



## Public awareness of forensic science: A cross sectional study in Lebanon

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### ABSTRACT

Forensic science is the application of science in order to serve the law. Among the vast field of forensics, forensic DNA casework is widely considered as one of the most outstanding types of forensic evidence. To better implement forensic investigation procedures, public awareness of forensic science is crucially required. The aim of this study is to evaluate the level of awareness among Lebanese public community by assessing their knowledge and perception regarding forensics and to question their willingness to participate in the national DNA database or in scientific research. A cross sectional study was conducted over 400 adult Lebanese from both genders residing in the five Lebanese governorates. The survey questionnaire was designed and carried out from August 2021 to February 2022 with 89% as responsive rate. The participants' characteristics were under study as well as their knowledge and perception statements in the purpose of investigating their relative association through independent *t*-test. The study revealed that 40% of the participants were aware of the forensic science. In addition, only 26% of the participants are willing to provide DNA sample. Moreover, sex and marital status factors has no impact neither on their public awareness nor on their intention to donate a DNA sample. Nevertheless, characteristics such as age, education, profession, and residency has significant differences. The survey identified that younger, employed, more educated people, and individuals residing in cities showed a better awareness of forensic science and intention to provide a DNA sample. However, it is very early to decisively predict the level of awareness and the rates of participation given the fact that nationwide surveys have yet to be launched. By consequence, awareness campaigns to increase public awareness on the importance of forensics is necessary to reduce concerns and gaps in Lebanese personal knowledge, and to encourage their future participation.

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## **INTRODUCTION**

During the past decades, the forensic science field has grown rapidly mainly due to the technology advances (Hall et al., 2014). Forensic science is the application of science in order to serve the law (Shen & Vieira, 2016). Forensic entomology, forensic toxicology, forensic anthropology, and forensic odontology are few examples of the forensic science disciplines (Smith & Bluth, 2016; Divakar, 2017; Faran et al., 2018; Samehsalari & Reddy, 2018). Among the vast field of forensics, forensic DNA casework is widely considered as one of the most outstanding types of forensic evidence (Hennessy et al., 2013). DNA profile is the combination of short tandem repeats obtained for multiple loci (Imad et al., 2014). Due to its power of discrimination, it is regarded as an important investigative tool in courts (van Oorschot et al., 2010).

While the local laws state the admissibility of the evidence collected at the crime scene, the established ethical principles guarantee that the human privacy and basic rights are well respected (Gamero et al., 2007; Bitzer et al., 2019). Therefore, the forensic science awareness is at first essential not only for the forensic scientists but also for the law enforcement officers, lawyers, and judges leading to a more efficient criminal justice system (Gardner et al., 2021). Hence, since the forensics can affect the community at whole, the public awareness of forensic science is crucially needed (Olckers & Hammatt, 2021). Moreover, to assure a better implementation of forensic investigation procedures, an increased concern about the public knowledge and perception regarding forensic based investigations should be addressed (Peterson et al., 2012).

Despite the huge progress through the last years, the forensics concept is still widely ambiguous (Yadav, 2017). Accordingly, public awareness of forensic science and willing to participate in a national DNA database were the focus of many studies worldwide (Gamero et al., 2007; Amankwaa, 2018). Nowadays, DNA databases are well established in almost 94 countries including Lebanon (Romanos & Borjac 2021; Machado & Silva, 2014). Although it has a small population of around 4 million, this eastern Mediterranean country is famous for its distinctive genetic, cultural, and bio diversity (Romanos et al., 2018; Romanos et al., 2021). Till the present day, studies of similar public perspectives in Lebanon were not conducted yet. Thus, the aim of this study is to evaluate the level of awareness among Lebanese public community by assessing their knowledge and perception regarding forensic science and to question their willingness to participate whether in the national DNA database or in a scientific research.

## **METHODS**

### **Study design and sample size**

A cross sectional study was conducted over 400 adult Lebanese individuals from both genders residing in the five Lebanese governorates (the capital Beirut, Mount Lebanon, Bekaa, North and South Lebanon) from August 2021 to February 2022. Eighty volunteers from each of the five governorates were randomly selected to participate in this study. The sample size was calculated according to the Krejcie-Morgan equation (Krejcie & Morgan, 1970).

### **Data gathering procedure and ethical consideration**

This research is based on an English language survey composed of a letter of invitation, a written consent, and an anonymous questionnaire. Once the study objectives were well identified by the invitation letter, the participants signed the informed consent. The questionnaire was designed to collect the participants general characteristics, as well as their knowledge and perception statements. The data collector in charge responded to the volunteers queries without affecting their answers with all the data kept confidential. "Charter of ethics and guiding principles of scientific research in Lebanon" designed by the national council for scientific research was implemented in this study (Hamze et al., 2016).

### Respondents' characteristics

The first domain of the questionnaire covered the socio-demographic status of the volunteers. Data regarding their gender, age, marital status, residency, level of education, and profession were collected.

### Knowledge-based questions

The knowledge domain of the questionnaire consisted of six statements. It questioned the participants if they were aware of the forensics definition, forensic disciplines, and DNA profiling definition. The participants answered these three questions by "yes", "no", or "a little bit" options. A "yes" response will be scored one and a "no" or "a little bit" responses will be scored zero. It also asked the volunteers if they previously provided a DNA sample whether in a scientific study or in an investigative case. The answers for these two questions were either "yes" or "no. Only married participants with under age children were involved in the 6<sup>th</sup> statement. They were asked if they give their permission to their under age children to provide a DNA sample if needed. They had to choose among "yes", "no", or "may be" options.

