

## Public Perception of Snake Envenomation and Snakebite First Aid in Saudi Arabia

Mohammed Abdullah S Almutawa<sup>1\*</sup>, Maher Mualla M Alotaibi<sup>2</sup>, Rafa Fateh Alotbi<sup>3</sup>,  
Rayhana Othman Al-Rasheedi<sup>4</sup>, Nasser Abdullah AlAqil<sup>5</sup>, Ghurmullah Jaber Y Alzahrani<sup>6</sup>,  
Faisal Alhumaidi Alruways<sup>7</sup>, Yazid Mohammed Alotaibi<sup>8</sup>

<sup>1</sup>Medical Student MBBS Undergraduate at Prince Sattam Bin Abdulaziz University, Al-Kharj, Saudi Arabia.

<sup>2</sup>Medical Intern MBBS Graduated from Prince Sattam Bin Abdulaziz University, Al-Kharj, Saudi Arabia.

<sup>3</sup>Medical Intern MBBS Graduated from Taif University, Taif, Saudi Arabia.

<sup>4</sup>Medical Student MBBS Undergraduate at Hail University, Saudi Arabia.

<sup>5</sup>Medical Student MBBS Undergraduate at Prince Sattam Bin Abdulaziz University, Al-Kharj, Saudi Arabia.

<sup>6</sup>Medical Intern MBBS Graduated from Prince Sattam Bin Abdulaziz University, Al-Kharj, Saudi Arabia.

<sup>7</sup>Medical Intern MBBS Graduated from Majmaah University, Al Majmaah, Saudi Arabia.

<sup>8</sup>Resident Family Medicine at Prince Sultan Military Medical City, Riyadh, Saudi Arabia.

### ABSTRACT

**Objective:** This study investigated the public perception of snake envenomation and snakebite management in the Kingdom Saudi Arabia.

**Method:** A cross-sectional Internet-based survey employing a self-administered questionnaire with items taken from the current literature and the recent guidelines. The survey was distributed through social medias over a three-month period starting from 20 th of June 2017.

**Results:** This sample reflected an average level of perception with total mean score equal to 24.68 out of 54. This score was included between the 1st and 2nd quartiles and as consequence corresponding to the average perception. The application tourniquet, slashing or sucking puncture, applying dates or honey, religious healing along with the application of cooking gas were the reported common practices. Male, higher education, rural residency, occupations, provinces, history of snakebite, attending a snakebite, earlier education on envenomation, and owing a snake pet were the predictors of better perception ( $p < 0.05$ ). Proper management and prevention was inversely proportionate with age, while general knowledge of snakebite was directly proportionate with age.

**Conclusion:** Indeed, the public perception of snakebite and first aid management was undesirable. Besides, myths and bizarre are still existing at tangible proportions. An educational campaign about snakebite management must be set into effect.

**Key Words:** First-Aids, Management, Perception, Snake Bites, Envenomation

### \*Correspondence to:

Mohammed Abdullah S Almutawa


6712 ibn Asim st.

ar-rabawah Alqwaeiyah Saudi Arabia Zip 19257.

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### INTRODUCTION

Snake envenomation is a very common life-costing problem worldwide.<sup>1</sup> Globally, it was reported that about 4 to 5 million snakebites and 20-125 thousand snakebite-attributed deaths occur annually.<sup>1-3</sup> Furthermore, about 4 million of the bitten victims developed permanent disabilities and disfigurements.<sup>3,4</sup> After all, the exact epidemiology of snakebite and its outcomes is underestimated worldwide. Therefore, the snakebites were considered as neglected extrinsic injuries by World Health Organization (WHO).<sup>3,5,6</sup>

The survival rate of snake bites differs from region to region depending on the type of snake common in a given region.<sup>7</sup> There

are about 6000 documented types of snakes in the globe, yet only 20%-30% of them were venomous.<sup>1,2</sup>

In Kingdom of Saudi Arabia, there is an extremely limited number of studies about snakebites.<sup>1</sup> Rather, some conclusions could be reached by the reported cases and hospital records review. For instance, a previous retrospective report from Saudi Arabia has concluded that there was not any case of neurotoxicity.<sup>8</sup> This may clue the poor existence of dangerous species of snakes there. Numerically, there are about 51 types of snakes present in the Kingdom of Saudi Arabia, yet only 17.65% of them are poisonous.<sup>1,9,10</sup>

The precautions and pre-hospital first aid of a snakebite are inalienable parts of the definitive control of envenomation, strictly speaking when the victim has been bitten far away distant from the closest healthcare centers.<sup>11</sup> However, the improper first aid such as using some herbals and traditional therapeutic measures may be to the detriment of the victims.<sup>12,13</sup> The best bet to put a limit to these mal-practices and encourage the proper first aid of snakebites is educating the public about the evidence-based first aid measures.<sup>3,14</sup> Consequently, there is a tangible importance for conducting a community-based survey identifying the current public perception about first aid for snakebites. This would assist in forming objective educating programs of how to control snakebites and to perform the appropriate first aid to victims. Consequently, The current study is aimed to assess the public perception of snake envenomation and first aid and preventive measures of snake bite in the Kingdom of Saudi Arabia. It identifies the self-reported lifelong prevalence of snake bites. The identification associations and correlations of the good perception is another aim of this study.

