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## Epidemiology Study And Methods Of Suicide Under The Age Of 18 Years During 2010-2020 In Tehran Province

Mehdi Forouzesh<sup>1</sup>, Abdolrazagh Barzegar<sup>1</sup>, Seyed Amirhosein Mahdavi<sup>1</sup>, Masoud Ghadipasha<sup>1</sup>, Seyed Shahram Mousavi<sup>1</sup>, Roya Kordrostami<sup>1</sup>, Nahid Dadashzadeh<sup>1\*</sup>, Rohollah Valizadeh<sup>2</sup>

- 1 Legal Medicine Research Center, Legal Medicine Organization, Tehran, Iran.
- 2 Student Research Committee, Department of Epidemiology, School of Public Health, Iran University of Medical Sciences, Tehran, Iran and Minimally Invasive Surgery Research Center, Hazrat-e Rasool General Hospital, Iran University of Medical Sciences, Tehran, Iran.

nahiddadashzadeh.forensic21@gmail.com

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**Abstract**

**Background:** Type of suicide is determined by various factors such as accessibility to drugs, economic problems and psychological disorders.

**Objective:** This study aimed to assess the epidemiology of suicide death, autopsy and effective factors in children < 18 years.

**Methods:** This was a cross-sectional study carried out on 350 autopsy bodies less than 18 years of age in Tehran Forensic Medicine Center during 2010-2020 who had struggled with suicide. Data were analyzed using SPSS version 18.

**Results:** Mean age of children was  $16.36 \pm 1.76$  years. The most common method in children less than 15 years and over 15 years was hanging (n=36) and poisoning with chemical substance (n=139), respectively ( $p < 0.001$ ). The most common method of the suicide was poisoning with chemical substance (n=147, 42%). The most common method of suicide in girls and boys was poisoning with chemical substance (n=81) and hanging (n=75), respectively. The highest number of children struggled with were residents in the outskirts of Tehran (n=113, 32.5%). Suicide rate in people with depressive disorder and tentative injury was 10% (n=35) and 18.6% (n=65). In 13 patients, vitreous humor alcohol was positive (mean alcohol:  $60.61 \pm 43.03$  mg/dl). The most common toxin observed in toxicology was rice tablet or aluminum phosphide (n=90, 25.7%). Regarding drug toxicity in toxicology, 52.6% (n=86) was not positive. Opium was found 7.4% of cases (n=26).

**Conclusion:** The suicide rate has been on the rise during the past ten years through hanging and poisoning with chemical substance such as aluminum phosphide, opium and tricyclic antidepressants especially in outskirts.

**Keywords:** Epidemiology, Suicide, Children, Iran

**Introduction**

Due to the increasing trend of suicide attempts in recent years, special programs should be considered for some countries (1). Suicide is often caused by despair following mental disorder, substance abuse or alcohol abuse. The most common methods of suicide vary from country to country and to some extent depend on the available methods. Common methods include

hanging, poisoning with drugs and toxins, firearms, etc. About one million people die of suicide each year, making it the tenth leading cause of death worldwide (2). The registered suicide rate among adolescents has almost tripled over the past few decades, in which is now the second leading cause of death among adolescents and young adults (3).

In Europe, the suicide rate among adolescent women is lower than men (4). The number of children and adolescents who die as a result of suicide is increasing over time. Psychological screening may identify accurate individuals at risk of death due to the relative rarity of suicide deaths (5). Suicide rates in Iran are lower than most countries, especially Western societies, but are higher than most Middle East countries (6).

Research around the world on suicide predisposing factors clearly demonstrates the role of drug use and substance abuse. There have not been many studies on adolescent suicide in Iran and due to the high statistics of substance abuse, drug abuse (7) (8) and the increasing number of suicides in Iran (9), there is a need for further investigation in the country. The aim of this study was a description of suicides in adolescents of Tehran Forensic Medicine Center from 2010 to 2020.

