ORIGINAL ARTICLE

Forensic analysis of suicide mortality in Sohag governorate (Upper Egypt) in the period 2005–2009

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KEYWORDS
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Sohag governorate;
Toxicological screening

Abstract  Background: Suicide is a self-inflicted death and complex human behavior with biological, sociological, and psychological roots. It is ranking among the top ten causes of death for individuals of all ages in most developed countries.

Materials and methods: In the present study, a retrospective evaluation of suicide cases in the Sohag Governorate, Upper Egypt was done. Data were collected from the cases of suicidal deaths in the period 2005–2009. Data on suicide incidence, age, gender, residence, education level, marital status, methods of suicide, toxicological analysis, seasonal variation and motive of suicides were collected. All data were statistically analyzed.

Results: The total number of cases was 42, the majority was female and the rate of suicidal deaths ranged from 0.16–0.35 per 100,000 populations. High prevalence was found in age group 15–30 years in both males and females and represented 57.1% of the total number of cases. The prevalence was higher in rural (83.3%), non-educated (81.0%) and single (69.0%). Poisoning was the most common method of suicide in both sexes, and represented 78.6% of the total suicidal deaths. The majority of suicidal deaths were highest in winter (45.2%) and summer (42.9%) in both genders and lowest in autumn 4.8%. The motive was unknown in 57.1%, psychological problems were reported in 31.0% and financial troubles in 11.9%.

Conclusion: Suicide rate in Sohag governorate is much lower than in other areas worldwide but still considered a grave problem and should be given high priority with regard to prevention. Psychological autopsy is needed in suicidal cases.

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1. Introduction

The definition of suicide is a self-inflicted death that is intentional rather than accidental. It is a complex human behavior with biological, sociological, and psychological roots.1,2 It may be seen in every community, from an average person reacting to stressful life conditions, to patients with severe mental health disorders. Suicide is still a very controversial matter,
due to it being one of the main reasons for death in recent years.\(^6\) Every year, almost one million people die as a result of suicide, with a mortality rate of about 16 per 100,000, which means that one death occurs every 40 s.\(^5\) Suicide is ranking among the top ten causes of death for individuals of all ages in most developed countries.\(^6\) It is believed that the most dramatic increase in suicide mortality will be observed in the Third World countries. This is because the socioeconomic and behavioral factors of suicide risk are present in a higher degree than in developed countries.\(^7\) Demographic features like age group, sex and method of suicide may exhibit variations between societies and between different regions of the same country, and even in the same region, depending on various variables.\(^8\) The most important problem in Egypt is that there is no data bank for suicide cases. This causes the suicide problem to be underestimated and, thus, neglected by the government, although this problem seems to be universal.\(^9\)

### 1.1. Aim of the study

The aim of the current study is to describe the medicolegal aspects of suicide mortality in the Sohag governorate, Upper Egypt, regarding the extent and demographic features like age group, gender, method of suicide, seasonal variation and motive of suicide.

### 2. Materials and methods

This study was conducted as a retrospective study on suicidal cases in the Sohag governorate, Upper Egypt, in the period 2005–2009. Autopsy reports of the cases identified as suicidal in the Forensic Medicine department, Ministry of Justice in the Sohag governorate from 2005 to 2009 were reviewed. Data on suicide incidence, age, gender, residence (urban or rural), education level, marital status, methods of suicide, toxicological analysis, seasonal variation and motive of suicides were collected. The Forensic Medicine department reports include full autopsy and toxicological analysis for the cause of death to differentiate between cases of homicidal, suicidal, or accidental cause of death. Doubtful cases regarding suicide or homicide were excluded. This study was approved by the Faculty Ethics Committee.

#### 2.1. Statistical analysis

Data were computed and analyzed using SPSS (Statistical Package of Social Sciences) version 9.0. The data were expressed as frequencies and mean ± SD. Chi square test was used to compare percentages and means were compared by T-test. \(P\) value was considered significant at level < 0.05.

