

FATAL POISONINGS IN THE SOUTH MARMARA REGION OF TURKEY, 1996-2003

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Aim: The aim of this study is to describe the characteristics of medico-legal autopsies of fatal poisonings in the south Marmara region, Turkey, in the period of 1996-2003, in order to provide further data for the characterisation of fatal poisonings, because there is a scarcity of such information from Turkey.

Methods: Of the 4242 autopsied cases, 415 (9.8%) deaths due to poisonings were examined; 26.8% females and 73.2% males. The mean age was 40.1±19.2 years old (range 0-88).

Results: The three most common types of poison were carbon monoxide (43.5%), insecticides (24.6%), and alcohol (18.4%). The most frequent unnatural manner of death was accidents (67.5%), followed by suicidal (27.5%) deaths. Insecticides were the cause in 71.9% of suicidal poisonings, whereas the cause was carbon monoxide in 63.2%, and alcohol in 27.1% of the unintentional poisonings. The deaths due to carbon monoxide were associated with coal stoves (48.3%), water heaters in bath (31.1%), and fires (17.8%). Organophosphorus insecticides were responsible for 91.1% of total insecticide poisonings. 73.7% of the alcohol poisonings were observed in years 2000-2002, and of the methyl alcohol poisoning, 35.9% and 29.7% were seen in years 2001 and 2002, respectively. Therapeutic drugs were encountered most frequently (75%).

Conclusion: In conclusion, in fatal poisoning cases who have undergone medico-legal autopsy in Bursa and province, CO is of great ratio.

Key words: Unnatural death, fatal poisoning, autopsy, carbon monoxide, insecticide.

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INTRODUCTION

The extent of unnatural fatalities within a society is a gross indicator of the socio-economic conditions and mental health of that society. Analysis of various factors influencing their trends enables policy makers in planning preventive and curative measures pertaining to the human habitations, industries and also to equip the health care institutions accordingly (1). Death due to poisoning has been known since time immemorial. Poisoning is a major problem all over the world although its type and the associated morbidity and mortality vary from country to country (1-11). According to the legal system of our country, all poisoning death cases are recorded as unnatural death and in addition, in Turkey, according to the article 89 of the Penal Code Law

Judicial Procedure (12); any case of death due to suspected or obvious poisoning must undergo the medico-legal autopsy. Thus, medico-legal autopsies are one of the reliable data source of fatal poisoning cases.

In Turkey, medico-legal autopsies are performed by the Morgue Departments of the branches of the Turkish Council of Forensic Medicine. There are seven branches in different cities and regions and one of them is in the city of Bursa, located in south Marmara region of Turkey. The Morgue Department of the Bursa branch also performs autopsies of six surrounding cities. The autopsies of the dead bodies or exhumed cases are carried out only at the written request of the prosecutors of these cities and their counties. Also in Bursa branch, the autopsies are performed by

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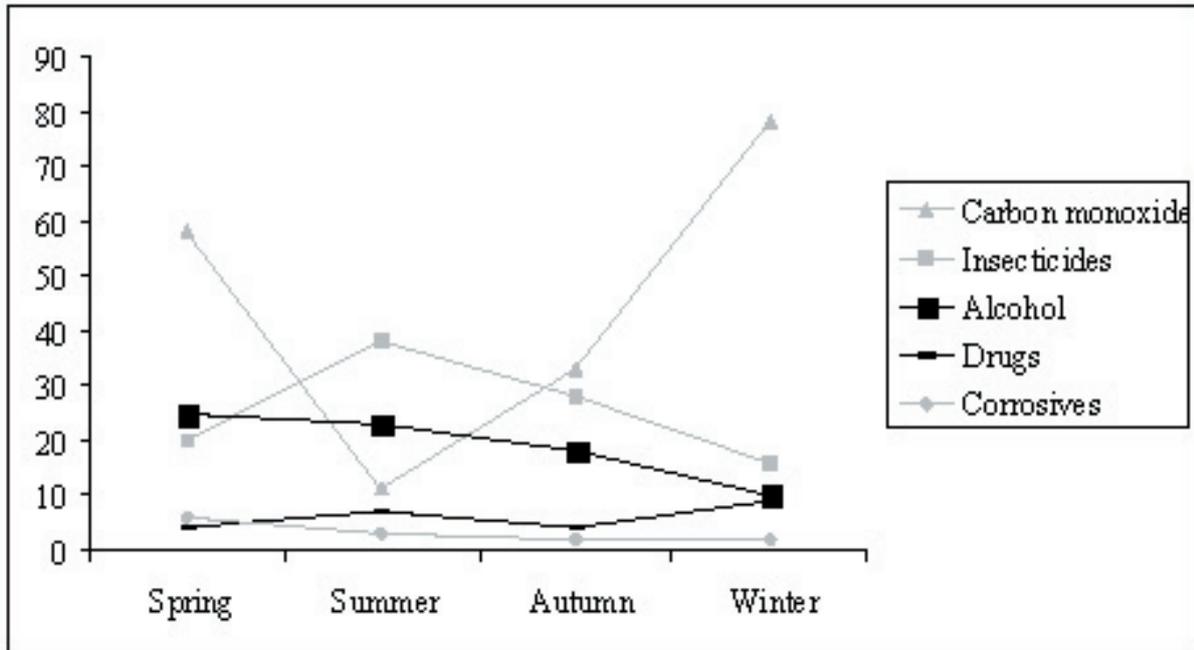