## **Methods and materials**

This was a cross-sectional study and the study population was consisted of 350 young people dying by suicide less than 18 years of age in Tehran Forensic Medicine Center during 2010-2020 who had struggled with suicide. In the next stage, the files of children under 18 years of age who had struggled with suicide were collected. The autopsy report and corpse samples were collected by experienced staff and sent to the toxicology laboratory of Tehran Forensic Medicine Center and the toxicology analysis report was recorded. According to the toxicological analysis report of legal drugs (including commonly used drugs in the pharmaceutical market such as benzodiazepines, barbiturates, phenothiazine, tricyclic antidepressants, etc.) and abused drugs (opioids, amphetamine-like compounds, alcohol, etc.) were collected in toxicological analysis. The other information were the type of drugs, age, gender, level of education, season, marital status, history of suicide, having mental disorder, and place of suicide. The collected data entered into SPSS software version 18 and were analyzed using descriptive (frequency, percentage, mean and standard deviation) and analytical tests (Chi-square and Pearson correlation).

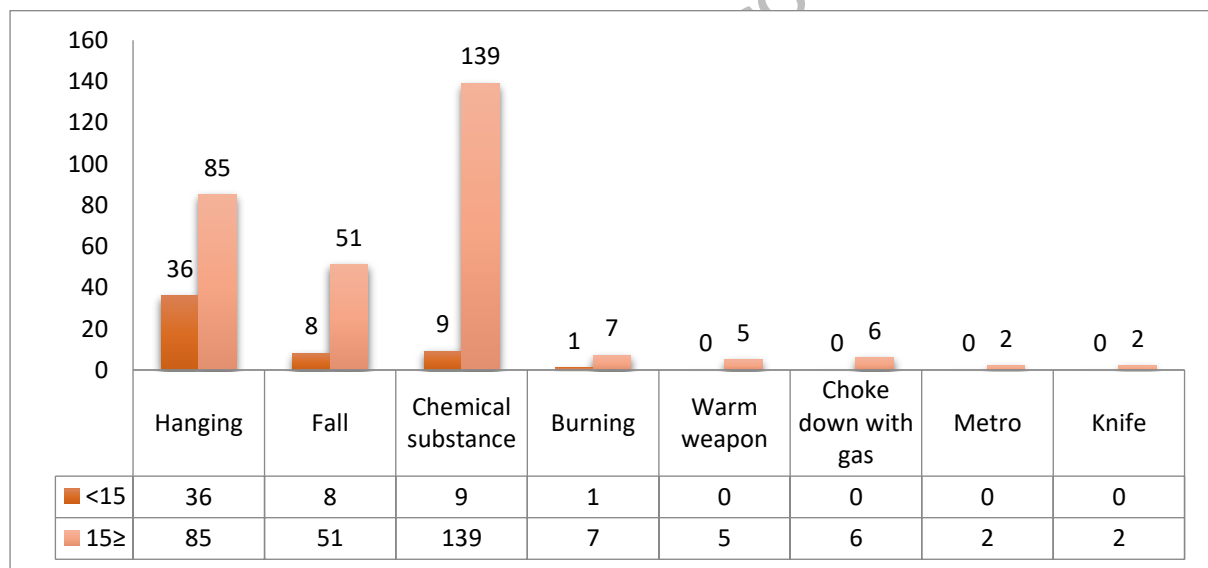
## **Ethical issues**

Human rights were respected in accordance with the Helsinki Declaration 1975, as revised in 1983. The study was approved by ethics committee of forensic medicine of Tehran (Ethical code# IR.LMO.REC.1399.052 available at It is online at <https://ethics.research.ac.ir/form/hsn795qc7gsfdw56.pdf>).