### 3. Results

During this period, 42 cases were determined to be suicidal (7.34%) out of the 572 cases autopsied in the course of the five year study at Sohag Forensic Medicine department, Ministry of Justice. The distribution of cases with respect to the annual number of autopsied cases and rate of suicide is shown in Table 1 and Fig. 1. The highest percentage of suicide was in 2005 (12.4% of the total number of cases) compared to the least percentage in 2009 (5.0%), i.e. there was a fluctuating trend of suicide in the Sohag governorate and the relation between the years is not significant \(P = 0.246\) with a rate ranging from 0.16 to 0.35/100.000 population. Of these, the total number of males was 13 (31.0%) while females were 29 cases, (69.0%). The mean age of male and female victims was 35.9 and 25.6 respectively.

The highest number of cases of both genders was in the age group between 15 and 30 years, (57.1%), also the highest number of male and female deaths was in this group (46.2% of males and 62.1% of females). There was no case aged lower than 15 years and the number of the cases in the age groups over 60 years was the lowest \((n = 2\), 4.8%), as shown in Table 2 & Fig. 2. There is no significant relationship between age group and sex of those committing suicide \((P\) value = 0.202).

The number of cases was higher in rural \((n = 35\), 83.3\%) than urban residence \((n = 7\), 16.7\%) of the studied cases; also, the number of cases was higher in non-educated \((n = 34\), 81.0\%) than educated \((n = 8\), 19\%) and in single \((n = 29\), 69.0\%) than married \((n = 13\), 31.0\%). There is no significant relationship between residence, education or marital status and gender of the studied cases \((P = 0.455, 0.195\) and 0.460 respectively), Table 3.

Suicide by poisoning was diagnosed in 33 cases (78.6%) and the majority of them were female \((n = 26\), 89.7\%). These were followed by hanging compromising 7 cases (16.7\%), 5 of them were male (38.5\%) and 2 female (6.9\%). Suicide by burning and drowning was diagnosed in one case (2.4%) for each. The relationship between gender and method of suicide was significant \((P = 0.023\), Table 4 & Fig. 3.

Toxicological screening of the poisoned victims revealed that the most common toxins used are carbamate (48.5\%), Paraphenylene diamine (PPD) (33.3\%) and organophosphorus compounds (9.1\%). Other toxins were aluminum phosphide, zinc phosphide and parakion, Table 5 & Fig. 4.

The majority of suicidal deaths were highest in winter \((n = 19\), 45.2\%), followed by summer \((n = 18\), 42.9\%), spring \((n = 3\), 7.1\%) and autumn \((n = 4.8\%). There is no significant relation between season and gender of the studied cases \((P = 0.252\), Table 6 & Fig. 5.

The motive of suicide was unknown in 24 cases (57.1\%), 8 of them were male (61.5\%) and 16 female (55.2\%); Psychological problems were reported in 13 cases (31.0\%), 3 of them were male (23.1\%) and 10 female (34.5\%); and financial troubles in 5 cases (11.9\%), 2 of them were male (15.4\%) and 3 female (10.3\%). The relationship between the motive and gender of the studied cases was not significant \((P = 0.729\), Table 7 & Fig. 6.

<table>
<thead>
<tr>
<th>Years</th>
<th>Total number of autopsied cases</th>
<th>Suicidal cases</th>
<th>Suicide rate per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>105</td>
<td>13</td>
<td>12.4</td>
</tr>
<tr>
<td>2006</td>
<td>119</td>
<td>6</td>
<td>5.04</td>
</tr>
<tr>
<td>2007</td>
<td>102</td>
<td>9</td>
<td>8.8</td>
</tr>
<tr>
<td>2008</td>
<td>125</td>
<td>8</td>
<td>6.4</td>
</tr>
<tr>
<td>2009</td>
<td>121</td>
<td>6</td>
<td>5.0</td>
</tr>
</tbody>
</table>

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Table 1: Distribution of suicidal cases by years and total number of autopsied cases in the Sohag governorate.

