

Prevalence of venomous snakebites in Iraq: A retrospective cross-sectional study

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ABSTRACT

Snakebite is a serious injury and a common reason for the increasing death rate. Thus, it should be treated and assessed as highly prior, even in cases that seem well. The paper presents a retrospective investigation of snakebites in Iraq from 2019 to 2021 conveyed by the General Administration of Statistics and Information, Ministry of Health, Republic of Iraq. After obtaining the institutional committee's approval, the authors performed the extraction, analysis, and reporting of the data.

A total number of 802 patients were informed throughout three years, with the highest percentage in males (63%). The maximum rate of snake envenomation ($P < 0.05$) was documented in (41.64%). The highest percentage of anti-venom injections administered in 2021 was 57% ($n = 1118$). Snakebite cases were mainly reported during June and July in al Yarmouk Hospital, with a total of 17.36% ($n = 50$) and 17.46% ($n = 52$), respectively. In Murjan Hospital, the months were September and August with a total of 50% ($n = 8$) and 40.35% ($n = 7$), respectively. In Baqubah Hospital, the months were May and August, with a total of 17.3% ($n = 52$) and 16.8% ($n = 50$), respectively. Finally, in the Al Hussein Hospital, the months were July and September, with a total of 23.5% ($n = 43$) and 22.2% ($n = 39$), respectively. Only 10 cases out of 802 died. The incidence of snakebites showed an increasing trend during the study period, and the incidence mostly occurred in July, August, and September.

Keywords: Snakebite, Anti-venom, Iraq, Mortality

Introduction

Snakebite represents one of the well-known reasons for death in different countries, particularly tropical ones [1]. Two million out of the 4.5–5.4 million worldwide snakebite cases every year advance clinical poisoning, about 400,000 become disabled, and 81,000–138,000 go dead [2]. The clinical envenoming of snakebite includes gangrene, neurotoxic paralysis, arrhythmias, neurological disorders, and death according to the species, age, size, and venom (hemotoxins, neurotoxins, and cytotoxins) of the snake [3]. Snake venom is an intricate mix of proteins,

resulting in several toxic actions. Because of the highly variable structure, snake venoms clinically cause different symptoms in envenoming, ranging from damaging the local tissues to systemic impacts that threaten life [3]. All venomous snakes in Iraq are categorized according to four species: Colubridae, Elapidae, Arctaspididae, and Viperidae. In Iraq, the current medical intelligence specifically delineates seven venomous snakes [4]. Antivenins are employed in treating the cases; however, four of the six species of poisonous snakes in Iraq belong to Viperidae (Vipers): *Pseudocerastes persicus*, *Cerastes*, *Echis carinatus*, and *Vipera lebetina*. The fifth and sixth belong to Elapidae (Cobras): *Walterinnesia aegyptia* and *Arabian cobra* (*Naja haje Arabica*). The antivenin used in Iraqi hospitals is hexavalent snake anti-venom immunoglobulin (SerpentoRazi VI)- Equine that is effective against six snake species: *Agkistrodon halys*, *Pseudocerastes persicus*, *Echis carinatus*, *Vipera albicornuta*, *Vipera lebetina*, and *Naja haje oxiana*. This anti-venom helps treat four types of snakes that may exist in the region only. Moreover, using anti-venom for different types of snakes is not useful and denotes improper risks (such as anaphylaxis) and costs [5-7].

