

# Outbreak of methanol fatalities in Jordan

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# الوفيات الناجمة عن التسمم بالكحول

## المثيلي في الأردن

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## الملخص

**هدف الدراسة :-** إستقصاء حالات التسمم بالكحول الميثيلي في المركز الوطني للطب الشرعي والأقسام التابعة له .

**طرق البحث :-** تم دراسة 1388 حالة (تشريح) تم الكشف عليها في المركز الوطني للطب الشرعي خلال الفترة من كانون ثاني وحتى نهاية شهر كانون اول من عام 2006م . ومن خلال التقارير الطبية القضائية وتقارير السموم تم معرفة الحالات التي لها علاقة بالوفاه نتيجة الكحول الميثيلي. وتم دراسة الحالات من حيث العمر والجنس وظروف الوفاة والدخول الى المستشفى وتركيز الكحول الميثيلي بالدم .

**النتائج :-** أظهرت الدراسة حدوث 17 حالة وفاة نتيجة التسمم بالكحول الميثيلي وكانت معدل الوفيات 0.3 لكل 100000 حالة . جميع الوفيات حدثت في الربع الأخير من العام 2006 وجميعهم من الذكور أعمارهم تتراوح بين 24- 56 عام ( معدل 36عام ) . من بين هذه الحالات 4 تم ادخالها الى المستشفى قبل الوفاة و 11 حالة وجدت متوفية وحالتان تم احضارهما الى المركز الوطني نتيجة حوادث سير قاتلة . كان تركيز الكحول الميثيلي في هذا الحالات ذو مدى واسع يتراوح بين 46-645 و بمعدل 306 ملغ/ 100مل . ولم يتم العثور على الكحول الميثيلي او الى ادوية أخرى .

**الإستنتاجات :-** حيث أن تناول الكحول في إزدیاد في المجتمع الأردني فإن حدوث وفيات نتيجة التسمم الكحولي متوقعا . وهناك نقص في المعرفة والمعلومات المترتبة على تناول الكحول الميثيلي تتطلب يقظة طبية وقضائية وتعليمية للتعامل مع هذه الحالات لانقاذ الأرواح والقضاء على هذه الظاهرة .

**الكلمات الدالة :-** الكحول الميثيلي ، الوفيات ، الأردن

## **Outbreak of methanol fatalities in Jordan**

## **Abstract**

**Aim:** To investigate methanol poisoning from perspective at the National Institute of Forensic Medicine and affiliated departments.

**Methods:** From 1<sup>st</sup> January 2006 to 31<sup>st</sup> December 2006 a total number of 1388 autopsies were carried out at the National Institute of Forensic Medicine, the medico legal and toxicology reports were probed for methanol related deaths. Variables abstracted include age, sex, circumstances of death, admission to hospital, principle cause of death, and blood methanol concentration in mg/100ml.

**Results:** 17 cases of fatal methanol intoxication were reported, representing a mortality rate of 0.3 per 100,000. All the deaths occurred in the last quarter of the year 2006, and all victims were males. The Major outbreak of 11 cases (64.7%) occurred in October. The victims mean age was 36 years (24-56 years), the age group 21-30 years accounted for 35.3% of the total cases. Eleven cases were found dead, 4 were admitted to hospital before death and 2 cases were brought to the forensic medicine institution due to fatal road traffic accident. Methanol concentration ranged from 46 to 645 mg/100ml (mean 306 mg/100ml), no ethanol or drugs of abuse were detected.

**Conclusion:** As alcohol intake propagates within Jordanian community, a significant increase in the number of fatal alcohol poisoning is expected. Jordanian society lacks the knowledge regarding the grave consequences of methanol intoxication. A prompt medical, legal and education plan should be implemented as soon as possible to save lives, as eradicating poisoning outbreaks requires time.

**Key words:** methanol; fatality; Jordan

## **Introduction**

Methanol (methyl alcohol) is a widely used industrial solvent. It is available as a constituent of some antifreeze solutions, various paints, varnishes, gasoline additives and ethanol denaturants <sup>1</sup>. Exposure can occur accidentally at home or in the workplace, but more commonly intentional <sup>2</sup>. Sporadic outbreaks of methanol poisoning occur in developing countries from adulterated ethanol or methanol mistaken as ethanol <sup>3</sup>.