**METHODS AND MATERIALS**

An Internet-based cross-sectional and descriptive study espouses both a self-administered and interview-based survey designed using a web-based questionnaire submitted over a 2-month period, starting from 18th of June, 2017, through different social media to general Saudi population. The sampling technique utilized by this study is the simple convenience method.

The electronic, structured 54-item questionnaire was developed based on the CDC recommendations<sup>15</sup> and the current literature.<sup>3,16,17</sup> It was designed using Google form and send to a group of forensic and emergency physicians to ensure its content and construct validity with high levels of agreement. The survey was made in English initially and then translated into Arabic by four translators unaware of one another. Then, it was translated backward to English by two other dual tongue Arabic speakers who are very fluent in English. The concordance between translators was very high. Thereafter, the questionnaire was pretested on 50 respondents with the clarity of questions, the time consumed, and flow of contents using the electronic version and a printed version. The pilot data were analyzed using different techniques on Statistical Package for the Social Sciences (SPSS, Chicago, IL, Inc., USA), including internal consistency (Cronbach's Alpha), inter-rater and intra-class correlation coefficient (ICC), and test-retest reliability. Table 1 displays the results of reliability

assessment. The final version of the questionnaire consists of several parts. The first part is the socio-demographic features including age, sex, residency, education level, and social class. The 2<sup>nd</sup> portion was concerned with the awareness and personal experience of snakebites. The third part was about the knowledge of snakes and snakebites including general knowledge of snakebites and envenomation consisting of 24 items, basic concept of envenomation (3 items), the most incidental times (5-items), poisonous snake in Saudi Arabia (6 items), and the clinical presentations of snakebites (10-items). The fourth section was about the first aids of snakebites (23 items) and the preventive measures (7 items). The survey was provided promotional part consisting of the ideal responses of the survey, as well as an Arabic version of the international educational materials of the snakebites which are to be supplied to who are eager to know the right answers. The scoring of the items was based on adding one point to each correct answer and zero to incorrect or unsure response. The total score for each domain will be as follows; 24 for general knowledge and 30 for the first aid and prevention of snakebites and 54 total scores. The mean scores of the two scaling domains and total score were categorized based on the four quartiles of maximum score of each domain into four classes with the following interpretations; poor if the mean score was less than the 1<sup>st</sup> quartile, average when it is between the 1<sup>st</sup> and 2<sup>nd</sup> quartiles, good if it was between the 2<sup>nd</sup> and 3<sup>rd</sup> quartiles and excellent if it was greater than 3<sup>rd</sup> quartile (Table 2).

Data was pre-coded and entered into the Microsoft Excel worksheet for management and scoring. The scoring outcomes along with the nominal variables were further coded and transferred into SPSS for advanced inferential analysis. Descriptive data were expressed as frequencies and percentages. Correlations between continuous variables were performed using linear regression and/or Pearson and Spearman correlation coefficient. Dichotomous variables (yes-no questions) were correlated with mean scores using Student T-test. Mean score differences between different categorical variables were analyzed using the suitable parametric (Independent sample T-tests for gender, ANOVA with post-hoc tests for any categorical variable with more than two cells. Statistical significance was set at less than 0.05. The participation in the survey was voluntary and informed consent was cited by all subjects. The confidentiality of respondents would be achieved by the anonymous, self-administered nature of the survey. The IP address of respondents was used to exclude any duplication.

**Table 1. The Reliability Assessment of the scale**

Domain	Internal consistency (α-Cronbach's test)	Inter-rater reliability	Intra-class Correlation Coefficient(ICC)
General Knowledge	0.744	0.87	0.74
First Aids & Preventive measure	0.767	0.85	0.75
Total score scale	0.788	0.81	0.80

