<1	1	5	17	50	70+	N/Av	Total
	-	-	-	-	-	-	-	-
	4	16	49	69				
Female deaths	0	0	0	1	0	0	0	1
Male deaths	0	0	0	2	2	5	0	9

Out of ten deaths, nine were males. Both age groups categories of 17-69 years and above 70 years claimed for 5 deaths per each. Total in-patient days counted for all patients admitted following organophosphate and carbamate poisoning in DGHNE in 2018 was 733 days. The average number of days of hospital admission was 3.2 per person.

Trend of females admitted following intoxication of organophosphate and carbamate was reduced 2014 to 2018 whereas trend of male slightly increased (Figure 1).

Figure 1: Male- female admissions following poisoning with organophosphate and carbamate and the trendline 2014-2018



From 2014-2018, the mean age of male and female admissions following organophosphate and carbamate poisoning was not very much fluctuated (Figure 2).

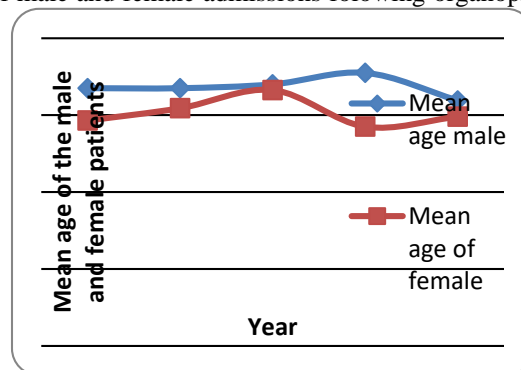


Figure 2: variation of median age of the male and female patients admitted following poisoning with organophosphate and carbamate 2014-2018

There is no very much fluctuation in total deaths of DGHNE due to poisoning with organophosphate and carbamate 2014-2018. The detailed information are illustrated in Table 3.

Table 3: Total deaths of DGHNE due to poisoning with organophosphate and carbamate 2014-2018

Year	Male	Female	Total no. of deaths
2015	8	0	8
2016	8	1	9
2017	6	1	7
2018	4	3	7
2019	9	1	10

IV. DISCUSSION

Organophosphate and carbamate poisoning causes huge burden to health in people of developing countries. Although the burden of this was totally preventable, it seems to remain as same for long period of time. This may be due to unavailable or inadequate preventive and control measures.

In DGHNE, poisoning cases following organophosphate and carbamate represents 0.41% of the total admissions and it has been accounted for 733 in-patient days. This is an economic burden to the country since it generates a considerable amount of cost to the health care sector which is a scarce resource for country like Sri Lanka. On the other hand, patients should bear the cost of lost man days due to hospitalization. It affects his and his/her household economy as well and the indirect consequences may be many more.

There were 10 deaths due to pesticide poisoning in 2018, which accounted for 1.4% of total deaths. Strictly adhere to protective measures, strong pesticide regulatory system and strong social support would have a role in preventing those admissions and deaths.

Most of the victims of organophosphate and carbamate poisoning were male and belongs to 17-69 age groups (85% of total). Those belong to labor force of the country and to young generation (Mean age 31.36 and 95% CI = 29.37-33.35) who would otherwise contribute to country's economy. Therefore, the total loss due to this hazard is immeasurable.

From those, 12.4% of victims were below 16 years of age and belong to future of the country. Limited issuing of the pesticides, providing proper knowledge on safe storing and safe use, social support and adolescence counseling would have definite role in preventing poisoning among those. The community should have adequate access to safety information.

Field staff in health and agriculture sectors such as midwives, PHIs and field level agricultural extension officers is the main sources of implementing successful preventive programs. In order to implement effective preventive program among the community, it is essential to revisit the responsibilities of these field level officers dealing with specially, farmer community, who frequently interact with agro-chemicals.

Inter-sectoral collaboration between agriculture, health, social and education services would give a better outcome in

preventive measures. Well established field health service and agriculture extension service in Sri Lanka will definitely achieve the success, if they continue to work together.

The number of deaths and victims of agro-chemical poisoning were higher than the most commonly addressed infectious diseases in the health sector. Unfortunately, there is no separate allocation in the health budget to implement effective programs to prevent or control this pathetic situation. Health managers and policy makers have to look in to this matter with an urge since this is a completely preventable scenario.

On the other hand, even though agricultural extension has a role to play in ensuring farmer well being, it can be observed that component is missing in today's production-oriented agricultural extension service. Therefore, it has become an essential and urgent need to incorporate farmer safety and well being also into its agendas in order to sustain the agricultural production process and save lives. Not only production related information, but also adequate attention should be paid to disseminate the knowledge on farmer safety and health such as protective techniques, safe use and health hazard of pesticides through competent field level agricultural extension officers.

V. CONCLUSION

Organophosphates and Carbamate insecticide poisoning is a totally preventable health hazard. It represents the considerable percentage of hospital admissions and hospital deaths in DGHNE. It mainly affects the young generation and work force and the prevalence remains quite same for a long period. Adequate protective measure is a must to implement immediately.

VI. ACKNOWLEDGEMENT

The generous support given by the Director, Deputy Director, and Medical record officers in DGHNE is greatly acknowledged.

VII. LIMITATIONS OF THE STUDY

Occupation of the victims and the mode of intoxication (occupational exposure, suicidal or homicidal) could not be explored in this study.

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