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Table 2: Distribution of suicidal cases by years and total number of autopsied cases in the Sohag governorate.
The average rate of suicide during the study period ranged from 0.16 to 0.35 per 100,000 persons. The rate is substantially higher than 0.1 per 100,000 persons reported by the WHO for Egypt in 1987. This may be explained by the effect of increasing depression among people, which may be aggravated due to social problems such as unemployment and spinsterhood. An additional factor that may aggravate the state of depression in youth, especially among males in our area, is the increase in drug abuse among youth, which is difficult to explain: does the depression lead them to use these drugs or does the drug abuse increase depression? This idea is supported by the work of Yassa et al., (2009) who indicated that bango (cannabis leaves), a commonly abused drug, was widely spread among youth in Upper Egypt, concentrated in the age group between 21 and 31 years, which is the same age group that has the highest suicide rate.

By comparing the suicide rates in Sohag to other studies in Egypt e.g. Assuit 0.55–0.81 for the period, 2005–2009, Port Said 1.66–2.41/100,000 for the period 1998–2004, Cairo 0.47–0.74/100,000 for the period 2003–2007, it is noticed that the rate of suicide in Sohag is lower than other areas. This variation can be explained by the difference in number of population, different cultural and socioeconomic levels in Sohag and other studied areas as well as the possibility of underestimation of the number of suicides due to a lack of adequate surveillance and misclassification.

The rate of suicide in Sudan was less than one/100000, 2.1/100000 in Jordan for the period 1980–1985, 4.42/100,000 in Turkey for the year 1999, 13.4/100,000 in Canada for the period 2003–2004 year, 11.5 for 2007 and 12.0/100000 for 2009 in USA and even 23/100,000 for 1992 in Canadian northwest territories. In the United Kingdom, suicide rate ranged from 16.5–17 for males and 5.0–5.4 for females in the period 2006–2010. In china, the annual rate of suicide is 23/100000. We can see the lower rates in Sohag compared to the other studies. The fact that the suicide rate is still lower than that of other countries may be explained by the effect of religion and the good relations between family members throughout the country, especially in Upper Egypt. This idea is supported by the work of Setenay et al., (2007) who reported that religion plays a great role, especially with respect to a belief in an afterlife, which averts feelings of hopelessness, a feeling that has been described as an important predisposing factor for suicide. The relation of high religious affiliation to low suicidal rate is documented. Religion plays a great role in giving people defenses against isolation or alienation.
are considered criminal offenses. Furthermore, in general, Islam forbids suicidal behavior. Dervic et al., 2004 reported that religious affiliation is associated with less suicidal behavior. After other factors were controlled, it was found that greater moral objections to suicide and lower aggression level in religiously affiliated subjects may function as protective factors against suicide attempts. Comparing the Religiosity Index scores of 67 countries with suicide statistics published in 2007 by the World Health Organization reveals a clear pattern: In countries where most people are highly religious, suicide rates are dramatically lower than in countries where most people are not religious. It is possible that religion serves as an antidote to the lack of purpose that can make a desperate act such as suicide seem appealing. Believing in something bigger than oneself may allow some people to hold onto life in a world where people without such a belief sometimes give up all hope. Another possibility is that some religious people may believe that committing suicide jeopardizes their security in an

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male (n = 13)</th>
<th>Female (n = 29)</th>
<th>Total (n = 42)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>No.</td>
</tr>
<tr>
<td>Residence</td>
<td>Rural</td>
<td>10</td>
<td>76.9</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Urban</td>
<td>3</td>
<td>23.1</td>
<td>4</td>
</tr>
<tr>
<td>Education</td>
<td>Educated</td>
<td>4</td>
<td>30.8</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Non educated</td>
<td>9</td>
<td>69.2</td>
<td>25</td>
</tr>
<tr>
<td>Marital status</td>
<td>Single</td>
<td>10</td>
<td>76.9</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Married</td>
<td>3</td>
<td>23.1</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 3 Distribution of studied cases according to residence, education and marital status in relation to gender.

<table>
<thead>
<tr>
<th>Mode of suicide</th>
<th>Gender</th>
<th>Male (n = 13)</th>
<th>Female (n = 29)</th>
<th>Total (n = 42)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
</tr>
<tr>
<td>Poisoning</td>
<td>7</td>
<td>53.8</td>
<td>26</td>
<td>89.7</td>
<td>33</td>
</tr>
<tr>
<td>Hanging</td>
<td>5</td>
<td>38.5</td>
<td>2</td>
<td>6.9</td>
<td>7</td>
</tr>
<tr>
<td>Burn</td>
<td>0</td>
<td>0.0</td>
<td>1</td>
<td>3.4</td>
<td>1</td>
</tr>
<tr>
<td>Drowning</td>
<td>1</td>
<td>7.7</td>
<td>0</td>
<td>0.0</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 4 Distribution of suicide according to method and gender.
Figure 3  Methods of suicide in the Sohag governorate in the period 2005–2009.