## **Results**

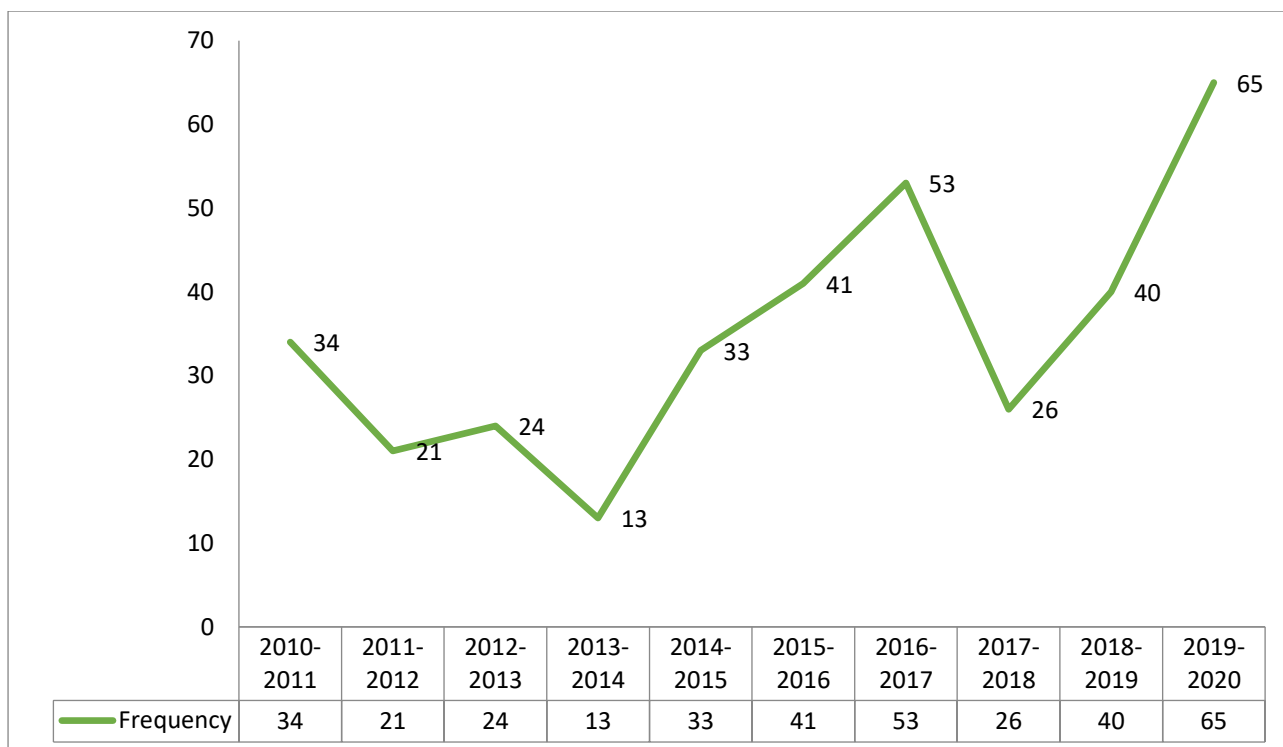
In this 10-year retrospective study, 350 suicides that underwent autopsy and toxicological assessment were investigated. The mean age of children in this study was  $16.36 \pm 1.76$  years

and the age range was between 11-18 years. The most common method in children less than 15 years and over 15 years was hanging (36) and poisoning with chemical substance (n=139), respectively in which the differences was statistically significant ( $p < 0.001$ ) (Figure 1). In terms of gender distribution, 52.3% of the children were girls (n=183) and 67.9% were boys (n=167), but there was no significant difference between the two groups ( $p > 0.05$ ).



**Fig 1:** Suicide methods in children less than 15 years and over 15 years

Of these, the highest number of deaths due to suicide in 2019-2020 was 18.6% (n=65) and the lowest rate was 3.7% (n=13) in 2013-2014. Overall, the suicide rate has been on the rise during the past ten years (Figure 2). The most common method of suicide was poisoning (n=147, 42%) followed by hanging (n=121, 34.6%) and the rarest method was using a knife (n=2) and jumping in front of metro (n=2). In 2010-2011, the most common method of suicide was the poisoning with chemical substance, which was the most common method until 2015-2016 and after this year the most common method of suicide was hanging (Table 1).



**Fig 2:** Trend of changes in the Frequency of the suicide in the past 10 years

**Table 1:** Trend of suicide methods over the past 10 years by methods

Suicide method	2019-2020	2018-2019	2017-2018	2016-2017	2015-2016	2014-2015	2013-2014	2012-2013	2011-2012	2010-2011
Hanging	31	9	9	26	20	14	2	7	2	1
Fall	16	10	7	15	1	2	3	3	1	1
Chemical substance	12	19	5	11	16	16	7	13	17	31
Burning	2	1	0	0	2	1	0	1	1	0
Warm weapon	2	0	2	0	1	0	0	0	0	0
Choke down with gas	2	1	0	0	1	0	1	0	0	1
Metro	0	0	2	0	0	0	0	0	0	0
Knife	0	0	1	1	0	0	0	0	0	0

Totally, the most common method of the suicide was poisoning with chemical substance (n=147, 42%) (Table 2).