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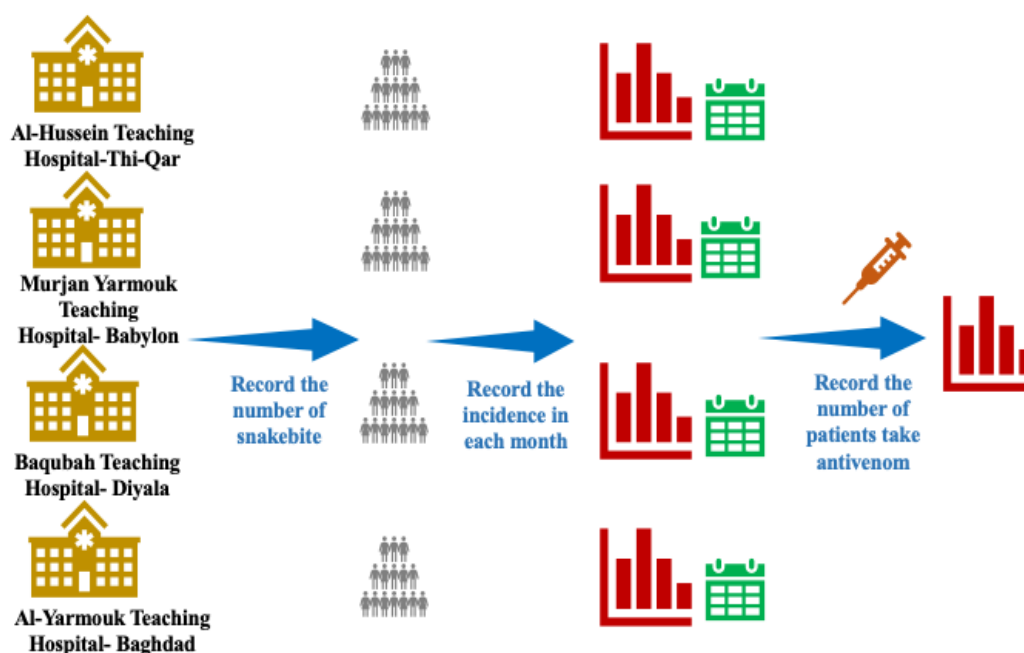
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A better knowledge of snakebites' incidence and mortality may improve their management. The data of the present paper may help healthcare providers and medical planners enhance the administration of snakebite cases [8]. Carrying out epidemiological studies is necessary as a key step toward developing local and standard therapeutic protocols concerning regional and national facilities and therapeutic needs. The paper evaluates snakebite records by poisonous snakes in different geographical regions over three years (2019-2021) to promote a better understanding of regional and seasonal variation, prepare the required quantity of anti-venom in the suitable month, and reduce snakebite mortality in Iraq.

Materials and Methods



Graph 1. Graphical abstract of the study.

Statistical analysis

The authors analyzed the data of each case using Microsoft excel and ANOVA (SPSS version 24) [9]. Then, they expressed data in the form of the mean \pm standard error of the mean (SEM), frequency, and percentage. Results were considered significant if the p-value was less than 0.05.

Results and Discussion

The prevalence of snakebites was documented in the four different geographical provinces in Iraq: Thi-Qar (Nasiriya), Babylon, Diyala, and Baghdad, in which study was conducted for three years (2019- 2021) in Al-Hussein, Murjan, Baqubah, and Yarmouk Teaching Hospitals, respectively. The paper reviewed 802 envenoming cases in these hospitals according to the data of the General Administration of Statistics and Information, Ministry of Health, Iraq. These data were obtained based on a unified protocol by all health centers and hospitals (graphical abstract 1). We conducted data analyses according to a standard data sheet based on the rate and distribution of snakebites (annually and monthly), sex of the patient, number of anti-venoms, type of anti-venom, date of the snakebite, mortality, and identifying the snakebites that were performed by a specialist if the snake was carried with the case either caught or killed or regarding the available photos of venomous snakes.

Annual rate and bite distribution

A total number of 802 venomous snakebites was registered in all hospitals included in the study (2019–20121), with a mean of 267.3 ± 5 /year. The maximum snake envenomation ($P < 0.05$) registered in 2021 rated 41.64% ($n = 334$). In 2020 and 2019, the rates were 34.4% ($n = 276$) and 23.9% ($n = 192$), respectively (**Figure 1**).

