

## MedPeer Publisher

Abbreviated Key Title: MedPeer

ISSN : 3066-2737

homepage: <https://www.medpeerpublishers.com>

---

# Maâjoune Poisoning in the Pediatric Population

**DOI:** 10.70780/medpeer.000QGXL

## AUTHOR AND AFFILIATION

EDDAHOUMI Y<sup>1,2</sup>, BENNANI I<sup>3</sup>, OULD DAGHRIA C<sup>2</sup>, BOUATIA M<sup>1,2</sup>

<sup>1</sup> Faculty of Medicine and Pharmacy of Rabat, Mohammed V University, Rabat, Morocco

<sup>2</sup> Children's Hospital of Rabat, CHU Ibn Sina, Rabat, Morocco

<sup>3</sup> Faculty of Medicine, Pharmacy and Dental Medicine of Fez, Fez, Morocco

Corresponding author: EDDAHOUMI Y

## ABSTRACT

**Background:** Maâjoune poisoning in children and adolescents is a worrying public health problem. This study analyzes its epidemiological characteristics and the factors associated with voluntary poisoning and severity.

**Methods:** Retrospective descriptive and analytical study of 691 Maâjoune poisoning cases in patients aged 0 to 18 years, extracted from the database of the CENTRE ANTI-POISON ET PHARMACOVIGILANCE MAROC (CAPM) from 2018 to 2023. Univariate analysis (chi-square, Fisher, Mann-Whitney) was followed by multivariable logistic regression.

**Results:** The median age was 15 years (IQR: 10–17) and 76.5% of patients were male. The most affected regions were Casablanca-Settat (35.6%) and Rabat-Salé-Kénitra (23.8%). Poisoning was voluntary in 58.2% of cases (substance use: 50.4% of all cases) and accidental in 41.8%. A severity grade  $\geq 2$  was observed in 73.2% of patients; the outcome was favorable in 96.2% of known outcomes and 2 deaths were recorded. In multivariable analysis, age  $\geq 13$  years (aOR = 54.1; 95% CI: 23.7–123.3) and male sex (aOR = 1.79; 95% CI: 1.03–3.13) were associated with voluntary poisoning. Severity was associated with age  $\geq 13$  years (aOR = 2.78), admission to the emergency department (aOR = 2.08) and region.

**Conclusion:** Adolescents, particularly males, are the group most frequently affected by voluntary poisoning. Prevention and education interventions targeting adolescents are warranted; regional differences in reported cases should be interpreted with caution.

## KEYWORDS

Poisoning; Maâjoune; pediatric population; adolescents; toxicovigilance

## **MAIN ARTICLE**

### **INTRODUCTION**

Maâjounne is a traditional preparation widely consumed in Morocco, made of plants, dried fruits, honey or sugar, to which cannabis is frequently added [1]. In Morocco, it has been reported as the most frequently incriminated drug in poisonings notified to the CENTRE ANTI-POISON ET PHARMACOVIGILANCE MAROC (CAPM) [1,2]. Its confectionery-like appearance, sweet taste and easy availability expose children and adolescents to accidental ingestion as well as to deliberate consumption. The onset of effects, often delayed compared with smoking, favors repeated dosing and overdose [3,4]. Recent reviews emphasize the rising incidence of pediatric cannabis poisoning, particularly with edible products [5].

In children, manifestations range from drowsiness and hypotonia to impaired consciousness, respiratory depression and seizures, and may require hospitalization, including intensive care [4,6]. However, Moroccan pediatric data remain limited, coming mainly from poison-center series [2] and from a study of the neurocognitive sequelae of use in adolescents [1]. The aim of this study was to describe the epidemiological characteristics of Maâjounne poisoning in the pediatric population and to identify the factors associated with voluntary poisoning and severity, as well as its circumstances and consequences.

### **METHODS**

#### **Study design and population**

This was a retrospective descriptive and analytical study based on the database of the CENTRE ANTI-POISON ET PHARMACOVIGILANCE MAROC (CAPM) from 2018 to 2023. Among the 1,845 poisonings recorded in the database, 691 cases in which the product involved was Maâjounne (all spelling variants: Maajounne, Maâjounne, Maajoun, etc.) were included. Patients were aged 0 to 18 years (120 patients, 17.4%, were 18 years old). Cases were included regardless of the mode of reporting.