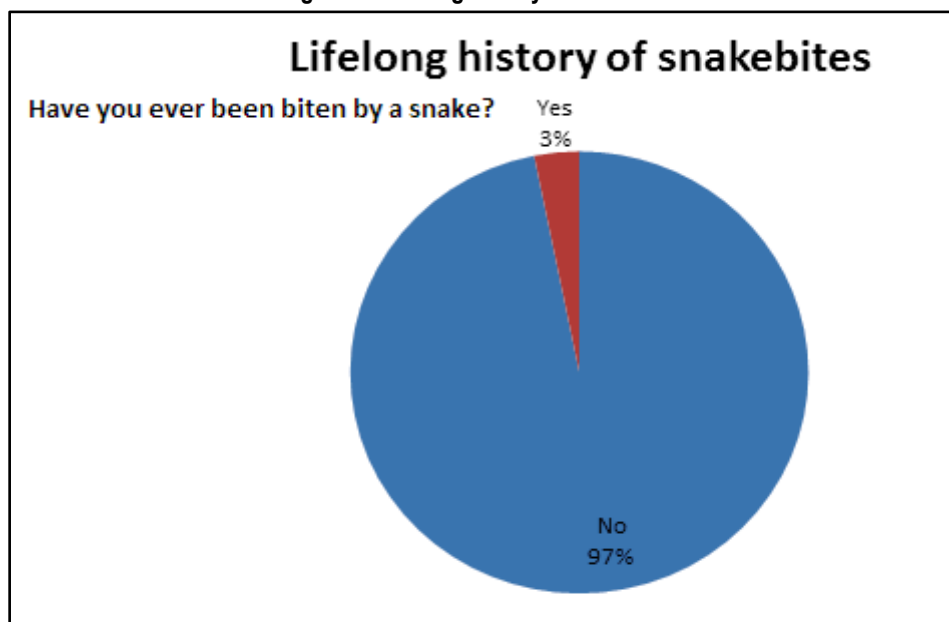
**Table 2. Categorization of the mean scores**

Domains	Number of cells	Total score	Classes			
			Poor	Average	Good	Excellent
Knowledge	3	24	≤6.75	6.751-12.5	12.51-18.25	>18.25
First Aid and prevention	3	30	≤8.25	8.26-15.5	15.5-22.7	>22.7
Total score	3	54	≤14.75	14.86-27	27.1 -39.4	>39.4

**Table 3: Sociodemographic Features**

Variable		Frequency	Percentage
<b>Gender</b>	Male	509	51.60%
	Female	477	48.40%
	Total	986	100%
<b>Marital status</b>	Married	549	55.70%
	Single	416	42.20%
	Other	21	2.10%
	Total	986	100%
<b>Educational level</b>	Illiterate or Primarily Educated	247	25.05%
	Intermediate and secondary school	342	34.68%
	University and higher	397	40.26%
	Total	986	100%
<b>Place of living</b>	Urban	670	68%
	Rural	316	32%
	Total	986	100.00%
<b>Province</b>	Central	387	39.20%
	Eastern	73	7.4
	Western	303	30.7
	Southern	115	11.7
	Northern	108	11
	Total	986	100
<b>Occupation</b>	Governmental or financial (official)	309	31.3
	Governmental (Military)	39	4
	Housewife	87	8.8
	Retired	16	1.6
	Non-Employed	69	7
	Student	443	44.9
	Own business	23	2.3
	Total	986	100
<b>Monthly income</b>	<5000 SR	234	23.7
	5001-1000 SR	249	25.25
	10001-15000	209	21.2
	15001-20000	156	15.8
	>20000	138	14
	Total	986	100

**Figure 1: Lifelong history of snakebites**



**RESULTS**

Out of 1007 responses, 986 fell under the inclusion criteria with a response rate of 97.91%. Out of them, 51.6% were male and 48.4% were female. The mean and standard deviation of age was 29.3 and 9.5 years old, respectively. The biggest proportion of the sample was married subjects (549, 55.7% vs 416, 42.2%). The remainder 2.1% cited others either divorced or widow. The vast majority are post-secondary graduates approaching about 83.2%. In the region of 68% of subjects were living in cities. The residency regions showed the best distribution where the percentages in decreasing orders were; 39.2% for central, 30.7% for western, 11.7% for southern, 11.% for northern, and 7.4% eastern. In connection to occupations, the black preponderance of the sample were students leveling out at 44.9%. Coming right after that is the governmental civilian officials comprising 31.3%. Military agents, Non-employed, self-employed, and retired constructed about 8.8%, 7%, 2.3%, and 1.6%, respectively. The

monthly income reflected the ideal variation as about 25.3% received 5001-10000 Riyals per month, 23.7% get less than 5000 Riyals, 21.2% get 10001-15000 Riyals, 15.8% are paid from 15,001 and 20,000 Riyals, and the remainder 14% of the sample have a monthly income more than 20,000 Riyals. (Table 3)

Figure 1 displays the self-reported prevalence of snakebites among the sample. It revealed that 25 subjects composing 3% have been bitten by a snake once in their lifetimes. The largest proportion of them reported that they underwent by professional healthcare management wherein 14 subjects were taken to hospital by attendees and 2 drove themselves to hospital. Rather, 9 victims were saved without any medical help. The average age of victims was 40 years with a vast majority being males comprised 64% and 44% from the central province, 24% from the western province, 20% from the northern province, and 12% were from the south, and no case was reported from the eastern region.

