

A Study on Suicidal Poisoning in a Tribal Area of Mahabubabad, Telangana

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Abstract

Background: Pesticide poisoning kills hundreds of thousands of people in the Asia Pacific region each year. The majority are from deliberate self-poisoning with organophosphorus pesticides (OP), paraquat etc. It is a critical health problem in rural areas, where hazardous pesticides are easily available. Very few studies were present regarding this in India and research on anti-dotes to commonly available pesticides is very minimal. According to WHO report, it is the 2nd most common cause of death among people aged 15-29 years.

Methodology: An observational study was conducted to study suicidal poisoning cases from Jan-June 2022 in a retrospective record-based manner. Qualitative variables were represented with graphs and tables. Quantitative variables were represented with mean and Standard deviation. Multinomial logistic regression was done to test the significance of poisoning agents with survival status. Nagelkerke R-squared mean regression model was considered in the analysis. p-value less than 0.05 was considered significant.

Results: The incidence of suicidal poisoning was 696(~0.46%) during the study period. The mean age of the study population is 32.5±12.3 years. Majority of the cases were Organophosphorus compounds and paraquat comprising a total of about 26.11%. Fatality rate was 17.4% Multinomial logistic regression of various poisoning agents showed high significance of mortality OP poisoning (p=0.03), Paraquat poisoning (p<0.001) and Herbicides (p=0.02).

Conclusion: Young populations were more prone to commit suicide suggesting increased recognition of the need for a coordinated response involving public health officials and psychiatric specialists to conduct mental health awareness camps and to provide counselling. Strengthening of translational research to develop anti-dotes for commonly available pesticides.

Keywords: deaths, pesticide, poisoning, suicide, tribal

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Introduction

Poisoning as a means of suicide is not only a health problem but also a social problem in a larger aspect. Verbal autopsies in several rural areas of the country documented that the suicide rates may be five-fold higher compared to the national average.² It is a critical health problem in rural areas, where hazardous pesticides are easily available in the home and nearby shops. According to WHO report, it is the 2nd most common cause of death among people aged 15-29 years.³ Although global age-standardized suicidal rates showed an overall decline in the 2019 report, it varies in developing countries with low incomes where there is a considerable incidence of suicidal poisoning.⁴ As per the National Crime Record Bureau (NCRB) report of 2021, 164,033 people committed suicide in India, with a rate of 12 per 100,000 population which rose from 11.3 per 100,000 in 2020.⁵ Suicide by consuming poison was 25.1% in 2021.⁵ Family Problems (other than marriage related problems)' (33.2%), 'Marriage Related Problems (4.8%) and 'Illness' (18.6%) have together accounted for 56.6% of total suicides in the country during the year 2021. The overall male: female ratio of suicide victims was 72.5: 27.5.⁵ Many cases go unreported when the attempts become non-fatal. Suicidal methods vary based on social, economic, and cultural backgrounds. Suicide results from complex biological, genetic, psychological, socio-cultural, and environmental interactions.⁶ Highly Hazardous Pesticides (HHPs) of World Health Organization (WHO) toxicity classes Ia, Ib, and II - such as the organophosphorus insecticides monocrotophosphorate, and methyl parathion or the herbicide paraquat⁷- have been responsible for most pesticide suicides worldwide over the last five decades.^{8,9} Medical treatment of pesticide-poisoned patients is challenging, particularly in tribal areas, where access to healthcare facilities is much lower.

There is very little focus on this social issue by the policymakers in India. Very few studies were done on this topic all over India. Hence, this study was undertaken with the aim to study the suicidal poisoning cases in this region.

Objectives: • To study the incidence of suicidal poisoning during the study period. • To assess the mortality rate of various poisoning agents consumed by the subjects.

Methodology

Study type: Observational study

Study location: Tribal area of Mahabubabad, Telangana

Study period: Jan-June 2022

Inclusion Criteria:

- Subjects who committed suicide by means of ingestion of poisoning agents.
- Both males and females

Exclusion Criteria:

- Subjects with severe comorbidities including renal, hepatic and cardiac disorders.