#### **Variables**

The variables analyzed were age (in years, then in three groups: <6 years, 6–12 years, ≥13 years), sex, region of residence (former and current administrative regions were merged into the current regions), residence (urban or rural), place of poisoning (home or outside home), admitting department (emergency department or other departments), circumstance (voluntary, i.e. intentional exposure including substance use, suicide attempt and criminal administration

by a third party, or accidental), final severity grade and outcome. Two outcomes were considered: voluntary poisoning (versus accidental) and severity, defined as a final grade  $\geq 2$  (pronounced signs or severe poisoning) versus grade 0–1.

### Statistical analysis

Database labels were harmonized (spelling variants; “unknown” and “not specified” values were considered missing). Quantitative variables are expressed as median and interquartile range (IQR) and qualitative variables as counts and percentages, calculated on available data. In univariate analysis, the chi-square test or Fisher’s exact test (expected counts  $< 5$ ) was used for qualitative variables and the Mann-Whitney test for age. Multivariable analysis relied on binary logistic regression including variables with  $p < 0.20$  in univariate analysis (complete-case analysis). Results are expressed as adjusted odds ratios (aOR) with 95% confidence intervals (95% CI). Model fit was assessed with the Hosmer-Lemeshow test. The significance level was  $p < 0.05$  (two-sided). Analyses were performed with Python (SciPy and statsmodels).

### Ethical considerations

The data were extracted and provided by the officials of the CAPM and were analyzed anonymously.

## **RESULTS**

### General characteristics

A total of 691 cases were analyzed. The median age was 15 years (IQR: 10–17); 132 (19.1%) of patients were under 6 years old, 98 (14.2%) were 6 to 12 years old and 461 (66.7%) were 13 years or older. Males predominated (521 (76.5%)). The most affected regions were Casablanca-Settat (244 (35.6%)) and Rabat-Salé-Kénitra (163 (23.8%)). When the mode of reporting was recorded, 55 (83.3%) of reports were spontaneous, and 502 (79.9%) of patients were managed in the emergency department (Table 1).

### Circumstances, severity and outcome

Poisoning was voluntary in 399 (58.2%) of cases, including 348 cases of substance use (50.4% of all cases), 23 suicidal cases and 25 criminal cases (intentional administration by a third party), the type not being specified in the remaining 3 cases, and accidental in 287 (41.8%). The final severity grade, recorded for 522 patients, was  $\geq 2$  in 382 (73.2%) (grade 3: 23 cases). The outcome was favorable in 506 (96.2%) of patients with a known outcome, and 2 deaths

were recorded (Table 2). Length of hospital stay could not be analyzed because too few data were available.

### Univariate analysis

Voluntary poisoning concerned older patients (median age 17 vs 8 years;  $p < 0.001$ ) who were more often male (82.2% vs 68.0%;  $p < 0.001$ ); it occurred less often at home (61.5% vs 77.0%;  $p < 0.001$ ) and was more often managed in the emergency department (83.7% vs 75.0%;  $p = 0.007$ ). Region and residence were not associated with the circumstance (Table 3). A severity grade  $\geq 2$  was associated with age ( $p < 0.001$ ), region ( $p < 0.001$ ), residence ( $p = 0.038$ ) and admitting department ( $p < 0.001$ ) (Table 5).

### Multivariable analysis

After adjustment (528 complete cases), age  $\geq 13$  years (aOR = 54.1; 95% CI: 23.7–123.3;  $p < 0.001$ ), age 6 to 12 years (aOR = 2.61;  $p = 0.045$ ) and male sex (aOR = 1.79;  $p = 0.041$ ) remained associated with voluntary poisoning, whereas place of poisoning and admitting department were no longer associated (Table 4; Hosmer-Lemeshow  $p = 0.760$ ). For severity (428 complete cases), age  $\geq 13$  years (aOR = 2.78; 95% CI: 1.28–6.07) and admission to the emergency department (aOR = 2.08; 95% CI: 1.16–3.72) were associated with greater severity, whereas residence in Casablanca-Settat (aOR = 0.41) or Rabat-Salé-Kénitra (aOR = 0.24) was associated with fewer severe forms; voluntary circumstance was not independently associated with severity ( $p = 0.555$ ) (Table 5).

## DISCUSSION

This study of 691 cases confirms that Maâjoune poisoning mainly affects male adolescents. The very strong association between age  $\geq 13$  years and voluntary poisoning (aOR = 54.1), with a wide confidence interval due to the small number of voluntary poisonings before 6 years of age, indicates that accidental ingestions mainly concern young children whereas deliberate consumption concerns adolescents, which is consistent with hospital series in which accidental exposures involve the youngest children and intentional consumption involves adolescents [4,7]. The independent male predominance (aOR = 1.79) suggests that recreational consumption is more frequent among boys.