**Table 4: Awareness And Experiences of snakebites**

Variable	Frequency()	
	Yes	No
Life-long History of snakebite	25(3)	961(97)
Had medical help after a snake bite	20(80)	5(20)
Attended someone bitten by a snake	76(7.7)	910(92.3)
The bitten person was saved	72(94.7)	4(5.3)
Participating in saving someone	39(51.3)	37(48.7)
Knowledge of how to save a person from a snake bite	455(46.2)	531(53.8)
Having a snake pet	19(1.9)	967(98.1)

**Table 5: General Knowledge of snake envenomation in KSA**

	Correct answer		
	Number	Percentage	
1-Most of snakes in KSA are Non-poisonous (T)	155	15.7	
2-Poisonous snakes have oval head with regular teeth marks(F)	196	19.9	
3-If someone hold killed snake he may get poisoned from cut head(T)	388	39.4	
Which one of the common snakes in KSA are considered Poisonous?	4-Atractaspis microlepidota (T)	49	5.0
	5- Cerastes Cerastes gasperettii(T)	533	54.1
	6-Echis coloratus(T)	124	12.6
	7-Spalerosophis diadema(F)	122	12.4
Which one of these times considered high incidence to snake bite to happen?	8-Eryx jayakari(F)	91	9.2
	9-Walterinnesia aegyptia (T)	427	43.3
	10-Afternoon (F)	240	24.3
	11-At the night (T)	573	58.1
Which of the following is a clinical manifestation of a snakebite?	12-After raining (T)	330	33.5
	13-Summer (T)	688	69.8
	14-Winter (F)	483	49.0
	1- Sign of two bore in the site of bite (T)	601	61.0
	2- Redness and swelling around bite (T)	522	52.9
	3- Severe pain around the site of bite (T)	640	64.9
	4- Nausea and vomiting (T)	618	62.7
	5- Difficulty in breathing ( in severe cases there is no breath) (T)	675	68.5
	6- Blurred vision (T)	283	28.7
	7 - Increase sweating and salivation (T)	512	51.9
8- Numbness in the face and/or limbs (T)	479	48.6	
9- Weakness and drowsiness (T)	342	34.7	
10- Dizziness (T)	592	60.0	

T stands for true while F stands for False

**Figure 2: Sample mean scores in the two main domains and overall score**

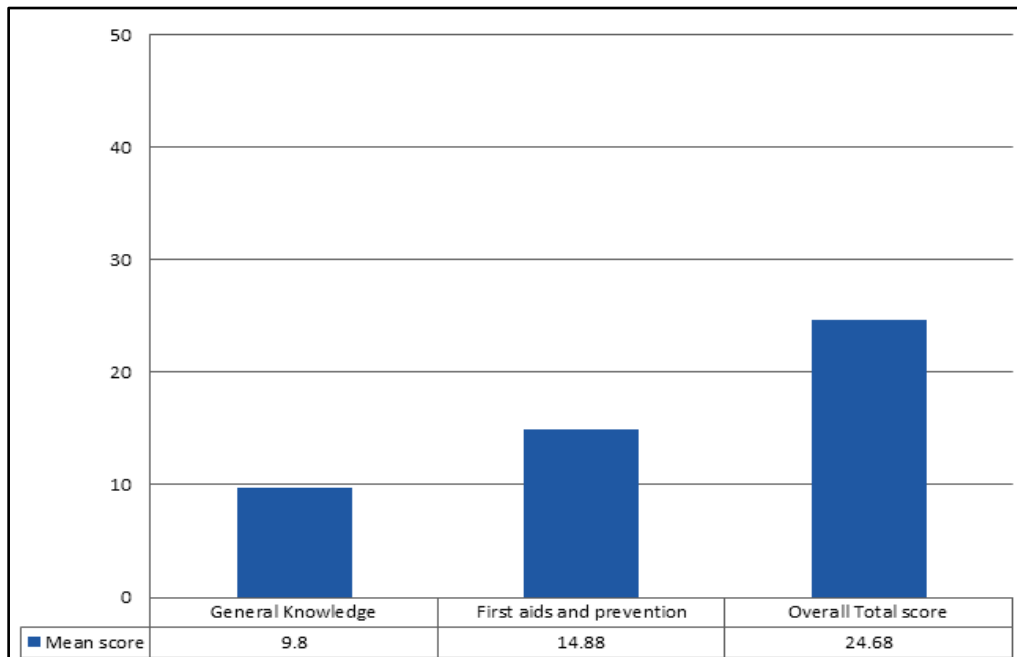


Table 4, shows the frequencies and percentages of subjects' responses to the awareness and familiarity questions. In the region of 7.7% of the sample have attended a bitten victim. Out of them, 94.7% reported the survival of their victims and 51.3% played an active role in saving the victims. More than half the sample have never read or heard about the first aids of snakebite (comprising 53,8% as compared to 46.2%). A very small proportion of subjects looking after a snake pet with the highest fraction of them possessing a non-venomous snake.