Datacollection: An observational study was conducted in tribal area of Mahabubabad from January to June 2022 in a retrospective record-based manner. As area hospital of Mahabubabad is the only tertiary care centre available in this area, all the poisoning cases are usually admitted here. Hence the incidence of poisoning cases was recorded at this centre. Variables collected included age, sex, type of poisoning and survival status. The poisoning agent was identified and recorded after collecting used bottles from the patient's attender at the time of admission. Thus, collected data was entered in Microsoft Excel (Ms Office 365) and analysed. Qualitative variables were represented with graphs and tables. Quantitative variables were represented with mean and standard deviation. Multinomial logistic regression was done to test the significance of poisoning agents with survival status. Nagelkerke R-squared mean regression model was considered in analysis. p-value less than 0.05 was considered significant. The approval was taken with Rc.No 42/2023 dated 3 November, 2023.

Results

The incidence of suicidal poisoning was 696 (~0.46%) during the study period. Out of all the 696 subjects, 54.2% were comprised of males and 45.8% were females. Mean age of the study population is 32.5±12.3 years.

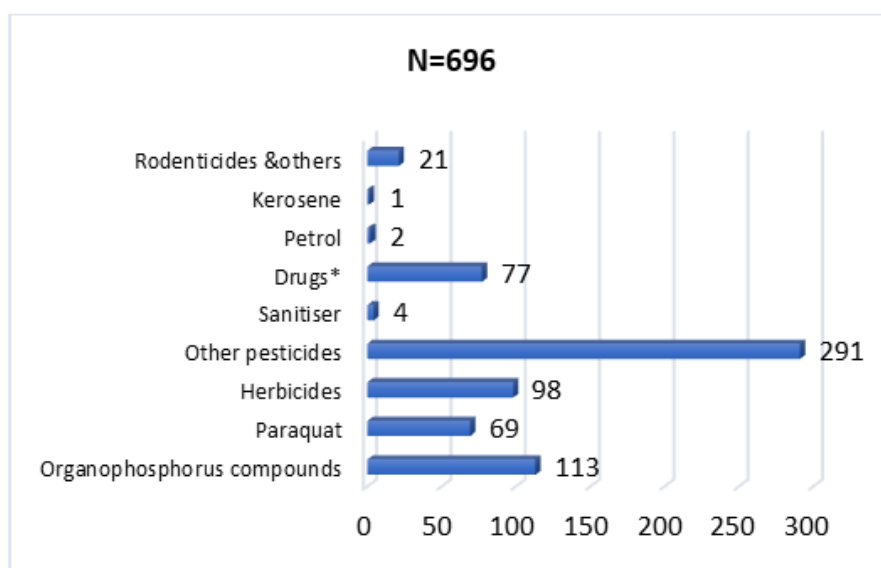
Table 1: Sociodemographic profile of the study population

Parameter	(N=696)	In %
Sex		
Male	375	53.9
Female	321	46.1
Age (In Years)		
<15	13	1.9
16-25	229	32.9
26-35	238	34.2
36-45	128	18.4
46-55	53	7.6
56-65	18	2.6
>65	17	2.4
Mean Age 32.5±12.3		

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Marital status		
Unmarried	99	14.1
Married	597	85.9
Employment		
Agricultural works	512	73.6
Others	184	26.4

Table 1 shows the demographic profile of the study subjects. Majority 238 (34.2%) of the subjects were aged between 26-35 years. Subjects aged <15 years were 13(1.9%), 16-25 years were 229(32.9%), 36-45 years were 18.4%, 46-55 were 7.7% and remaining were aged between 55-65 years (18,2.6%) and >65 years (17,2.4%). About 16.2% were unmarried. Majority (73.6%) were working as agricultural labourers.