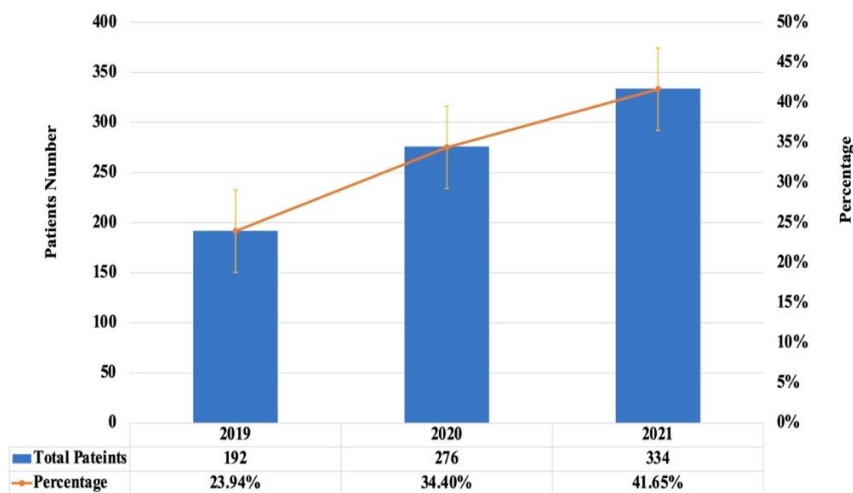


Figure 1. Year-wise frequency of snakebites (2019–2021)

Monthly rate and bite distribution

The comprehensive distribution and rate of snakebites month-wise are displayed in the figures below. Regarding the statistics provided by the Ministry of Health, Iraq, over three years (2019-2021), most snakebite cases were documented in June and July in al Yarmouk Teaching Hospital with a total of 17.36% (n = 50) and 17.46% (n = 52), respectively. In contrast, the minimum rate of 0% (n = 0) was documented in January, as shown in **Figure 2**. In Al Murjan Teaching Hospital, most snakebite cases were documented in September and August with a total of 50%

(n = 8) and 40.35% (n = 7), respectively, while no cases were recorded in other months, as shown in **Figure 3**. In Al Baqubah Teaching Hospital, most cases were documented in May and August with a total of 17.3% (n = 52) and 16.8% (n = 50), respectively, but the minimum rate was documented in December (n = 1), as shown in **Figure 4**. Finally, in the Al Hussein Teaching Hospital, most cases were documented in July and September with a total of 23.5% (n = 43) and 22.2% (n = 39), respectively, but the minimum rate was documented in January and February 0% (n = 0), as shown in **Figure 5**.

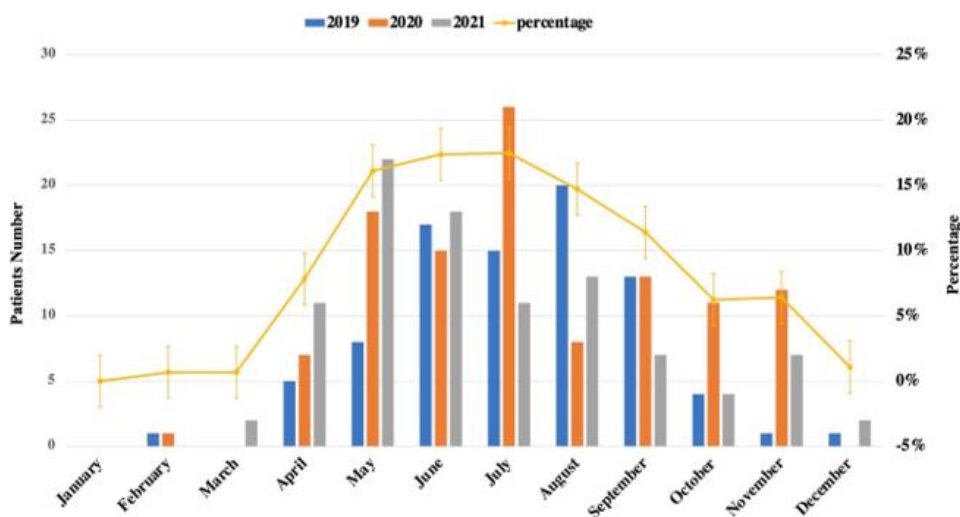


Figure 2. Monthly frequency of snakebite victims (2019–2021) in Al Yarmouk Teaching Hospital