The common practiced remedial and mythic measures implemented to the bitten victims or performed by those who attended a snakebite were; application of tourniquet (38.5%), application of gas (11.5%), application of herbals (2.6%), application of dates (2.6%), sucking the venom (3.8%), incision of the puncture (2.6%). The right safety- measures reported by the attendees were taking victims to the hospital (32.1%), calm the victim (2.6%), and covering the puncture (2.6%).

The overall mean scores of all domains were significantly higher among those who had positive history of snakebite (student T-test, p=0.001), those who attended bitten victims(student T-test, p=0.000), those who had a previous education on snakebite (student T-test, p=0.000), and those who owe a snake pet(student T-test, p=0.000).

Table 5 illustrates the general knowledge of snakes' envenomation and manifestations. Generally, the sample means score was 9.8 corresponding to an average level of knowledge (it was between 6.75 and 12.5) in the general knowledge domain, (Figure2). The mean score of general knowledge was significantly different between the two genders (Male>Female, 10.4±5.1 vs 9.1±4.8 independent T test=4.2, p=0.000), educational level (Two-tailed ANOVA test F=3.276, p=0.038), type of residency (Rural>Urban, 10.6±5.1 vs 9.4±4.69, independent T test=3.51, p=0.000), different regional provinces (Two-tailed ANOVA test F=2.657, p=0.032), different occupations (Two-tailed ANOVA test, F=2.744 p=0.012). The mean score of general knowledge steadily increased with increasing levels of education showing statistically significant differences between post-secondary graduates and

illiterate or primarily educated(Post-hoc LSD and Bonferroni, p value = 0.035). Besides, it was found to be significantly different in favor of financial or governmental officials over housewives, unemployed subjects, and students(Post-hoc LSD and Bonferroni, p values = 0.028, 0.001, and 0.004, respectively). According to the provinces, the statistically significant differences were in favor of the central province over eastern and southern over eastern (Post-hoc LSD and Bonferroni, p values = 0.005 and 0.011, respectively). Provinces in descending order from higher to lower mean score were southern, central, northern, western and eastern regions.

Table 6 and Table 7 display the public perception about the first aid and preventive measures of snakebites, respectively. They summarizing the frequency and percentage of correct responses to each statement of first aid and preventive measures. The mean score of the first aid and preventive measure was 14.88 out of 30 (as presented by Figure 2 ). This score falls within the 1<sup>st</sup> and 2<sup>nd</sup> quartile range which is corresponding to an average level of perception (8.25-15.5). The mean score of this domain was significantly differing according to gender(Male>Female, 14.9±5.1 vs 13.6±4.9 independent T test=| -4.2 | , p=0.000), type of residency (Rural>Urbanized, 14.35±5.1 vs 12.98±4.9, independent T test=| 4.1:4.1 | , p=0.000), marital status(Two-tailed ANOVA test, F=10.133 p=0.000), educational levels(Two-tailed ANOVA test, F=27.783 p=0.000), and occupations(Two-tailed ANOVA test, F=3.303,p= 0.000). The post-hoc concluded that there are statistically significant differences between married and others (Post-hoc LSD and Bonferroni, p = 0.000) as well as single and others (Post-hoc LSD and Bonferroni, p = 0.000) but no statistically significant differences between single and married(Post-hoc LSD and Bonferroni, p = 0.511). According to the educational levels, the mean score of first aid and preventive measures significantly increased with increased level of education in favor of the university and higher group over intermediate and secondary and/or illiterate and primary education groups(Post-hoc LSD, p values=0.014 and 0.000, respectively). In addition, it was significantly higher among intermediate and secondary group over

the illiterate and primary education group (Post-hoc LSD and Bonferroni, p value= 0.000). As related to occupations, the financial and governmental officials scored significantly higher mean score of first aid and prevention as compared with governmental force field personals and businessman (Post-hoc LSD and Bonferroni, p values=0.002 and 0.043, respectively). Furthermore, governmental military personals achieved significantly higher mean scores on first aid and preventive measures over housewives, students, and non-employed subjects (Post-hoc LSD and Bonferroni, p values=0.012, 0.004 and 0.039, respectively). The latter scored significantly higher mean score than students (Post-hoc LSD and Bonferroni, p value=0.013). Finally, the overall total score of the sample in all domains was found to be 24.68 which is equivalent to the average range of proposed perceptual level (Table 5). The overall total score of public perception is predicted gender( M>F, 25.3±8.2 vs 22.7±8.0 independent T test= | -4.9;-4.9 |, p=0.000), type of residency (R>U, 24.96±8.2 vs 22.41±8.04, independent T test= | -4.48:4.47 |, p=0.000), educational level (Two-tailed ANOVA test, F=18.248 p=0.014), marital status (Two-tailed ANOVA test, F=5.977 p=0.004), and occupations (Two-tailed ANOVA test,