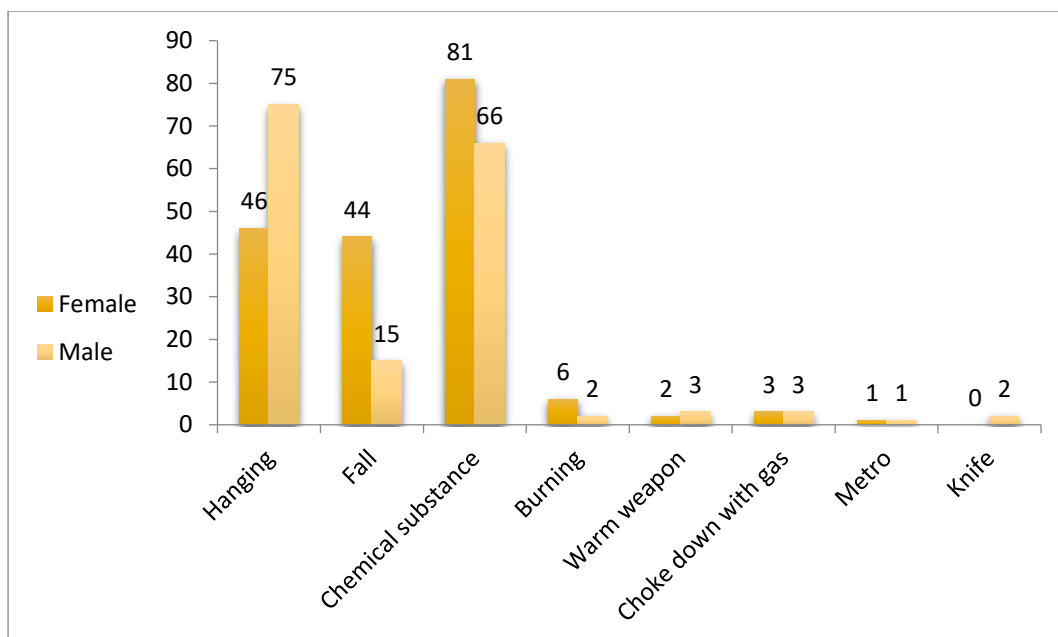
**Table 2:** Suicide methods of the children who struggled with suicide

Suicide methods	Frequency	Percent
Chemical substance	147	42.0
Hanging	121	34.6
Fall	59	16.9
Burning	8	2.3
Choke down with gas	6	1.7
Warm weapon	5	1.4
Knife	2	0.6
Metro	2	0.6

The most common method of suicide in girls was poisoning with chemical substance (n=81) and then hanging (n=46). It should be noted that suicide with a knife has not been seen in this period. The most common method of suicide in boys was hanging (n=75) followed by poisoning with chemical substance (n=66). The method of jumping in front of metro was not seen in boys at all (Table 3, Figure 3).

**Table 3:** Comparison of the male and female regarding the method of suicide

Variable	Suicide method								X2	P value
	Hanging	Fall	Chemical substance	Burning	Warm weapon	Choke down with gas	Metro	Knife		
Female	46	44	81	6	2	3	1	0	21.172	<0.001
Male	75	15	66	2	3	3	1	2		