Figure 1. The distribution of fatal poisonings according to the seasons.

the academic personnel of the Department of Forensic Medicine of Uludag University Medical School as a part of graduate and postgraduate education.

Bursa is an agricultural and industrial city which receives considerable migration from other regions in Turkey. Bursa, with a population of approximately 2.2 million people, is the fourth largest city of Turkey, and the largest city in the south Marmara region representing

the general demographic features of the south Marmara region, which has an approximate population of 5.5 million people (13). Over the 8 years from 1996 to 2003, approximately 130 000 deaths occurred in the region (14).

Bearing this these in mind, we aimed at investigating the autopsied fatal poisoning cases retrospectively, to describe the characteristics of fatal poisonings in south Marmara region, over a period of 8

Table 1. Age distribution according to the type of poisons

Age	Type of poison						Total
	Carbon monoxide	Insecticides	Alcohol	Drugs	Corrosives	Others	
0-9	15	2		1		2	20
%	75%	10%		5%		10%	100%
10-19	23	10	2	2		1	38
%	60.5%	26.3%	5.3%	5.3%		2.6%	100%
20-29	34	20	6	7	1	5	73
%	46.6%	27.4%	8.2%	9.6%	1.4%	6.8%	100%
30-39	29	13	15	8	3	3	71
%	40.8%	18.3%	21.1%	1.3%	4.2%	4.2%	100%
40-49	23	17	38		3	3	84
%	27.4%	20.2%	45.2%		3.6%	3.6%	100%
50-59	19	13	5	2	4	4	47
%	40.4%	27.7%	10.6%	4.3%	8.5%	8.5%	100%
60-69	17	13	6	3	1	1	41
%	41.5%	31.7%	14.6%	7.3%	2.4%	2.4%	100%
70-79	13	10	2		1		26
%	50%	38.5%	7.7%		3.8%		100%
80-88	5	2					7
%	71.4%	28.6%					100%

$\chi^2=97.084, p<0.001$.