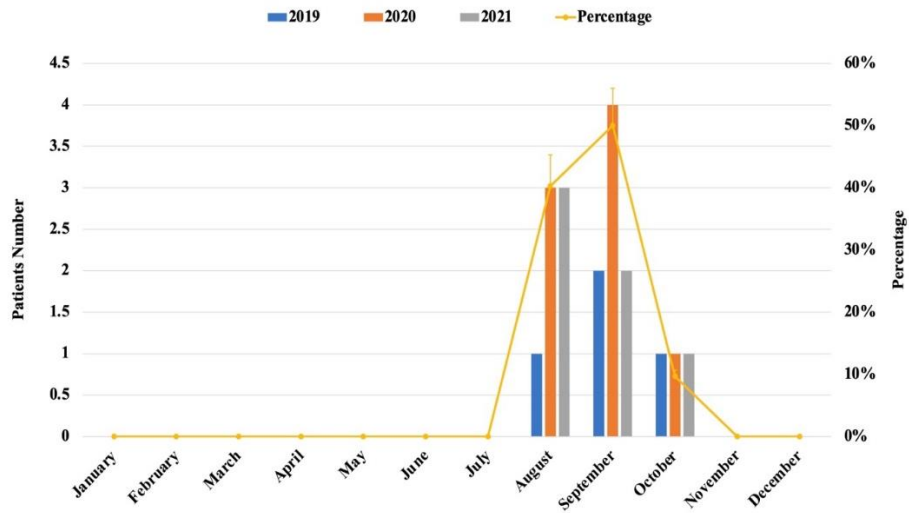


Figure 3. Monthly frequency of snakebite victims (2019–2021) in Marjan Teaching Hospital

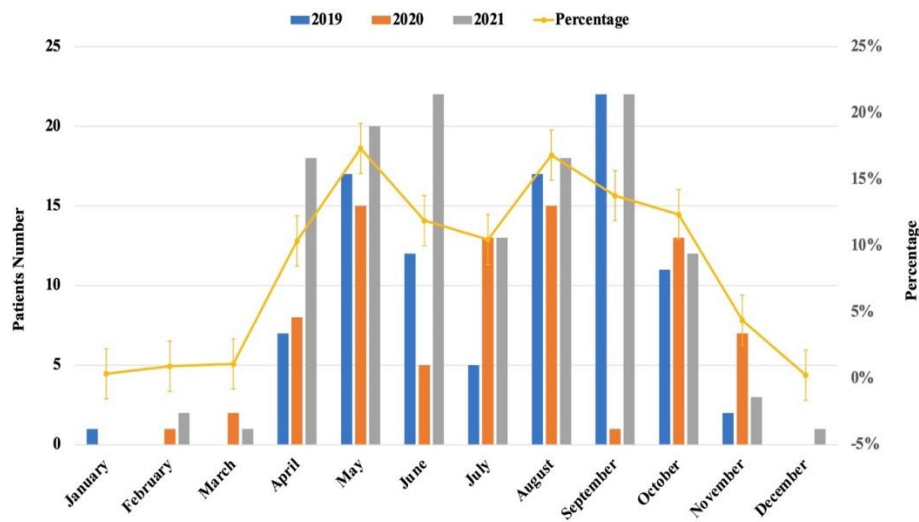


Figure 4. Monthly frequency of snakebite victims (2019–2021) in Baqubah Teaching Hospital

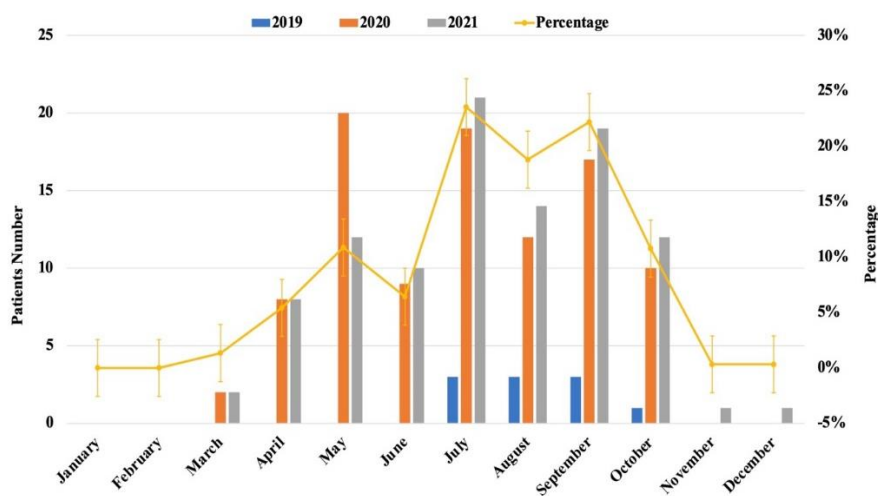


Figure 5. Monthly frequency of snakebite victims (2019–2021) in Al Hussein Teaching Hospital

Snakebite distribution according to the sex of the patient

The data showed that the rate of males was higher than female victims ($P < 0.05$). The rate of biting (males–females) scored 63% ($n = 504$) and 37% ($n = 298$), respectively. The maximum rate of snakebites was in 2021 (40%, $n = 202$) among males, but the minimum was in 2019 (22%, $n = 112$). The maximum (44%, $n = 132$) and minimum (27%, $n = 80$) rates of the females were documented in 2021 and 2019, respectively (Figure 6a).