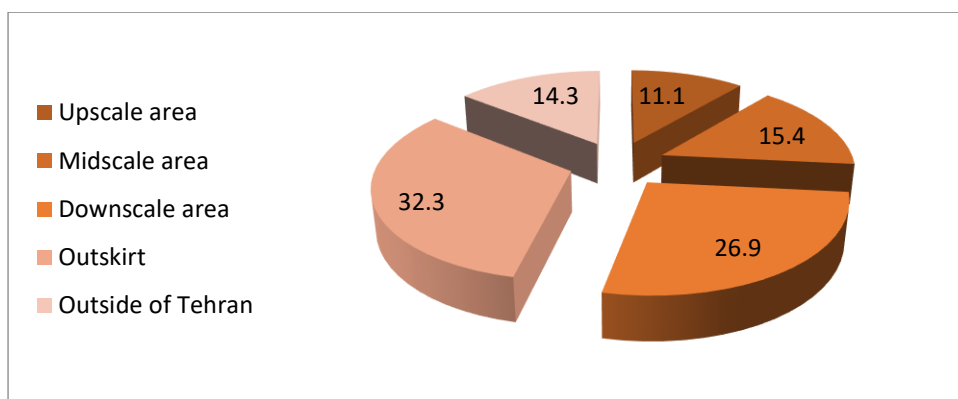
**Fig 3:** Comparison of the male and female regarding the method of suicide

The most educational level was high school (n=134, 38.3). The level of illiteracy was 4.9% (n=17) (Table 4).

**Table 4.** Education level of the study samples

Education level	Frequency	Percent
Illiterate	17	4.9
Primary school	35	10.0
Middle school	111	31.7
High school	134	38.3
Diploma	22	6.3

The highest number of children were residents in the outskirts of Tehran (n=113, 32.5%) and then downscale area had 94 suicides (26.2%) because these areas are not in a good economic and social situation and it requires attention and psychological training and how to properly deal with young people and adolescents by parents and school officials (Figure 4).



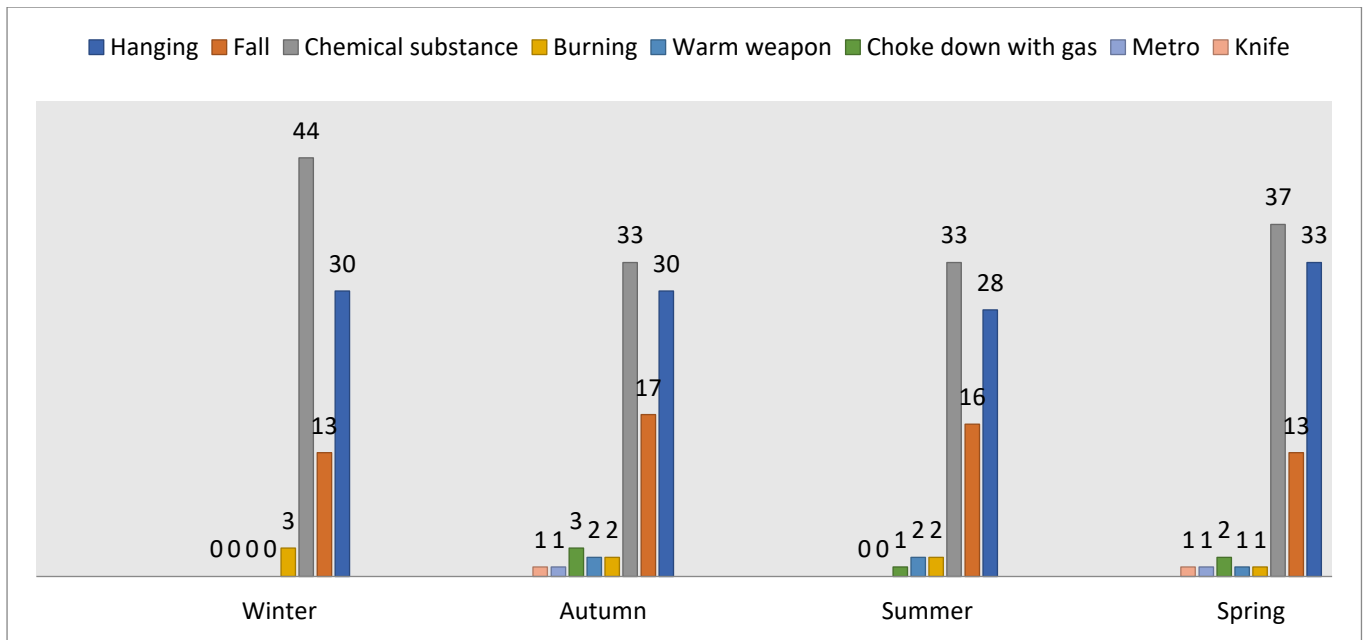
**Fig 4:** Frequency of suicide based on the place of residence

There was no significant relationship between the incidence of suicide leading to death and the season. Also, the method of suicide was not different in four seasons (Table 5, Figure 5).