The concentration of cases in Casablanca-Settat (35.6%) and Rabat-Salé-Kénitra (23.8%) may reflect population density, access to healthcare facilities and the quality of reporting. These figures are raw case counts, not adjusted for regional population size, reporting completeness or access to care, and therefore do not establish a higher regional incidence or risk. The lower

frequency of severe forms in these two regions may also reflect different reporting and grading practices, and this finding should be interpreted with caution. The association between severity and admission to the emergency department is expected, since the most symptomatic patients are more often referred there; it probably reflects referral patterns and clinical decision-making rather than an independent risk factor. Hospital reports mostly correspond to symptomatic forms, which exposes to an underestimation of the true incidence. The prognosis is generally favorable (96.2% favorable outcomes among known outcomes), but a severity grade  $\geq 2$  in 73.2% of patients and 2 deaths are a reminder of the potential seriousness of these poisonings [4,5].

Our findings are consistent with earlier Moroccan poison-center data, summarized by Ait Belcaid et al., which showed a marked male predominance (male-to-female ratio of 3.6) and a higher risk of hospitalization below 15 years of age [1]; in our series, the male-to-female ratio was 3.3. Beyond acute toxicity, Maâjoune use in adolescents has been associated with attention and memory impairments [1], which underlines the importance of preventing repeated voluntary consumption.

### Limitations

The limitations of this study include the voluntary-reporting origin of the data and the probable under-reporting of mild cases managed outside healthcare facilities. Several variables were largely incomplete (mode of reporting, origin, length of hospital stay, and final severity grade missing for 169 patients), which restricts analyses to complete cases (428 of the 691 patients in the multivariable severity analysis) and exposes to selection bias; patients with complete and incomplete data were not compared. Exposure to Maâjoune was based on the product recorded in the database: the composition of the preparations, the quantities ingested, the cannabis content and possible co-ingested substances were not available, and confirmed exposure could not be distinguished from suspected exposure, which limits the attribution of clinical outcomes to the preparation itself. Criminal poisonings ( $n = 25$ ) were classified as voluntary according to the database, although the child did not consent to the exposure. Grouping of administrative regions and harmonization of free-text labels may have introduced misclassification. Finally, the cross-sectional design does not allow causal inference (the associations observed should not be interpreted as causal), and the confidence interval of the association with age is wide.

## **CONCLUSION**

Maâjoune poisoning is a pediatric public health problem, with a male and adolescent predominance and a high proportion of voluntary poisonings. Prevention and education interventions targeting adolescents, in schools and families, are warranted, together with improved reporting and awareness of the risks associated with the presentation of these products.

## **TABLES :**

Table 1: Sociodemographic characteristics and reporting modalities of the patients (N = 691)

| <b>Characteristic</b>                            | <b>Value</b> |
|--------------------------------------------------|--------------|
| Age, years, median (IQR)                         | 15 (10–17)   |
| Age <6 years, n (%)                              | 132 (19.1%)  |
| Age 6–12 years, n (%)                            | 98 (14.2%)   |
| Age ≥13 years, n (%)                             | 461 (66.7%)  |
| Male sex, n (%) [n = 681]                        | 521 (76.5%)  |
| Casablanca-Settat, n (%) [n = 686]               | 244 (35.6%)  |
| Rabat-Salé-Kénitra, n (%) [n = 686]              | 163 (23.8%)  |
| Urban residence, n (%) [n = 596]                 | 542 (90.9%)  |
| Spontaneous report, n (%) [n = 66]               | 55 (83.3%)   |
| Origin: healthcare facility, n (%) [n = 39]      | 36 (92.3%)   |
| Managed in emergency department, n (%) [n = 628] | 502 (79.9%)  |

IQR: interquartile range. Percentages are calculated on available data (n in brackets).