Treatment and mortality

Out of 802 poisoned snakebite cases, only 1.24% ($n = 10$) of death victims were reported in the population under study. Other cases recovered after hospitalization (Figure 6b).

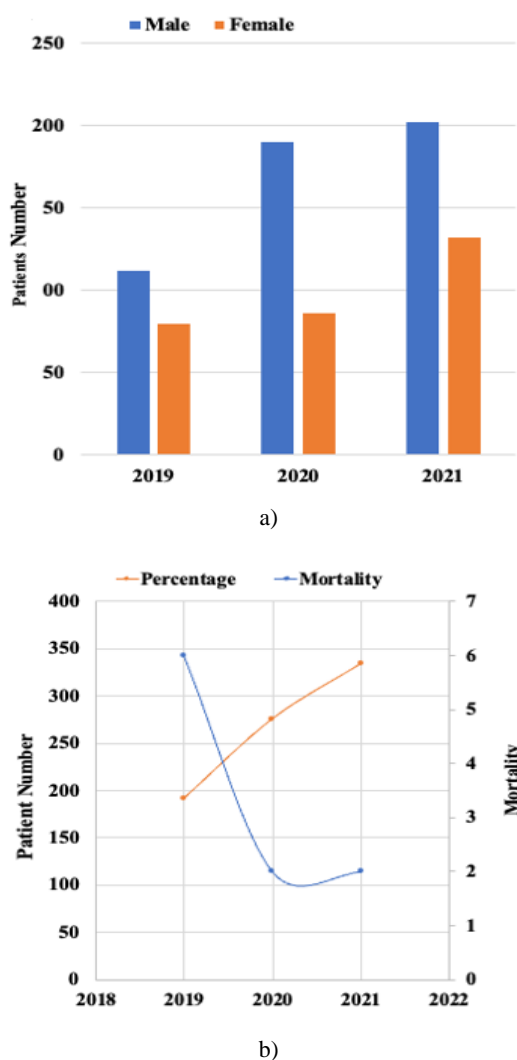


Figure 6. a) Frequency of bites based on the sex of the patient, b) Number of cured and dead cases by snakebites (2019-2021)

Antiserum dose

Hexavalent snake anti-venom immunoglobulin (SerpentoRazi VI)- equine was administered intravenously to the victims. Each vial included 10 ml of purified immunoglobulin fractions. The

highest percentage of anti-venom injections administered in 2021 was 57% ($n = 1118$), and the lowest percentage in 2019 was 15% ($n = 293$), as shown in Figure 7a. Finally, Figure 7b shows that the administration of anti-venom is greater than the number of recorded cases of snakebite, indicating that not all cases were precisely recorded in all reviewed hospitals.