Table 5  Distribution of suicide cases according to poisoning and gender.

<table>
<thead>
<tr>
<th>Poison</th>
<th>Male (n = 7)</th>
<th>Female (n = 26)</th>
<th>Total (n = 33)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.  %</td>
<td>No.  %</td>
<td>No.  %</td>
<td></td>
</tr>
<tr>
<td>Carbamate</td>
<td>5  71.4</td>
<td>11  42.3</td>
<td>16  48.5</td>
<td>0.221</td>
</tr>
<tr>
<td>Paraphenylene diamine (PPD)</td>
<td>1  14.3</td>
<td>10  38.5</td>
<td>11  33.3</td>
<td></td>
</tr>
<tr>
<td>OPP</td>
<td>0  0.0</td>
<td>3   11.5</td>
<td>3   9.1</td>
<td></td>
</tr>
<tr>
<td>Aluminum phosphide</td>
<td>1  14.3</td>
<td>0   0.0</td>
<td>1   3.0</td>
<td></td>
</tr>
<tr>
<td>Zinc phosphide</td>
<td>0  0.0</td>
<td>1   3.8</td>
<td>1   3.0</td>
<td></td>
</tr>
<tr>
<td>Parkinol</td>
<td>0  0.0</td>
<td>1   3.8</td>
<td>1   3.0</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4  Toxins used in suicide in the Sohag governorate in the period 2005–2009.

Table 6  Distribution of suicide cases according to seasonal variation and gender.

<table>
<thead>
<tr>
<th>Season</th>
<th>Male (n = 13)</th>
<th>Female (n = 29)</th>
<th>Total (n = 42)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.  %</td>
<td>No.  %</td>
<td>No.  %</td>
<td></td>
</tr>
<tr>
<td>Winter</td>
<td>4  30.8</td>
<td>15  51.7</td>
<td>19  45.2</td>
<td>0.252</td>
</tr>
<tr>
<td>Spring</td>
<td>2  15.4</td>
<td>1   3.4</td>
<td>3   7.1</td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>7  53.8</td>
<td>11  37.9</td>
<td>18  42.9</td>
<td></td>
</tr>
<tr>
<td>Autumn</td>
<td>0  0.0</td>
<td>2   6.9</td>
<td>2   4.8</td>
<td></td>
</tr>
</tbody>
</table>
afterlife. Alternately, the human connections that people typically forge in religious groups may serve as a buffer against suicide.  

In addition to religious affiliation, low suicidal rate may also be due to the possibility of misclassification of suicide as an accidental death because of the Islamic proscription against suicide. Nations with low suicide rates are often suspected of covering up suicides by labeling them as natural, accidental or undetermined. Suicide rates are lower in religious countries than in secular ones and this may be due to underreporting in religious countries because of concerns over stigma. Yet, some of the differences may be real, although it is not known whether the negative association between religion and suicide is due to its integrative benefits (such as social cohesion) or to the moral imperatives of religious belief, given its prohibitions against suicidal behavior.

The present study showed that there were gender differences in suicide rates. It was higher in females than males and predominant in singles (69.0%) than married. This may be explained by the increasing stress on females because of the traditions and increased spinsterhood, mainly in Upper Egypt. Marriage was found to have a preventive factor in attempted suicide. It is possible that suicides are underreported or misclassified when they occur in families with strong religious ties, it is also possible that single women and men have fewer such ties and thus their suicides are over-represented in these data.

These results matched with those of Yip et al., (2000) and Phillips, et al., (2002) and disagreed with those of other studies that there was a higher suicide risk in men than in women, as they are more susceptible to anxiety and depression. Hawton (2000) stated that the suicide rates in most countries are higher among males than in females, except for China, which has very high rates of suicide in females, especially in rural areas. This is explained by the fact that females seek help for psychological problems more than males.