**Table 5:** Comparison of the male and female regarding the method of suicide

Variable		Season				Statistics
		Spring	Summer	Autumn	Winter	
Suicide method	Hanging	33	28	30	30	$X^2=14.406$ $P=0.852$
	Fall	13	16	17	13	
	Chemical substance	37	33	33	44	
	Burning	1	2	2	3	
	Warm weapon	1	2	2	0	
	Choke down with gas	2	1	3	0	
	Metro	1	0	1	0	
	Knife	1	0	1	0	





**Fig 5:** Comparison of the male and female regarding the method of suicide

Suicide rate in people with depressive disorder according to parent declaration was 10% (n=35) and the most common method of suicide was poisoning (n=65, 18.6%). The suicide rate in people who had the effects of tentative injury on the body at the autopsy was 18.6% (n=65) (Table 6).

**Table 6:** Comparison of the children regarding the history of depression and tentative injuries

Variable		Frequency	Percent
Tentative injury (self-stabbing)	Yes	65	18.6
	No	285	81.4
Depression	Yes	35	10.0
	No	315	90.0

In 13 patients, vitreous humor alcohol was positive; the mean level of alcohol was  $60.61 \pm 43.03$  mg/dl (ranging from 10-169). No relationship was found between age and alcohol level. According to the autopsy examination, only one case of severe suspected injury was seen in hymen and anal examination (Table 7).

**Table 7:** Correlation of the age and vitreous alcohol level

Correlation		Alcohol
Age	Pearson Correlation	0.346
	P value	0.247
	N	13
Alcohol (mean± SD, range), mg/dl		60.61±43.03, 10-169

The most common site selected for suicide was home (n=309, 88.3%) and the most common method at home was poisoning (n=133) and then hangings (n=114). In this study, 14 children had a history of alcohol or drug addiction. The most common method used for suicide in the addicted children was chemical substance (n=11) (Table 8).

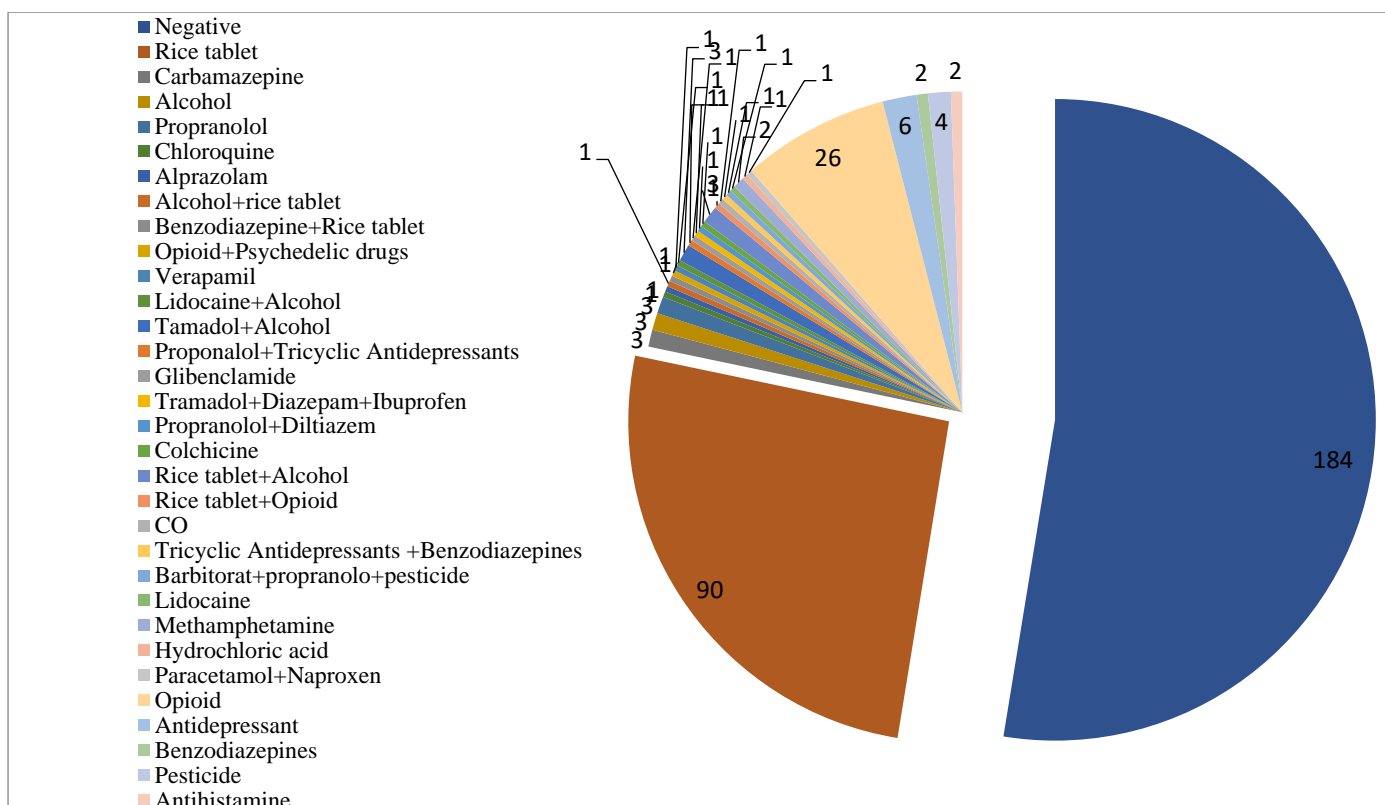
**Table 8:** Comparison of the children regarding the suicide method