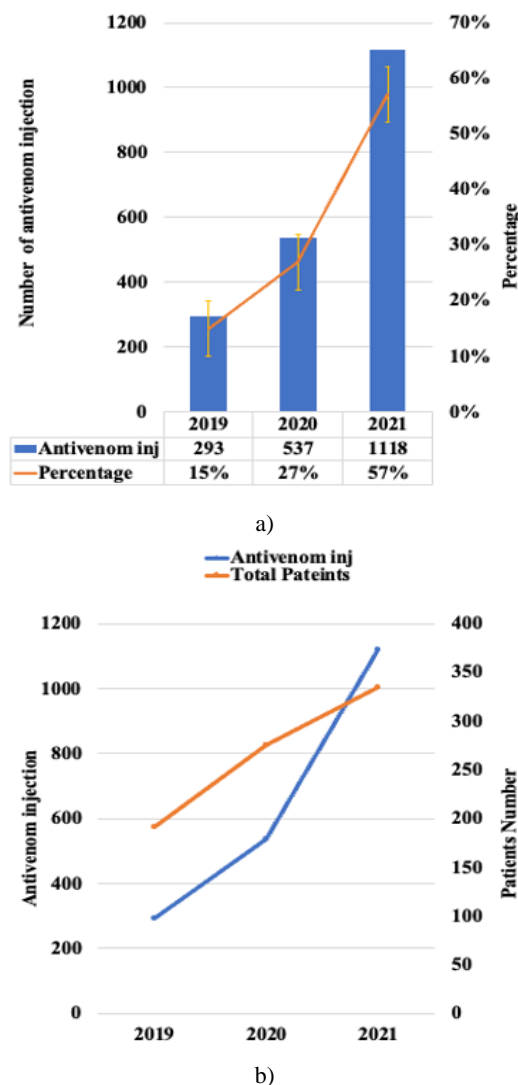


Figure 7. a) Frequency of anti-venom to snakebite over the period, b) Frequency of snakebite and anti-venom over the period (2019-2021)

Snakebite is a major public health issue in all countries [10]. Globally, reports on the prevalence, cases, or death caused by snakebites rely on data from medical centers and hospitals. The present paper evaluated the prevalence of snakebites by venomous snakes across Iraq. Iraqi provinces have a rich fauna of reptiles, especially venomous snakes. Their climate ranges from semiarid to arid, causing the diversity of venomous snakes in the Middle East region. The study (2019-2021) reported 802 venomous snakebite victims in Iraq. However, this number is less than the number reported in a similar study in Riyadh, Saudi Arabia, with 236 and 1019 snakebite victims over five years [6]. A higher rate of snakebite envenomation was reported in summer compared to other seasons, with the lowest in winter because snakes are inactive in hibernation due to low ambient

temperatures. The data under study illustrated variations in the frequency of the documented victims of snakebites over three years (period of the study). The maximum occurrence was reported in 2021, with 334 victims.

Moreover, the maximum snake envenomation was reported in July and August, but the minimum was in January and December. The findings match the statistics of other researchers in other areas of Iraq, such as Habeeb *et al.* (2016) and Lamb *et al.* (2008) [11, 12] in Morocco [13] and Saudi Arabia [6] but disagree with Paula Neto *et al.* that found higher snakebites from December to April (54%) with the minimum number in the third quarter (July- September) (15%) [14]. Most cases under study were male victims, and more than half of them were bitten during farming work. These reports match those reported in neighboring countries like Saudi Arabia [6] and some other parts of the world like Iran, Isfahan province with 96% [15], the southeast Arabian Peninsula with 87% [16], Brazil with 89.5% [17], and Morocco with 53% [17] male predominance. The various incidence of bites according to the sex of the victim may happen because most females spend time in indoor activities, but males almost work in deserts and agricultural lands [6, 11].

In contrast, Monteiro *et al.* (2010) illustrated that most cases (60%) were females in India [18]. Undoubtedly, the number of snakebite victims in the various areas of Iraq is high, but the low mortality rate (1.75%) of patients illustrates the achievement of the Iraqi national strategy against the fatal snake bite envenomation by affording excellent medical facilities and developing supportive care even in remote areas. Luckily, anti-venom can be accessed in all medical centers across Iraq. Moreover, the Iraqi strategy effectively handled snakebite envenomation by establishing national records and keeping targeted poly anti-venom available. However, the authors recommend raising awareness and conducting training to the general public, particularly the inhabitants and workers in rural areas, regarding venomous snakes, avoiding snakes, timely management of allergic reactions post-snakebite, administering adequate and convenient doses of anti-venom, referral to the nearest medical center, and proper administration of victims help reduce the death rate.

Conclusion

The incidence of snakebites showed an increasing trend during the study period, and the incidence mostly occurred in July, August, and September. The Ministry of Health should focus on this period and prepare sufficient anti-venoms to decrease the mortality percentage to less than 1. Additionally, it should raise public awareness about early diagnosis and the use of proper snake anti-venoms to save the victims. Delaying the suitable treatment may cause high morbidity and mortality.

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Ethics statement: The study protocol, number 953A, was approved by the Scientific and Ethical Committee at the College of Pharmacy, University of Al-Farahidi.

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