In Jordan some alcoholic drinkers consume (75% v/v alcohol) as alternative to usual alcoholic drinks because of its cheap cost. From Sept 2006, cases of methanol intoxication were detected for the first time.

Retrospective review of deaths over a four year period was done in an attempt to identify previous outbreaks; no similar attacks of fatal intoxication were reported. Review of Jordanian medical literature regarding fatal alcohol toxicity revealed two articles addressing the fatal poisoning of alcohols and drugs with no data regarding methanol fatalities <sup>4,5</sup>.

## **Materials and methods**

From 1 January 2006 to 31 December 2006 a total number of 1388 autopsies were carried out at the National Institution of Forensic Medicine (NIFM), the database were manually reviewed from the archive searching for all poison-related and alcohol-related deaths, cause of death on each case was determined by the medico legal reports. Postmortem toxicology results were reviewed, head space Gas Chromatography – Flam Ionization Detector (GC-FID) was used for the detection of alcohols as described in below. Cases of fatal methanol intoxication have been identified; all the postmortem reports were manually reviewed using a standardized data collection form. Variables abstracted included age, sex, circumstances of death (sudden death, coma, and road traffic accident), admission to hospital, and principle cause of death.

Alcohols in blood were analysed on Shimadzu model 2010 series Gas Chromatography-flame ionization detector (GC-FID) equipped with a Shimadzu model AOC-5000 Headspace Sampler. The chromatographic column was Meta wax (30 x 0.25mm ID, with film thickness 0.25 $\mu$ m), it was kept Initially at 40 °C for 1 minute, then the temperature was increased up to 110°C by increases of 8 °C per minute, and it was kept at this temperature for 2 min. The injector and detector temperature were 200 and 240 °C respectively, Helium was used as a carrier gas (1.2 ml/min.).

## Results

The total number of medico legal autopsies carried out in 2006 was 1388, methanol was detected in the blood of seventeen cases (1.2%) representing a mortality rate of 0.3 per 100,000 (Jordanian population in 2006 was 5.9 million). On analysis, all the cases were found to be males, mean age was 36 years (range 24-56 years). The highest number of cases occurred in those age group 21-30 years (6 cases, 35.3%) followed by the age group 31-40 years (5 cases, 29.4%), 41-50 years (4 cases, 23.5%) and (2, 11.7%) in the age group 51-60 years. It was found that no fatal poisoning in adults age of 60 years and above and at 20 years and below. All the victims were Jordanians except one. All the deaths occurred in the last quarter of year 2006 with a significant number of cases reported in September (3 cases, 17.6%), the highest number of cases appeared in October (11 case, 64.7%) then a significant decrease to (2, 11.6%) in November and only one case in December. Eleven cases (64.7%) were found dead on the scene, four cases (23.5%) were admitted to hospital in coma state and died there and two cases presented as fatal road traffic accident (RTA) (Table1). The cause of death was as follows; in 14 victims (82.4%) methanol intoxication was the cause of death, in the remaining 3 victims (17.6%) methanol intoxication was regarded as a contributing factor in the cause of death.

Blood methanol concentrations are presented in Figure 1, the lowest was 46 mg/100ml and the highest was 645 mg/100ml (mean 306 mg/100ml). In 15 cases (88%) methanol concentration was > 80 mg/100ml. No ethanol or other drugs of abuse were detected, except in one case in which ibuprofen was detected.

## Discussion

Methanol poisoning is a potentially fatal medical emergency because of its metabolism to formic acid<sup>6</sup>. Formic acid accumulates and there is a direct correlation between the formic acid concentration and increased morbidity and mortality<sup>7</sup>. Since the toxic effects are caused by the metabolites rather than methanol itself, there is often a substantial delay between ingestion and onset of clinical toxicity<sup>8</sup>. The mortality and morbidity rates remain very high despite intensive therapy<sup>9</sup>.