**Fig 1: Distribution of poisoning agents among the study subjects**

*Drugs: Paracetamol, Metformin etc

Fig 1 depicts the type of compounds used for suicide among the study subjects. Majority 291 (41.8%) had used various pesticides. Organophosphorus compounds and paraquat comprised a total of about 26.11% with 16.2% of OP poisoning and 9.91% of Paraquat compounds respectively. Suicide by Herbicidal agents were (98,14.08%), Drugs (77,11.1%), Rodenticides (21,3.02%), sanitiser (4,0.57%), petrol (2,0.3%), Kerosene (1,0.14%) and Other were 21(5.9%).

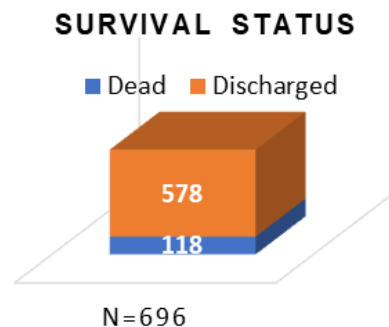
**Fig 2: Survival status of the study subjects**

Fig 2 shows the survival status of the study accounting to 16.9%. subjects. Total 118 died due to suicidal poisoning

Table 2: Multinomial logistic regression showing survival status with various poisoning agents.

Agent	Dead(=N)(In%)	Discharged(=N)(In%)	p-value*	Exp(B)
OP	39(5.8)	74(10.9)	0.03	0.256
Paraquat	61(9)	8(1.2)	<0.001	0.022
Herbicides	2(0.3)	96(14.2)	0.02	8
Rodenticides and others	16(2.3)	380(56.3)	~0.08	~3.2
Total	118(17.4)	578(82.6)		

Negelkerke R-Square- 0.551, Survival status 1.00- Dead, 2.00- Discharged---1.00-

*Multinomial logistic regression was used to test the significance with various poisoning agents

Table 2 shows the survival status of the subjects across various poisoning agents. Fatality was high with Paraquat poisoning (9%) followed by OP compounds (5.8%). Herbicides accounted for 0.3% and mortality with rodenticides and others was 2.3%.

Multinomial logistic regression was used to test the significance of survival status with various poisoning agents. Significant results were obtained for OP poisoning (p=0.03), Paraquat poisoning (p<0.001) and Herbicides(p=0.02). No significant results were observed with other pesticides.

Discussion

This study was based on tribal area of Mahabubabad, Telangana. The population was estimated to be 145,679 in 2022.¹⁰ Several Tandas’ (rural settlements) exist in this area.

The present study comprised of 696 cases during the study period.

In the present study, incidence of suicidal poisoning was found to be 696 during the study period. Males comprised of 54.2% and 45.8% were females. The gender disparity was marginal in this study population. Majority 238 (34.2%) of the subjects were of young age between 26-35 years. Mean age of the study population is 32.5±12.3 years. Poisoning is a major problem in young adults who commit suicide mainly due to hardships of life encountered during early adulthood.

As per national Crime records bureau 2021, suicidal rates among various states is depicted below(Fig 5).⁵ Majority of suicides had occurred in Maharashtra(13.5%).Telangana contributes to 6.2% of the cases.