F=3.281, p=0.003). Subjects with a university and higher degree scored significantly higher scores than those who got an intermediate to a secondary degree and illiterate or those who primarily educated (Post-hoc LSD and Bonferroni, p values=0.014 and 0.000, respectively). Moreover, those who had an intermediate to secondary degree scored statistically higher score than did illiterate or primarily educated subjects (Post-hoc LSD and Bonferroni, p values=0.000). Married and single subjects scored statistically significantly higher total scores than those who cited others (Post-hoc LSD and Bonferroni, p values=0.000 and 0.000, respectively). Rather, the post-hoc showed no statistically significant differences between married and single subjects (Post-hoc LSD and Bonferroni, p values=0.366). Therefore, the marital status may not be a predictor of good perception of snake envenomation. The linear regression concluded that a significant correlation between age and mean scores of general knowledge of snake and snakebites (t-constant=47.65; t-age=6,625 p-constant=0.000;p-age=0.000), first aid of snakebites (t-constant=32.1;t-age= -3,020 p-constant=0.000; p-age=0.003) and total score (t-constant=23.5; t-age2,217, p-constant =0.000;p-age=0.027).

**Table 6: Perception of First Aids of Snakebites**

Which of these steps must be followed in First aid of snake bite case? Measure	Correct answers	
	Frequency	%
1- Once you notice a snakebite call 997 (T)	917	93
2- Try to remember the color and shape of snake help in treatment(T)	805	81.6
3- Keep victim in safe area away from snake (T)	647	65.6
4- let the victim stay calm and relaxed (T)	689	69.9
5- Stay quiet and don't draw attention of snake (T)	737	74.7
6- Do never try to catch or kill the snake (T)	389	39.5
7- Do first aid if you can't reach hospital immediately (T)	869	88.1
8-Tell victim to Sit or lie down with site of the bite being below heart (T)	514	52.1
9- Clean site of the bite with water and soap (T)	201	20.4
10- Cover site of the bite with clean and dry cloth (T)	395	40.1
11- Don't wait for the symptoms to appear to take an action(T)	833	84.5
12-Apply tourniquet (F)	207	21
13-slash the wound with a clean knife. (F)	379	38.4
14- Suck out the poison by mouth (F)	344	34.9
15- Apply ice or sterilize the wound in water (F)	402	40.8
16- Persuade the victim to take herbals as painkiller (F)	472	47.9
17- Give the victim Aspirin regardless his/her age. (F)	460	46.7
18- Drink beverages that contain coffee (F)	456	46.2
19- Apply honey at the site of bite (F)	424	43
20- Make massage for bores of the bite (F)	483	49
21- Try not to move victim frequently, especially wound area (T)	419	42.5
22-Remove any jewelry from bite area (T)	432	43.8
23-Remove shoes if the bite is on leg or foot (T)	622	63.1

**Table 7: Preventive Measures**

Which of the following preventive measures were recommended by CDC?	Correct Answers	
	Frequency	Percentage
1- Avoid storing paddy harvest inside house (T)	341	34.58
2-Controlling rodents inside houses(T)	483	48.99
3- Storing firewood outside the houses (T)	240	24.34
4- Clean area around home from leaves and grass (T)	510	51.72
5- Tapping the ground with stick when walking outside home(T)	134	13.59
6- Carry lights or torch when walking at dark area (T)	423	42.90
7-Wear protective shoes when walking outside or working in the farm(T)	443	44.93

T stands for true while F stands for False

## DISCUSSION

Given that Saudi Arabia is not densely-populated neither is shown to have widespread agricultural activities, it is lacking in several species of venomous snakes. The self-reported lifelong crude prevalence of snakebites was low as it comprised only 3% of the total sample size. The preponderance of bitten subjects was medically treated. Conversely, a previous survey explored that the majority of its population treated by traditional healers and nobody sought a medical care.<sup>17</sup>

The average age of victims was 40 years with a vast majority being males comprised 64%. Similarly, the male victims prevailed the cases of snakebite as to a previous pertinent study.<sup>1</sup> This may indicate the variation of daily activities between the two genders as reported by a previous epidemiological study.<sup>18</sup> To elaborate, male are more exposed to heavy outdoor activities like farming, cutting woods, looking after dairy animals, and as consequent contacting higher number of strolling snakes.