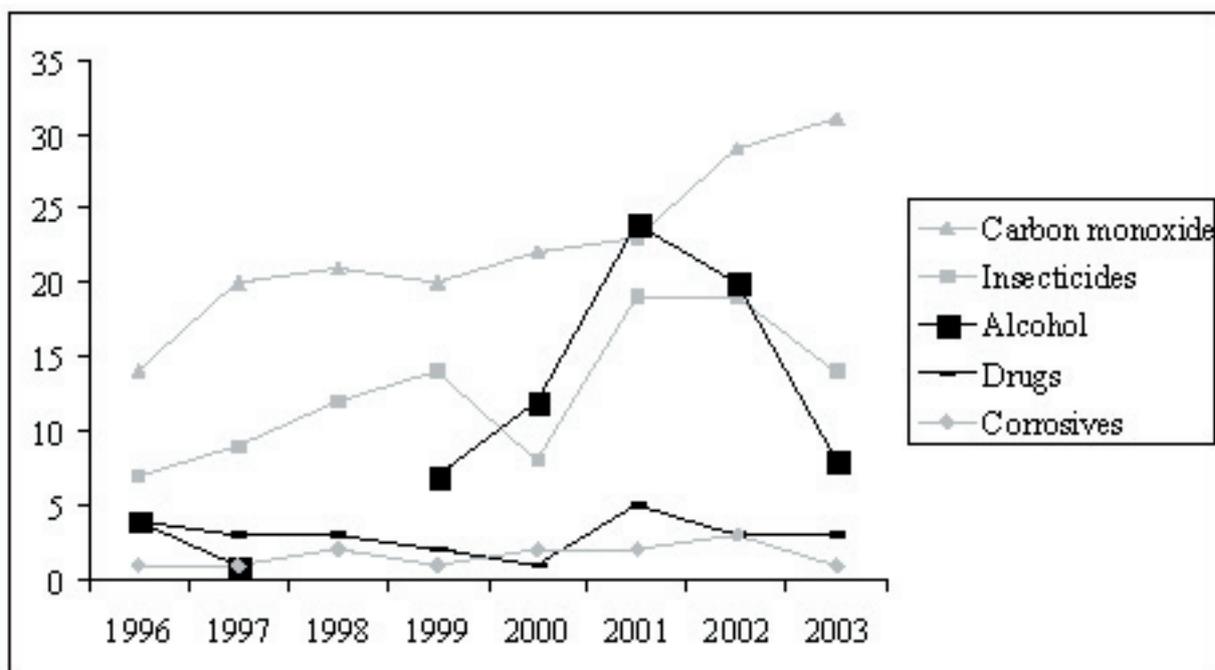


Figure 2. The distribution of fatal poisonings according to years.

years, in order to provide further data for the characterisation of fatal poisonings in Turkey. Also this study is an attempt to expose some information, which will hopefully help lessen the number of the fatal poisonings in the future.

MATERIALS AND METHODS

In the period from January 1996 until the end of 2003, the records of the Morgue Department of the Bursa branch of the Council of Forensic Medicine of Turkey were reviewed. These records were obtained from the duplicate copies of the post-mortem archives preserved in the department for future references. They have included the chemical analysis reports, pathological reports, hospital documents, any specific documents supplied by the prosecutors, police and/or relatives, death certificates and all other

relevant documents.

Information regarding age, sex, month, year, type of poison, the scene, place of death, manner of death was recorded to a registration form and then transferred to Microsoft Excel.

Manner of death is defined as homicide, suicide, accident, and undetermined. The cases with the documents that enable to define the manner of death as homicide, suicide or accident exactly are accepted as undetermined.

Data were transferred from Microsoft Excel program into SPSS 10.0 for windows and statistical analysis were performed using it. The comparisons of the means were done by the t-test. A χ^2 test was used for contingency table analysis. Probability values <0.05 were considered significant.

Table 2. Sex distribution according to the type of poisons

Gender	Type of poison						Total
	Carbon monoxide	Insecticides	Alcohol	Drugs	Corrosives	Others	
Male	119	74	75	13	8	14	303
%	39.3%	24.4%	24.8%	4.3%	2.6%	4.6%	100%
Female	61	28	1	11	5	5	111
%	55%	25.2%	0.9%	9.9%	4.5%	4.5%	100%
Total	180	102	76	24	13	19	414
%	43.5%	24.6%	18.4%	5.8%	3.1%	4.6%	100%

$\chi^2=35.119$, $p<0.001$.

Table 3. Manner of death with respect to the type of poisons

Manner of death	Type of poison						Total
	Carbon monoxide	Insecticides	Alcohol	Drugs	Corrosives	Others	
Homicide		1					1
%		100%					100%
Suicide	3	82		15	12	2	114
%	2.6%	71.9%		13.2%	10.5%	1.8%	100%
Accident	177	5	76	6		16	280
%	63.2%	1.8%	27.1%	2.2%		5.7%	100%
Undetermined		14		3	1	1	19
%		73.6%		15.8%	5.3%	5.3%	100%

$\chi^2=349.760$, $p<0.001$.

RESULTS

From January 1996 through December 2003 a total of 4242 autopsies were done of which 415 involved poisoning, constituting 9.8% of total cases. The age was known in all except seven male cases, and ranged from 7 months to 88 years. Fatal poisonings were seen most commonly in the 40-49 year (20.3%, n: 84), 20-29 (17.6%, n: 73), and 20-29 year (17.2%, n: 71) age groups, while rarely observed in the oldest and youngest age groups (Table 1). Of the cases, 111 (26.8%) were females and 303 (73.2%) were males (Table 2). The mean age of female cases was 36.8 years (Standard deviation (SD): 22.5 years) and it was 41.3 years (SD: 18.2 years) for males ($F=8.594$, $p=0.035$).