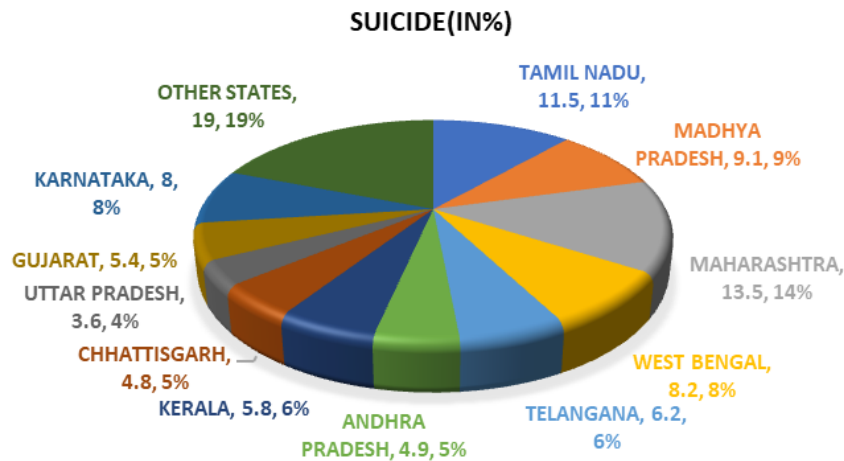


Fig 5: National Crime Records Bureau(NCRB), 2021

NCRB data indicate that pesticides were used in 441,918 reported suicides in India from 1995 to 2015, 90.3% of which occurred in 11 of the 29 states.¹¹

Based on a study in Uttar Pradesh by Narendra et.al., among suicidal poisoning cases ($n = 98$), the most common age group involved was 11-20 years (36.7%) followed by 21-30 years (35.7%), 31-40 years (16.3%) and more than 40 years (11.2%). Majority of the cases were males (59.2%) and the most of them belong to rural areas (58.2%).¹²its socio-demographic profile and its reasons in all admitted cases of suicidal poisoning in hospital.

Methods: A cross-sectional study was conducted on cases of poisoning of any age group admitted in the Chhatrapati Shivaji Subharti Hospital, Meerut. Poisoning cases with history or evidence of suicide were further interviewed. A semi-structured interview schedule in Hindi was used to collect data. Microsoft Excel 365 and R software version 3.6.0 were used for data entry and analysis respectively.

Results: Among total 135 poisoning cases admitted in hospital, 126 provided consent and included in the study. Prevalence of suicidal poisoning was 77.7% (98

In a retrospective study done by Sharma et.al, a total 505 patient files with poisoning cases were admitted at emergency department. The mean age of the patients was 28.43 ± 14 years. In gender-wise ratio, male patients (59%) were comparatively higher than the females (39%).¹³

In the present study about 16.2% were unmarried. Majority (73.6%) were working as agricultural labourers which makes them easily accessible to various pesticides and other chemicals. Majority 291(41.8%) committed suicide with various pesticides. Organophosphorus compounds and paraquat comprised 16.2% and 9.91% respectively. Suicide by Herbicidal agents were (98,14.08%), Drugs (77,11.1%), sanitiser (4,0.57%), petrol (2,0.3%), Kerosene (1,0.14%) and Other were 21(5.9%). Insecticides and pesticides, which are easily available in this region, enable them to commit suicide in their moments of despair.

In a similar study by Sharma et.al., study, majority of poisoning cases, 310 (61.38%) consumed organophosphorus compound (OPC), whereas other cases used medicinal (4.14%), corrosive (4.14%), phenol (3.16%), chemicals (1.98%), kerosene (1.58%),

alcohol (1.38%), plants (1.38%).¹³ In a study by Tanuj Kanchan on suicidal poisoning in Southern India, preference for organophosphates was relatively more in males when compared to females, who preferred zinc phosphide, carbamates and medicinal agents.¹⁴ In another study by Chaudari et.al, the most common poison used was organophosphates (48.7%).¹⁵

Pooled analysis of studies in Indian population from 2010-2020 revealed that pesticides were the main cause of poisoning in adults, with an incidence of 63% (63%-64%)(95% C.I). Also, a forensic toxicology analysis on 674 cases of self-poisoning suicidal deaths in Iran between 2011-2015, the most often used suicide method was self-poisoning with pesticide (aluminium phosphide tablets,91.8%) followed by opioids(5.7%), methamphetamine(3.1%), cyanide(2.5%) and strychnine(1.5%) and organophosphates (0.2%).

According to University of Bristol study on highly hazardous pesticide self-poisoning in India, 1-in-4 suicides occur in India and about 30% of these deaths are by pesticide ingestion -the state of Maharashtra had the most suicide deaths in 2021.¹⁶

In India about 70% population belong to rural areas¹⁷ where, agriculture is the main livelihood and hence accessibility and availability to these pesticides is very high.