There is a number of mythic and bizarre remedial measures reported by the current sample. What seemed to be new to the literature was the application of cooking gas on the puncture sites. Consistent with the previous pertinent studies in the literature<sup>3,19</sup>, the application of tourniquet and/or incision of the wound and mouth sucking venom from the puncture site are also practiced as regards the present sample.

The public perception of snake envenomation and snake bite management according to the current sample laid between the 1<sup>st</sup> and the 2<sup>nd</sup> quartiles. Albeit being less than 50% of the total score, it was pre-categorized as average level. The current sample was highly educated and this may provoke confounding effect on the current level of perception reported here. As a result, even though it is not the acceptable level of knowledge, the reported scores of the current sample can be even better than the fact. In comparison, two previous articles reported higher levels of awareness of snakebite management.<sup>16,20</sup>

In spite of the undesirable level of knowledge of first aid and prevention of snakebite, it seemed reassuring when looking at imperative requirements of safety individually. For example, more 90% of subjects would call the ambulance once having an incidence of snakebite. A previous pertinent study from Sri Lanka was in an agreement with the current sample in relation to calling for medical help.<sup>16</sup> This simply eases our minds concerning the presence of deliberate negligence in the first aid measures among the most study population.

It was concluded that most species of snakes in the Kingdom of Saudi Arabia are non-poisonous. According to Al-Sadoon MK and his coauthors, 17.6% of all species in the KSA was venomous.<sup>1</sup> This was known to only as much as 15.7% of the current sample. Moreover, the vast majority of the current sample was unable to identify the poisonous snake species. As for the illustrated investigatory question regarding the four determined poisonous species in the Arabic peninsula, only 5%, 12.4%, and 43.3% could respectively classify *Atractaspis microlepidota*, *Echis coloratus*, and *Walterinnesia aegyptia* as venomous species. There is an element of truth that *Cerastes cerastes gasperettii* was distinguished as poisonous by as much as 54.1%, they are the most predominant snake species in the Kingdom of Saudi Arabia<sup>21,22</sup> and consequently it goes against the grains to be beyond anyone's knowledge in the Kingdom of Saudi Arabia. Therefore, we came to the conclusion that the identification of

poisonous species was below the par with respect to this sample. This came in an alignment with a previous pertinent survey from Nepal.<sup>23</sup>

A number of studies have suggested suitable times, seasons and climates for snakes demonstrating that snakes predominate after raining, at night, and during summer.<sup>3,18,24</sup> To take a case in point, a previous epidemiological Saudi study, most cases of snakebite were recorded during the period from May to September which represents the summer season.<sup>18</sup> Fortunately, this was known to as much as 69.8% of respondents in the current sample. In addition, a good number of subjects were familiar with the right circadian and climate of snake existence. To be specific, 33.5% and 58.1% were respectively informed that snakes predominate after raining and at the night. In comparison, the previous pertinent Chinese study showed more preferential percentages of knowledgeable subjects.<sup>3</sup>

The current literature suggested certain structural features differentiating between poisonous and non-poisonous species.<sup>3,24</sup> The only used, yet unverified feature is the oval head with teeth marks. This was queried in the current survey and only 19.9% of respondents correctly answered it. Contrariwise, in the previous force field, Chinese population more than half of the sample could figure out the correct response to the same question.<sup>3</sup>

The Center for Disease Control and Prevention (CDC) recommended against picking up the biting snake even if it was already killed for the safety, yet recalling the shape and color of the invading snake.<sup>3,15,25</sup> Unfortunately, as low as 39.5% of respondents were informed about the recommendation against catching or killing the biting snake, and only minority of them were acquainted with the fact that killed snakes still can be as poisonous as its living species. In Addition, according to the literature, the application of a tourniquet, slashing of puncture, and sucking of the venom from the puncture should not be practiced.<sup>15,20</sup> In the current study these three malpractices or as such were replied correctly by only the minority as 21%, 38.4%, and 34.9% cited not to apply a tourniquet, not to slash the wound, and not to suck out poison by mouth, respectively. Paradoxical as it may be prohibited, an American article struggled over the efficacy of the constriction bands to the superficial venous and lymphatic flow with a pressure of 20 mmHg and one or two fingers easily sliding beneath.<sup>20</sup> According to them, it should be applied proximal to wound and be kept till the administration of antivenin.<sup>20</sup> These constriction bands are not anything of the blind tourniquet which may block the arterial blood flow and as consequence delivering the victim from the sublime to the ridiculous, albeit sharing blockage characteristic. In the light of that, it could be concluded that the application of constriction bands with the aforementioned criteria, but never the blind tourniquet, should be improved to be approachable by the public so as to attain an ideal conservative management. The highly recommended conservative measure with little to no debate is immobilization of as possible.<sup>15,20</sup> Auspiciously, 69.9% of the present sample was informed about this measure. Also, it was found that about 90% of respondents of this study would call the ambulance and activate an emergency setting as soon as possible regardless of the clinical vignette of the bitten victim. This is consistent with the current guidelines and recommendations.<sup>3,15,24</sup> As a matter of fact, not all snakebites are venomous cases and need to be treated with antivenin, rather any bites need to be managed in the hospital

whether or not from venomous snake species.<sup>20,24</sup> As an illustration, there are many other treatment measures should be considered concurrently with antivenin, such as anti-tetanus, antibiotics, and analgesics.<sup>20,24</sup> Consequently, any bitten victim should be delivered to the nearest healthcare center.<sup>24</sup>