Carbon monoxide, insecticide and alcohol poisonings were the three most common types of poison with 43.5%, 24.6% and 18.4% of poisonings, respectively. Fatal poisonings due to drugs was 5.8%, corrosives was 3.1%, and all others 4.6% (mushroom in 6 cases, volatile substances e.g. adhesive, paint thinner in 4 cases, methane in 4 cases, carbon dioxide, strychnine, ethylen glycol, arsenic in 1 case, and alcohol together with benzodiazepine in 1 case).

Homicidal poisoning was observed only in one victim. Insecticides were the cause of 71.9% of suicidal poisonings, whereas the cause of unintentional poisoning was CO in 63.2%, and alcohol in 27.1% of the unintentional poisonings (Table 3).

In the winter CO exposures were greater than other times of the year (Figure 1). The deaths were associated with coal stoves (48.3%), water heaters in bath (31.1%), fires (17.8%) and others

(2.8%, e.g. exhaust gasses, deep hole gasses).

In the summer the insecticide poisonings were greater than at other times of the year (Figure 1). The insecticide intoxications were mostly due to suicidal ingestion only one of them was homicidal and five of them were accidental. Organophosphorus insecticides were responsible for 91.1% of total insecticide poisonings followed by organochlorine compounds (6.9%) and carbamates (2%).

The third most common cause of death was alcohol poisoning (18.4%, n=76). A male dominance was seen evidently (M/F: 75/1) (Table 2); the mean age was 42.63 (SD: 11.51) years. Fatal alcohol poisoning was most frequent at 40-49 years of age. The mean blood alcohol concentration was 258.82 (SD: 102.14) mg/dl (range 69-630). Also methyl alcohol was found in 64 of them with a mean blood methyl alcohol concentration 166.92 (SD: 97.81) mg/dl (range 38-414).

73.7% of the alcohol poisonings were observed in 2000, 2001 and 2002, that cause a significant difference compared to the other years ($\chi^2=23.19$, $p<0.001$) (Figure 2). Of the methyl alcohol poisoning, 35.9% and 29.7% were seen in years 2001 and 2002, respectively. There was alcohol intake in 11.7% of CO poisonings, 11.8% of insecticide poisonings, 12.5% of the drug-related deaths, alcohol was not detected in corrosive ingestion related deaths.

The medicine responsible for death were tricyclic antidepressants in 4 victims, antipsychotics in 2 victims, narcotic analgesic, salicylate, anticholinergic and antihypertensive in one victim and the combination of tricyclic antidepressants,

benzodiazepines, antipsychotics and anticholinergics in 8 victims. The narcotic drugs responsible for death were heroin in 3 victims, morphine together with tricyclic antidepressant, morphine together with benzodiazepine in one victim, and in one victim methadone was responsible for death.

DISCUSSION

The death rate due to poisoning is 9.8% in the present study carried out in medico-legal autopsies in south Marmara region of Turkey. This result is similar to the ratio (7.1%) reported by Duman et al. (2,15) from İzmir, the Aegean region, but quite lower than the ratio (22%) reported by Salaçın et al. (16) from Adana, the Mediterranean region of Turkey.

The findings of the present study are consistent with various reports from other parts of Turkey (2-4,15-18) and the other countries (5) suggesting that the persons in the most productive ages were commonly involved in deaths due to poisoning. It may be due to the reason that a younger person is usually employed more active, more mobile and faces the challenges of life more vigorously. This makes him more susceptible to anxiety, depression and cognitive impairments and hence more prone to the activities, which lead to accidental or suicidal deaths due to poisoning.

In this study only 26.8% of the cases were females, the male dominance was seen profoundly in all kinds of manners of death and this situation reflects the fact that females are less prone to deaths due to poisoning compared to males. This situation is consistent with the other studies in our country (2,15,16). However, many hospital-based studies from our country and from those conducted in the other countries have reported that majority of patients exposed to poisoning was female (3-8,17-20)

When the deaths due to poisonings are analysed, carbon monoxide is found to be the most common type of poisoning in south Marmara region, while the insecticides are the most common poison in İzmir, the Aegean region, and in Adana, the Mediterranean region of Turkey (2,15,16). The relatively higher incidence of carbon monoxide intoxication in this study was resulted from the cases that are found to be exposed to carbon

monoxide originating from stove smoke driven back from chimneys by strong southwest wind, which is a common experience in our region. Also the main source for unintentional carbon monoxide-related deaths was domestic coal stoves. For this reason most of the deaths due to CO poisoning in our region are preventable. It is pointed out that the utilisation of detectors and education hinder CO poisoning (21). So efforts need to be directed at reducing the underlying socio-medical causes in our region. The majority of the unintentional deaths due to poisoning were related to carbon monoxide in our region. In recent years, carbon monoxide poisoning was reported as a new method of suicide in Hong Kong by intentional burning charcoal in a confined space (22). It was also reported that the most common method of suicide with CO was by motor vehicle exhaust gases (23,24).