In this article comprehensive analysis of fatal methanol intoxication cases was studied, which constituted 1.2% of all medico-legal autopsies performed in 2006. All the cases were males, such finding was not surprising since habitual consumption of alcohol is mainly by males in the Jordanian society, our finding is in agreement with other studies with male predominance<sup>10-13</sup>. Studies in the developing countries reported that methanol related deaths occurred mostly in the age group of 30-40 years<sup>11, 12, 14</sup> and 41 - 45 years<sup>10</sup>, while in developed countries deaths due to methanol was highest among persons aged 35-54 years<sup>15, 16</sup>. In our study the age group mostly affected was 21-30 years (35.3%) followed by the age group 31-40 years (29.4%). This finding indicates that young Jordanians are more vulnerable to methanol fatal intoxication even when compared to other developing countries<sup>10, 14</sup>. Although alcohol is legally marketed in Jordan, Jordanians disapproves the alcohol intake due to religious and social reasons, as a result their experience with alcohols is very limited and when they start their early twenties they are most likely unaware of the danger of methanol and the adulteration of spirits. As in most outbreaks, obtaining a cheap source of alcohol is quite a common cause of methanol fatalities especially in those who have a low income.

A high percentage of cases (11cases, 64.7%) were found dead and only 4 cases (23.5%) were brought to medical attention at various stages of intoxication and admitted to hospital, while in other studies <sup>13, 10</sup> a significant lower percentage ( 44.2% and 44.4% ) were found dead and ( 55.8% , 55.6% ) of cases were admitted to hospital respectively. Such low percentage of hospital admission in our cases could be attributed to the lack of Jordanian experience with methanol intoxication and also to the fact that serious symptoms of methanol intoxication usually appear in a later stage, therefore victims continue to consume the alcoholic (methanol) beverage until they realize the intoxication symptoms and in most cases it is too late for admission to hospital.

It is known that the delay in admission to hospital and late diagnosis are still the main causes of high mortality in methanol poisoning <sup>17</sup>, the four cases admitted to hospital the patients died before the cases were diagnosed as methanol intoxication. It is important for physicians, to be aware of methanol poisoning symptoms<sup>10</sup>. In a previous study carried out in Jordan addressing the capabilities of emergency physicians in the diagnosis of ethanol intoxication, the study showed that physicians do misjudge and misdiagnose ethanol poisoning <sup>18</sup>.

The methanol concentrations in our study were ranged from 46 to 645 mg/100ml. In the literature, the minimal reported lethal blood methanol concentration is approximately 80 mg/100ml <sup>3</sup>. In 15 cases (88%) blood methanol concentration were above 80 mg /100ml, similar to those reported in the literatures<sup>10, 14</sup>, and in 13 cases methanol intoxication was the cause of death, while in the remaining two cases

methanol intoxication was considered as a contributing factor or indirect cause of death.

In most reported methanol related deaths, ethanol was present in a high percentage of cases 44%<sup>10</sup> and 27.7%<sup>14</sup>, and in a lower percent in other studies 13.7%<sup>17</sup> and 10.6%<sup>3</sup>. While in our study methanol was detected only during the analysis, with no ethanol. In one of the crime scene investigation in which four cases of fatal methanol poisoning, antiseptic bottles around victims. Extended search revealed that all victims obtained methanol from illicit street sources, methanol was sold as ethanol in re-used antiseptic bottles which are normally present in pharmacy (75% v/v ethanol).

## **Conclusion**

Alcohol intake is a sensitive issue for social and religious reasons within the Jordanian community in the past, nowadays alcohol intake is more acceptable among a large group of Jordanians leading to an increase in the number of alcohol intoxication and fatalities. Forensic pathologists should include methanol in their toxicology screen in all negative autopsy cases, while emergency physicians should investigate the presence of methanol especially in patients presenting with coma and severe acidosis. The study showed that Jordanian society lacks the knowledge regarding the grave consequences of methanol intake whether intentional or accidental, and the availability of methanol in illicit alcohol preparations (antiseptics, black market drinks or drinks unknown manufacturer). Education program should be developed as a preventive measure as soon as possible such interventions are simple and inexpensive and the potential benefits of save lives. Medical and legal authorities should also be aware of this problem and be prepared for new outbreaks which might occur in the near future or is occurring while this article is in preparation.