Table 2: Circumstances, severity and outcome (N = 691)

| <b>Variable</b>                                        | <b>Value</b> |
|--------------------------------------------------------|--------------|
| Voluntary poisoning, n (%) [n = 686]                   | 399 (58.2%)  |
| of which substance use, n (% of 691)                   | 348 (50.4%)  |
| of which suicidal / suicide attempt, n                 | 23           |
| of which criminal (administration by a third party), n | 25           |
| of which type not specified, n                         | 3            |
| Accidental poisoning, n (%)                            | 287 (41.8%)  |
| Final severity grade ≥ 2, n (%) [n = 522]              | 382 (73.2%)  |
| Final severity grade 3 (life-threatening), n (%)       | 23 (4.4%)    |
| High risk level, n (%) [n = 92]                        | 12 (13.0%)   |
| Favorable outcome, n (%) [n = 526]                     | 506 (96.2%)  |
| Deaths, n                                              | 2            |

Percentages are calculated on available data (n in brackets). Length of hospital stay is not presented (insufficient data).

Table 3: Univariate analysis of factors associated with voluntary poisoning

| <b>Factor</b>                       | <b>Voluntary (n = 399) n (%)</b> | <b>Accidental (n = 287) n (%)</b> | <b>p</b>         |
|-------------------------------------|----------------------------------|-----------------------------------|------------------|
| <b>Age (years). median (IQR)</b>    | <b>17 (15–18)</b>                | <b>8 (3–13)</b>                   | <b>&lt;0.001</b> |
| <b>Age group (n=686)</b>            |                                  |                                   | <b>&lt;0.001</b> |
| <6 years                            | 10 (2.5%)                        | 122 (42.5%)                       |                  |
| 6–12 years                          | 16 (4.0%)                        | 80 (27.9%)                        |                  |
| ≥13 years                           | 373 (93.5%)                      | 85 (29.6%)                        |                  |
| <b>Sex (n=676)</b>                  |                                  |                                   | <b>&lt;0.001</b> |
| Female                              | 71 (17.8%)                       | 89 (32.0%)                        |                  |
| Male                                | 327 (82.2%)                      | 189 (68.0%)                       |                  |
| <b>Region (n=681)</b>               |                                  |                                   | <b>0.717</b>     |
| Other regions                       | 158 (40.0%)                      | 116 (40.6%)                       |                  |
| Casablanca-Settat                   | 146 (37.0%)                      | 98 (34.3%)                        |                  |
| Rabat-Salé-Kénitra                  | 91 (23.0%)                       | 72 (25.2%)                        |                  |
| <b>Residence (n=593)</b>            |                                  |                                   | <b>0.628</b>     |
| Rural                               | 33 (9.6%)                        | 21 (8.4%)                         |                  |
| Urban                               | 311 (90.4%)                      | 228 (91.6%)                       |                  |
| <b>Place of poisoning (n=587)</b>   |                                  |                                   | <b>&lt;0.001</b> |
| Home                                | 211 (61.5%)                      | 188 (77.0%)                       |                  |
| Outside home                        | 132 (38.5%)                      | 56 (23.0%)                        |                  |
| <b>Admitting department (n=623)</b> |                                  |                                   | <b>0.007</b>     |
| Other departments                   | 61 (16.3%)                       | 62 (25.0%)                        |                  |
| Emergency department                | 314 (83.7%)                      | 186 (75.0%)                       |                  |

Chi-square or Fisher's exact test; Mann-Whitney test for age. Percentages are calculated on available data for each variable (n in brackets).

Table 4: Multivariable analysis (logistic regression) of factors associated with voluntary poisoning

| <b>Factor</b>                                 | <b>aOR</b> | <b>95% CI</b> | <b>p</b> |
|-----------------------------------------------|------------|---------------|----------|
| Age 6–12 years (ref. <6 years)                | 2.61       | 1.02–6.65     | 0.045    |
| Age ≥13 years (ref. <6 years)                 | 54.11      | 23.75–123.26  | <0.001   |
| Male sex (ref. female)                        | 1.79       | 1.03–3.13     | 0.041    |
| Outside home (ref. home)                      | 1.30       | 0.78–2.18     | 0.319    |
| Emergency department (ref. other departments) | 0.51       | 0.25–1.03     | 0.061    |

aOR: adjusted odds ratio; 95% CI: 95% confidence interval. Complete cases: n = 528 (325 voluntary poisonings). Variables with p < 0.20 in univariate analysis. Hosmer-Lemeshow: p = 0.760.