Variable		Addiction		X <sup>2</sup>	P value
		No	Yes		
Suicide method	Hanging	114	1	4.947	0.987
	Fall	57	2		
	Chemical substance	136	11		
	Burning	8	0		
	Warm weapon	5	0		
	Choke down with gas	6	0		
	Metro	2	0		
	Knife	2	0		

The most common toxin observed in toxicology was rice tablet or aluminum phosphide (n=90, 25.7%). Regarding drug toxicity in toxicology, 52.6% (n=86) was not positive. Opium was found 7.4% of cases (n=26). The use of tricyclic antidepressants was reported in 1.7% (n=6) and the use of propranolol was 1.7% (n=6) (Table 9, Figure 6).

**Table 9:** Frequency of suicide based on the drug used

Drug toxicity	Frequency and %	Drug toxicity	Frequency and %
No	184, 52.6	Propranolol+ Diltiazem	1,0.3
Rice tablet	90, 25.7	Colchicine	1,0.3
Carbamazepine	3, 0.9	Rice tablet+ Alcohol	3, 0.9
Alcohol	3, 0.9	Rice tablet+ Opioid	1,0.3
Propranolol	3, 0.9	CO	1,0.3
Chloroquine	1,0.3	Tricyclic Antidepressants +Benzodiazepines	1,0.3
Alprazolam	1,0.3	Barbiturate + Propranolol+ pesticide	1,0.3
Alcohol+ Rice tablet	1,0.3	Lidocaine	1,0.3
Benzodiazepine+ Rice tablet	1,0.3	Methamphetamine	2, 0.6
Opioid+ Psychedelic drugs	1,0.3	Hydrochloric acid	1,0.3
Verapamil	1,0.3	Paracetamol+ Naproxen	1,0.3
Lidocaine+ Alcohol	1,0.3	Opioid	26, 7.4
Tramadol+ Alcohol	3, 0.9	Antidepressant	6, 1.7
Propranolol+ Tricyclic Antidepressants	1,0.3	Benzodiazepines	2, 0.6
Glibenclamide	1,0.3	Pesticide	4, 1.1
Tramadol+ Diazepam+ Ibuprofen	1,0.3	Antihistamine	2, 0.6