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Table 1

Demographic characteristics, blood methanol concentrations and outcome in methanol poisoning

No.	Age	Sex	Conc. of methanol	Cause of death	Notes
1	35	Male	645 ±32.2mg/dl	Methanol	Admitted to hospital (coma)
2	42	Male	61±3.0 mg/dl	Methanol	Admitted to hospital (coma)
3	29	Male	220±11.0 mg/dl	Hemo-Pericardium	Admitted to hospital (coma)
4	31	Male	172±8.6 mg/dl	Methanol	Admitted to hospital (coma)
5	53	Male	128±6.4 mg/dl	Brain Hemorrhage	Presented as case of fatal road traffic accident
6	29	Male	46±2.3 mg/dl	Multiple Injury	Presented as case of fatal road traffic accident
7	25	Male	106±5.3 mg/dl	Methanol	Found dead
8	38	Male	500±25 mg/dl	Methanol	Found dead
9	44	Male	106±5.3 mg/dl	Methanol	Found dead
10	29	Male	421±21 mg/dl	Methanol	Found dead
11	26	Male	398 ±19.9mg/dl	Methanol	Found dead
12	43	Male	328±16.4 mg/dl	Methanol	Found dead
13	35	Male	638±31.9 mg/dl	Methanol	Found dead
14	24	Male	248±12.4 mg/dl	Methanol	Found dead
15	33	Male	325±16.2 mg/dl	Methanol	Found dead
16	43	Male	619±30.9 mg/dl	Methanol	Found dead
17	56	Male	250±12.5 mg/dl	Methanol	Found dead

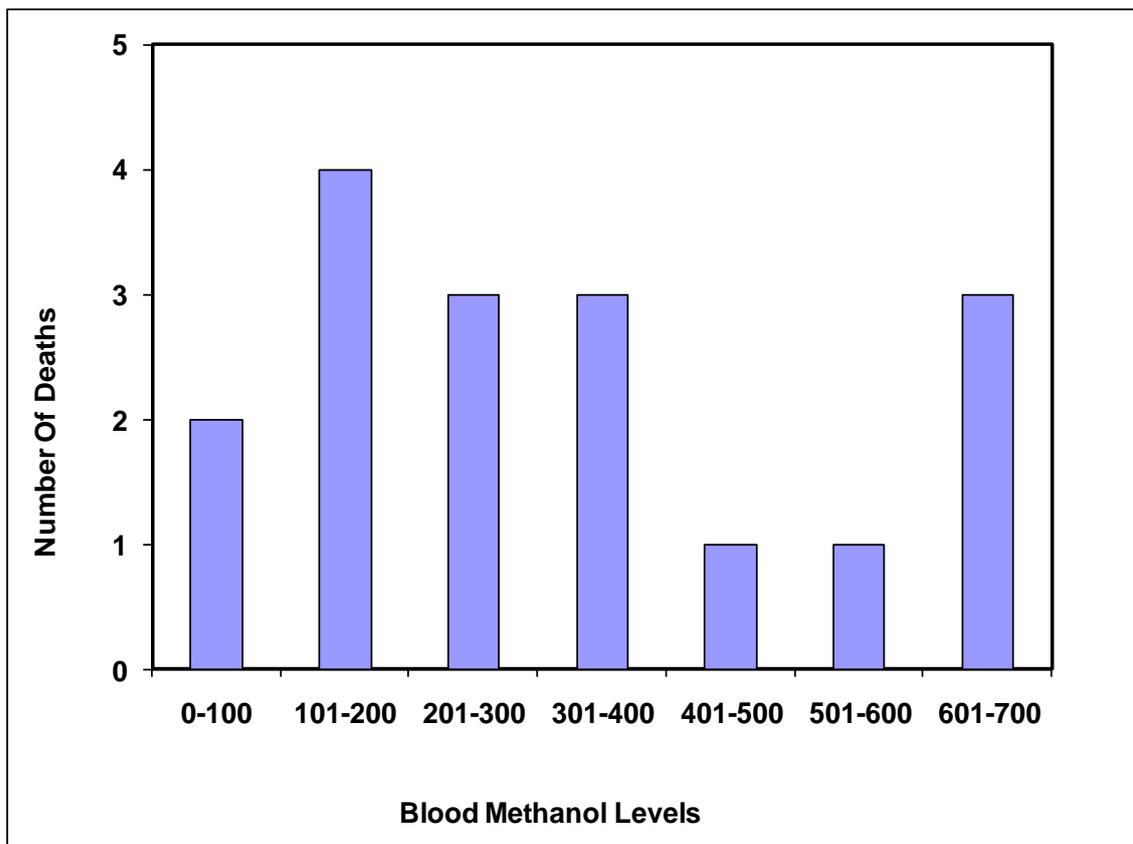


Figure.1 Distribution of blood methanol level among victims (mg/100ml)