In the present study, total 118 cases died due to suicidal poisoning accounting to 17.4%. The case fatality rate was high with Paraquat poisoning (9%) followed by OP compounds (5.8%). Herbicides accounted to 0.3% and mortality with rodenticides (and others) was 2.3%. Multinomial logistic regression of various poisoning agents showed high significance of mortality OP poisoning ($p=0.03$), Paraquat poisoning ($p<0.001$) and Herbicides ($p=0.02$). This is attributed to the high toxicity of the compounds as well as non-availability of specific anti-dote with respect to paraquat and herbicidal poisoning.

In a study by Sharma et.al., the average stay in the hospital was 12.53 ± 7.53 days and mortality rate was 8.31%.¹³ In Chatterjee et.al, study conducted in West Bengal, 93.19% of poisoning cases were attributed to suicide. Corrosives constituted 13.68% of the acute poisoning cases and pesticides constituted 12.16% of the total cases. In Faisal et.al., study on suicide attempts by poisoning, the most consumed agents

were acetaminophen in 59 (45.83%) and non-steroidal anti-inflammatory drugs (NSAIDs) in 22 (16.92%). The ICU admission rate was 8.5% (n=11).

In a systematic review on lethal poisoning conducted between 1999-2018 by Ayanthi et.al., deaths due to pesticide poisoning (94.5%) were dominant across the study period compared to other classes of poison [hair dye paraphenylenediamine poisoning (2.6%), medicine overdose (1.4%) or plant poisoning (1.0%)]. In Chatterjee et.al., study, the mortality rate was 16.05% and 34.72% respectively in corrosives and pesticide poisoning respectively. Univariate analysis of mortality in pesticide poisoning cases indicated that delay in getting primary care increased mortality. In Anuradha et.al., study, Of the 46 who died from self-poisoning, 78.3% had taken pesticides and 19.7% had eaten poisonous plants.¹⁸ In systematic review (1999-2018) by Ayanthi et.al., among the pesticides, aluminium phosphide was the most important lethal poison during the first 10 years before declining markedly.¹⁹ In a study conducted in Poland by Anna et.al., from 1999-2020, out of 14,660 self-poisoning suicide attempts, there were 2258 cases of deaths during the study period.²⁰

According to Bose et.al., eighty percent of the self-poisoning cases obtained the poisonous substance in or in close proximity to the home, highlighting the importance of safe storage in the domestic environment.¹⁸

Strengths and Limitations of the study:

The strengths of this study includes sample size, which is large and regression analysis was done which reduces the confounding effect.

The retrospective nature may have excluded few cases who died and couldn't make it to hospital. This may have introduced selection bias.

As it's a record-based study, the precise situation of this region might be known, and external validity might be a limitation in this study.

Conclusion

Despite a moderate decline in suicide rate over the last 20 years, India still has a large burden of suicide.²¹ Pesticides are frequently used as a method

of suicide - the nationally representative Million Death Study estimated that the rate of death by self-poisoning was 7.9 per 100,000 per year for women and 13.8 per 100,000 per year for men, with pesticides used in the majority of these.²²

As majority of the population depends on agriculture as livelihood in this rural set-up and due to high availability and accessibility to various pesticides the subjects commit suicide in their moments of despair. New preventative strategies are therefore greatly needed.

Young populations are more prone to commit suicide. The current response from a public health, medical and research point of view is inadequate.¹ Increasing recognition of the need for a coordinated response involving public health officials and psychiatric specialists to conduct mental health awareness camps and to provide counselling is very much essential.

Strengthening of translational research as the human toxicity of pesticides is poorly studied. There is dire need to develop anti-dotes to commonly available pesticides to help improvement in diagnosis and treatment.

Strict enforcement of laws is much needed to prevent suicides in this area.

Political commitment is necessary and suicidal prevention policies should be framed.

Ethical Clearance: The Ethical approval was taken from Office of Principal, Government Medical College, Mahabubabad with Rc.No 42/2023 dated 3 November, 2023.

Conflicts of interest: None

Funding: NIL

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