There are statistically significant differences in the scores of all domains of the survey between sociodemographic features, such as gender, type of residency, provinces, and educational levels. On the contrary, a previous Chinese study concluded that there was not significantly different in responses among sociodemographic characteristics.<sup>3</sup> The exploratory efforts for the rationalization turned out to conclude that the two studies are differing in the type of population being force field personnel in the previous Chinese and general population in the current Saudi study. However, in the present sample the marital status was of contradictive significance. To illuminate, as for the one-way ANOVA test there are statistically significant differences according to marital status. However, post-hoc least significant difference revealed that the statistically significant differences were concluded between either single or married and the "others" category. There is no significant difference between married and single. So it goes without saying that the significant differences are not predicted by marital status, some sort of confounding exists uncovered. The comparable groups of different monthly incomes showed no statistically significant differences in the scores.

It was concluded by a previous Nigerian study that distant victims showed a 2% higher risk of poor outcome following snakebite.<sup>11</sup> For one thing, it takes them miles beyond the nearest accessible medical care. Theoretically, areas with a fewer number of buildings are optimal shelters for dangerous species of snakes. Luckily but not ideally, the rural residents with respect to the present sample were more acquainted with the right perception of snake envenomation and its management as compared to the urban population.

The elderly subjects were found more knowledgeable regarding the general knowledge of envenomation than non-elderly ones. This may be attributed to the experiences of elderly on snake and envenomation. On the other hand, non-elderly subjects were longhand on the first aid and preventive measures of snakebites. This may indicate the capability of younger people of keeping abreast with the media and news as well as they are easy to target at anytime and anywhere.

The simple convenience sampling method, the internet-based survey, and cross-correlations of categorical variables allowed for several limitations. For one thing, the internet-based survey would allow for a high proportion of educated subjects in face of a limited number of uneducated or less educated subjects who are not good users of the internet. To elaborate, in the region of 46.2% of respondents had a previous formal education or even self-learning about snake envenomation and snakebite first aid and prevention. Student T-test showed statistically significant differences in the mean scores of all domains between those who read about the snake envenomation and who did not. In addition, the mean scores of all domain along with the total score were statistically significantly different according to educational levels based on two-tailed ANOVA test. To add a matter of excitement, the post-hoc analysis concluded that the mean scores are directly proportionate with the level of education. To elaborate, the

illiterates or primary education group scored the lowest mark followed by those with intermediate or secondary education and the highest score was in favor of the post-secondary graduates and higher education group. Furthermore, there was a statistically significant difference between illiterates or primary educated group and the two higher educational groups in favor of the latter. These findings could prove that the level of perception is influenced by the 46.2% previous education on snakebite, and the level of education wherein the vast majority of the respondents are either post-secondary graduates. Thus, it is apparently obvious that the education level could have exerted a confounding effect on the results and this can be attributed to the non-randomizing sampling technique exploited in this study. On expansion, the most ideally distributed sociodemographic features was the monthly income. Meanwhile, there is no statistically significant difference in total mean score of perception between different groups of monthly income. This may indicate that the statistically significant differences between the other sociodemographic features were owing to the high variation between the categorical groups. Rather, dichotomous variables such as genders were not highly variable from one another. Or that's to say, the categorical variables are correlated to each other. To illustrate, the occupation mainly dependent on the level of education. Thus the significant differences between different occupational groups may be resulting from the significant differences between the education groups. To wrap up, simple convenience sampling, online data collection, and cross-correlation of the sociodemographic features produced some sorts of limitations in the present study.

## CONCLUSION

Despite the higher level of education among the current sample, the public perception concerning the snake envenomation and snake bite management is still of average level. The significant predictors of good perception were found to be male gender, rural residence, higher educational degree, civilian officials, and living in southern or central provinces of Saudi Arabia. Older age was found significantly associated with increased general knowledge of snake envenomation. Rather, the perception of first aid and the preventive measures was significantly associated with younger age. Besides, positive history of snakebite, attending a bitten victim, receiving a previous education on snake envenomation and having a snake pet showed a significantly better perception of snake envenomation and snakebite first aids. Marital status and monthly income were found to exert no or little influence on the perceptual status the sample.

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