The age distribution for males and females appeared to be in the age range of 15–29 years. This is the age of youth and
work in males and, in females, the age of reproduction. So when youth faced problems as a decrease in the chance of working and the chance of marriage in females, they were pushed to commit suicide. This result is supported by that of Gad ElHak (2009)\textsuperscript{11} in PortSaid, Abdel Monem et al., (2011)\textsuperscript{9} in Assuit and Taha et al., (2011)\textsuperscript{12} in Cairo, who demonstrated that suicide rate was the highest in the age group of 20–30 years. The suicide rate decreased as age increased among males and females, which can be explained by the increase in the level of responsibility of males and females toward their families.

Regarding the residence, the present study showed that the rate of suicide is higher in rural residence than urban. This may be explained by the increasing stress, poverty and unemployment on people living in rural areas mainly in Upper Egypt. These results matched those of Yip et al., (2000)\textsuperscript{34} and Philips et al., (2002)\textsuperscript{21} who stated that in rural areas of China (Beijing), suicide rates are about three times higher than in urban areas increasing to almost 5-fold in women in the age-group of 25–34 years.

The seasonal variation of suicides is a well-documented phenomenon in the medical literature. The present study showed that there were differences in suicide rates in different seasons, with the highest rate in winter (45.2%) followed by summer (42.9%) and the lowest rate in spring and autumn (7.1%, 4.8% respectively). Durkheim (1970)\textsuperscript{42} found that the incidence of suicide was at its highest during spring or early summer and at its lowest during winter. This finding has been confirmed in numerous subsequent studies both from Northern\textsuperscript{41–46} and Southern Hemisphere countries.\textsuperscript{47,48} Durkheim (1970)\textsuperscript{42} explained that the seasonal variation in suicides was due to seasonal changes in the intensity of communal life and activity. Following this suggestion, one would expect a larger seasonal variation in the course of life in rural communities than in urban areas.

Several studies have indicated that the existence of seasonal variations in various peripheral and central aspects of serotonergic (5-hydroxytryptamine, 5-HT) function, 5-hydroxyindoleacetic acid concentrations (5-HIAA) in the cerebrospinal fluid (CSF), 5-HT levels in the hypothalamus, neuroendocrine responses to 5-HT agonists, and plasma concentrations of L-tryptophan (L-TRP) all of which may be involved in the seasonal variations of suicides.\textsuperscript{39,50}

The method of suicide among males differed from that of females, the main cause of death in males was toxins (53.8%), followed by hanging (38.5%), and drowning (1.7%), while in females, the distribution of causes of death was as follows: toxins (89.7%), followed by hanging (6.9%) and burns (3.4%). This can be explained by the differences in the personality characteristics between males and females, as males mostly chose more violent methods of suicide. These results differ from those of the WHO record, which classify the methods of suicide in different countries according to the WHO mortality database, finding that, in most of the studied countries (not including Egypt), hanging was the most frequent cause of suicide among males, followed by firearm injuries and poisoning.\textsuperscript{21}

In the present study, the most common toxin used for suicide among males and females was carbamate compromising (48.5%), followed by PPD (33.3%), organophosphates (9.1%), and Aluminum phosphide, zinc phosphide and parkinol (3.0% each). Jaga and Dharmani (2007)\textsuperscript{52} found that there was a relation among populations exposed to organophosphates, with respect to neurobehavioral effects, depression, suicide, and death. Furthermore, London et al. (2005)\textsuperscript{53} found that suicide rates were high in farming populations. They found that exposure to organophosphates led to serotonin disturbances, which are implicated in depression and suicide.

5. Conclusion and recommendations

It is to be concluded that suicide rate in the Sohag governorate is much lower than other areas worldwide. However, it is still considered a grave problem and should be given high priority with regard to prevention and also calls for more researches on social, life circumstances of these groups. It is also concluded that psychological autopsy is needed in suicidal cases. It is to be recommended to keep the poisonous substances out of the reach of any person with a history of psychological problems, financial troubles or previous suicidal attempts.

References

16. Seguin M, Lesage A, Chawkny S. Suicide cases in New Brunswick from April 2002 to May 2003: the importance of better recognizing