Table 5: Factors associated with severity (final grade  $\geq 2$ ): univariate and multivariable analyses

| Factor                                        | Crude OR (95% CI) | p      | aOR (95% CI)     | p      |
|-----------------------------------------------|-------------------|--------|------------------|--------|
| Age 6–12 years (ref. <6 years)                | 1.58 (0.85–2.95)  | 0.146  | 1.47 (0.69–3.11) | 0.316  |
| Age $\geq 13$ years (ref. <6 years)           | 3.05 (1.89–4.93)  | <0.001 | 2.78 (1.28–6.07) | 0.010  |
| Male sex (ref. female)                        | 1.18 (0.75–1.85)  | 0.479  | —                | —      |
| Voluntary circumstance (ref. accidental)      | 1.44 (0.98–2.13)  | 0.066  | 0.82 (0.42–1.60) | 0.555  |
| Casablanca-Settat (ref. other regions)        | 0.31 (0.19–0.53)  | <0.001 | 0.41 (0.22–0.75) | 0.004  |
| Rabat-Salé-Kénitra (ref. other regions)       | 0.20 (0.12–0.33)  | <0.001 | 0.24 (0.13–0.46) | <0.001 |
| Urban residence (ref. rural)                  | 0.43 (0.19–0.97)  | 0.043  | 0.76 (0.28–2.05) | 0.588  |
| Emergency department (ref. other departments) | 3.08 (1.85–5.13)  | <0.001 | 2.08 (1.16–3.72) | 0.014  |

OR: odds ratio; aOR: adjusted odds ratio (complete cases:  $n = 428$ , 325 severe forms; Hosmer-Lemeshow  $p = 0.901$ ). Sex ( $p > 0.20$ ) was not included in the model.

## ACKNOWLEDGEMENTS

The authors would like to thank the team of the CENTRE ANTI-POISON ET PHARMACOVIGILANCE MAROC for providing the data and for their collaboration.

## DECLARATIONS

**Funding:** This study received no funding.

**Conflicts of interest:** The authors declare no conflict of interest.

**Ethics approval:** The data were extracted and provided by the officials of the CAPM and analyzed anonymously.

**Informed consent:** Individual informed consent was not required, as this was a retrospective study based on anonymized data from the CAPM pharmacovigilance and toxicovigilance database, with no patient contact.

**Author contributions:** EDDAHOUMI Y: data analysis, study management, writing of the original draft and revision of the manuscript. BENNANI I: critical reading and correction of the manuscript. OULD DAGHRIA C: data collection. BOUATIA M: supervision of the study. All authors read and approved the final version of the manuscript.

## REFERENCES :

1. Ait Belcaid H, Diffaa A, Sebban H, Belkhouda MA, Assda R, Sedki A. Neurobehavioral and social sequelae of "Maajoune illicit drug" use by young individuals. Arch Neurosci. 2023;11(1):e138597. doi:10.5812/ans-138597  
<https://doi.org/10.5812/ans-138597>
2. Soulaymani A. Intoxications par les drogues au Maroc. Données du Centre Anti Poison du Maroc (1980-2008). TOXICOLOGIE, 2011, N°8
3. Cao D, Srisuma S, Bronstein AC, Hoyte CO. Characterization of edible marijuana product exposures reported to United States poison centers. Clin Toxicol (Phila). 2016;54(9):840-6. doi:10.1080/15563650.2016.1209761  
<https://doi.org/10.1080/15563650.2016.1209761>

4. Kaczor EE, Mathews B, LaBarge K, Chapman BP, Carreiro S. Cannabis product ingestions in pediatric patients: ranges of exposure, effects, and outcomes. *J Med Toxicol.* 2021;17(4):386-96. doi:10.1007/s13181-021-00849-0  
<https://doi.org/10.1007/s13181-021-00849-0>
  
5. Zerbo S, et al. Acute cannabis intoxication among the paediatric population. *Front Toxicol.* 2025:1558721. doi:10.3389/ftox.2025.1558721  
<https://doi.org/10.3389/ftox.2025.1558721>
  
6. Richards JR, Smith NE, Moulin AK. Unintentional cannabis ingestion in children: a systematic review. *J Pediatr.* 2017;190:142-52. doi:10.1016/j.jpeds.2017.07.005  
<https://doi.org/10.1016/j.jpeds.2017.07.005>
  
7. Wang GS, Le Lait MC, Deakyne SJ, Bronstein AC, Bajaj L, Roosevelt G. Unintentional pediatric exposures to marijuana in Colorado, 2009-2015. *JAMA Pediatr.* 2016;170(9):e160971. doi:10.1001/jamapediatrics.2016.0971  
<https://doi.org/10.1001/jamapediatrics.2016.0971>