This is different from most other methods, in which attempts outnumber successes (25). The frequency of this method has been attributed to the news coverage such deaths draw and the popularity of hatchback cars, which require a shorter hosepipe. The frequency of suicide by motor vehicle exhaust gases has led to it being described as the modern self poisoning method (26). Also unintentional carbon monoxide-related deaths due to flueless gas-fueled water-heating appliances were reported (27). The distribution of carbon monoxide-related deaths in the years over this period was uniform with the ratio to all autopsies between 3.6% and 5.4%, but it was most common in winter in our region. Non-intentional poisonings are highly correlated with the winter months (23). Wilson et al. (23) reported that in England up to 1992 the number of suicides with motor vehicle exhaust gases increased steadily, but in that year the rate of suicides with motor vehicle exhaust gases dropped due to increase in the percentage of the United Kingdom car fleet with catalytic converters fitted almost 10 contemporaneously.

Acute pesticide poisoning is recognized as a problem confined to the developing countries. Due to the economical importance of agricultural production in our region, as well as whole Turkey, insecticides are used in large quantities for intensive land cultivation. According to

our study, organophosphorus insecticides were responsible for majority of the insecticide poisonings, and in suicidal poisonings, insecticides were the major killers and constituted 71.9% of total deaths. Poisoning with organophosphorus insecticides was also the primary agent in Tehran, Sri Lanka, Jordan and Taiwan (9,28-30). In Yucatan, Mexico; Tokyo, Japan; Sevilla, Spain; San Fernando, Trinidad; in the central of Portugal pesticide poisonings were the major cause of death (10,11,31-34). However, in England and Wales pesticides were responsible for only 1.1% of fatal poisonings, but organophosphates were the most commonly involved insecticide (35).

Alcohol is most commonly abused drug in many countries and has so much association with forensic medicine that it has been considered primarily to all other substances. Its abuse is a prime factor in many accidents and the majority of unnatural deaths are catalyzed by alcohol intake. In this study alcohol-related deaths occurred in 76 cases within the age group of 30-49 year having the highest number of cases.

Methanol is readily available from many commercial products. Poisoning with methanol may be the result of either accidental or intentional ingestion. Desperate alcoholics have intentionally substituted methanol-containing substances for ethanol, in spite of being aware of its potentially harmful effects. Methanol poisonings are rare and are generally reported as case reports but in Turkey methanol poisonings are a major problem (36). While several large epidemics have been reported (37-39), we have only sporadic cases within the 8-year study. Methanol-related deaths were frequent in our region with a 15.5% (n=64) among the fatal poisonings; they were all unintentional. In our region as well as whole Turkey, alcoholics are in low socio-economic status. Increase of methyl alcohol poisonings in the last years was perhaps because of the alterations in the economic status of people due to the economic crisis. The economic crisis in year 2000 affected the people heavily in Turkey and one of the effected groups was the heavy drinkers, who might have drunk cologne and grain alcohol because of their cheapness, which can have quantities of

methyl alcohol in it.

Fatal poisonings due to drugs is a common problem worldwide. Increasing fatal poisonings due to drugs has been documented in many studies (40-45). The distribution of drugs causing fatal poisonings varies depending on the region. In Nordic countries poisoning among drug addicts take the first place in fatal poisonings (46,47). Steentoft et al. (46) reported that the greatest number of drug addict deaths in Nordic countries was seen in Denmark, followed in descending order by Norway, Sweden, Finland and Iceland. In Denmark, Norway and Sweden heroin and morphine was the most frequently encountered drug (47). In our study, drug related deaths were relatively low (5.8%), and the most common cause of drug-related deaths was suicidal intake of therapeutic drugs.

In conclusion, in fatal poisoning cases who have undergone medico-legal autopsy in Bursa and province, CO is the most common reason. We think that these accidental deaths due to poisoning may be prevented by means of precautions to be taken and education.

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