**Fig 6:** Frequency of suicide based on the place of residence

## Discussion

Soole et al., reviewed suicide in children 14 years of age and younger as a systematic review. They showed that incidence of suicide and gender differences increase with age; hanging is the most common method; and the rate of psychiatric disorders is lower among child suicides. Previous suicide attempts have been a significant risk factor. Children drank less alcohol before struggling with suicide (10). In 2018, Zalar et al., examined suicide methods leading to death. A suicide records over the past 40 years showed that hanging, as the most common form of suicide, is a suicide attempt in men with the aim of causing death, not a suicide attempt. On the other hand, drug use is associated with suicide attempts and is more commonly used by women. Not all suicidal ideation can predict suicidal death. Identifying the most determining risk factors for suicidal behavior can be used as a basis for planning effective prevention strategies, timely identification and adequate professional assistance to people at risk (11).

Laido et al reported their study results on children suicide. They stated that the trend of suicide rate significantly declined from 2001 to 2014 only in males but there were no significant changes in female suicide rate. Also, about 30% of suicide method was hanging (12). These results were not consistent with our results because chemical substance was the dominant method and the second reason of death was hanging.

Polewka et al. revealed that suicide attempts are more common among young people, especially teenage girls and young women. The suicide rate in this age group has increased dramatically in the last few years. Phenomena that are particularly important in preventing suicide in adolescents include suicidal ideation, suicide attempt, and complete suicide. A multistage study of World Health Organization (WHO) on suicide behavior shows that Europe has the highest annual average rate of suicide attempt among young women aged 15 to 24 (13).

A meta-review by Shooshtari et al. on the factors associated with suicidal attempts in Iran found that depressive disorder is the most common leading cause of suicide attempters in which 45% of cases had depression (14). These authors declared that being histrionics among females, and Schizophrenia and Paranoia among males are effective factor to struggle with suicide. The structure of family can play main role in the prevention of the suicide attempts. Shooshtari et al. indicated that conflicts in the family (souse, parent, and children) were effective psychosocial factors in suicidal attempts (14). Our study was consistent with the study by Shooshtari et al. because depressive disorder and tentative injuries showing mental disorder were reported in the cases but due to the young sample in our study, the severity of depression and other mental disorders had low frequency.

Todeshkchuei et al., performed a study entitled "psychosocial factors associated with suicidal behavior". They showed that family conflicts and lower education are associated with suicide attempts (15). McLone et al. assessed factors associated with suicide among adolescents and young adults. The majority of adolescents and young adults had mental disorder (16). Another study on adolescent students by Pandey et al. showed that food insecurity, anxiety, loneliness and gender are affecting factors. They indicated that having some close friends is protective effect against suicide (17). This study was inconsistent with our results e.g. gender in our study was not different. It may be due to cultural differences between Nepal and Iran. Food insecurity can be related to economic status and place of residence then we can attribute the food insecurity of downscale or outskirts in our study that affected the suicide.

In a study by Marion et al. elderly suicide rates increased by deviations of monthly mean temperature. It means that season can affect elderly's suicide rate (18), however our results were not consistent in this regard and the frequency of suicide were no significantly different by season.

### **Limitation and suggestion**

Considering that the production of new science and findings is possible with accurate recording of data, it is suggested that the files be filled with research objectives and more care be taken in this regard. Our main limitation was that the data was single-provincial at a specific time of ten years (2010-2020). It is suggested that a similar study be conducted at the national level in order to compare the provinces and more accurately address the various dimensions of suicide in people under 18 years of age.

### **Conclusion**

The suicide rate has been increased during the past ten years through hanging and poisoning with chemical substance such as aluminum phosphide, opium and tricyclic antidepressants especially in outskirts. This is important to take main actions regarding people's inaccessibility to medicines and preventive measures. By reviewing the obtained results, it is possible to provide information about suicide methods to the relevant authorities and parents, and to

provide information, and to warn the general level of the community to prevent and create awareness about it for educating high-risk individuals.

### **Authors' contribution**

MF, ND, SSM, AB, SAM, MG and RK: Concept, design, collection of the data and manuscript draft. All authors read and signed the final paper .

### **Conflicts of interest**

The authors declare that there is no conflict of interest .

### **Ethical consideration**

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors .

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None

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