### Perception-based questions

The perception domain of the questionnaire was composed of five statements. The answers were either "yes" or "no" options. The first four statements covered various aspects including the accuracy of the used techniques, the reliability of the results, the confidentiality of the personal data, and the understanding of the relative association between the forensics and the law. The willingness of participants to provide a DNA sample whether to enroll in a national database or to participate in a scientific research was the subject of the last statement. A "yes" response will be scored one and a "no" response will be scored zero. Those who answered by "no" were asked to justify their answers.

### Statistical analysis

Both descriptive and analytic statistics are shown in this study. The frequencies, the percentages, the mean, and the standard deviation of the descriptive statistics are presented in this test. As for the analytic statistics, it was applied in this research to highlight the associations between first the participant characteristics and their knowledge and second the participant characteristics and their perception. Data were observed and analyzed using the independent *t*-test. Results with *p* value equal or less than 0.05 ( $p < 0.05$ ) were considered significant.

## RESULTS

A total of 450 surveys were initially collected. After excluding 50 individuals due to missing answers, 400 volunteers successfully completed the survey. The survey responsive rate is 89%. Concerning the volunteers residency, they were similarly distributed over the five governorates (20% each). As for the gender, an approximately equal sex distribution was obtained with men comprising 52.5% of the sample. Regarding their age, the majority of the participants were in their 30's (36.8%) followed by the 20's (19%) and 40's (17%) then the 50's (12%). The elder participants in their 60's and 70's constituted 6.5% and 5.5% of the sample respectively. The lowest percentage was obtained for volunteers between 18 and 20 years old (3.2%). The mean  $\pm$  standard deviation age is  $39.63 \pm 13.99$  years. Slightly more than the half of the participants were married with children under age (52%). While dealing with the education, almost 60% of the volunteers had obtained a university education whether were graduate (37%) or post-graduate (21.5%). Participants with secondary education were 15.5% and participants with a pre-secondary education constituted 26% of the sample. Concerning the profession, 27% of the participants were unemployed. Regarding the job description, 53.5% of the participants owned a non-scientific-based job unlike the remaining 19.5%. Table 1 represents the participants detailed characteristics.

*Table 1. The participants detailed demographic data*

Participants characteristics	n (%)
Sex	
Male	205 (52.5%)
Female	195 (47.5%)
Age	
18- 20<	13 (3.2%)
≤20-30 <	76 (19%)
≤30-40<	147 (36.8%)
≤40-50<	68 (17%)
≤50-60<	48 (12%)
≤60-70<	26 (6.5%)
≥70	22 (5.5%)
M ± SD	39.63 ± 13.99
Marital status	
Single/Married but no children under age	192 (48%)
Married with children under age	208 (52%)
Residency	
Beirut	80 (20%)
Mount Lebanon	80 (20%)
Bekaa	80 (20%)
North	80 (20%)
South	80 (20%)
Education	
Pre-secondary	104 (26%)
Secondary	62 (15.5%)
Graduate	148 (37%)
Post-graduate	86 (21.5%)
Profession	
Unemployed	108 (27%)
Scientific-based job	78 (19.5%)
Non-scientific-based job	214 (53.5%)

Note: *n* - Frequency; % - Percentage; *M* - Mean; *SD* - Standard Deviation

A more simplified illustration of the participants characteristics limited into only two groups each is shown in Table 2. Concerning the age, and since the mean age is 39.63 years, volunteers were subdivided into two age groups of <40 and ≥40 years constituting 59% and 41% of the sample respectively. Meanwhile, the single individuals constituted 35% of the sample and the married ones 65%. The residency was divided into two groups, the first one composed of volunteers residing in the capital Beirut and the nearest areas to the capital characterized by Mount Lebanon forming 40% of the sample and the second one is characterized by the more distant areas of Bekaa, North, and South Lebanon forming 60% of the sample. Regarding the education feature, it was subdivided into school and university options composing 41.5% and 49.5% of the sample respectively. At the end, the unemployed individuals such as retired workers, married house wives, and university students were 27% of the sample and the employed individuals ones were 67%.

*Table 2. The participants simplified demographic data*

Participants characteristics	n (%)
Sex	
Male	52.5%
Female	47.5%
Age	
<40	59%
≥40	41%
Marital status	
Single	35%
Married	65%
Residency	
Beirut, Mount Lebanon	40%
Bekaa, South, North	60%
Education	
School	41.5%
University	49.5%
Profession	
Unemployed	27%
Employed	63%

*Knowledge statements responses*

As for the forensic science definition, this study showed that 48% of participants were not aware of its definition while 12% chose the answer “a little bit”. As a result, only 40% of the volunteers were aware of forensics definition. In addition, this test revealed that 65% of participants were not aware of forensic disciplines while 7.5% answered by “a little bit”. By consequence, forensic disciplines were recognized by only 27.5% of participants. Furthermore, the results elucidated that 59% of volunteers were not aware of DNA profiling definition with 5% answered by “a little bit”. Thereby, only 36% of participants were aware of DNA profile definition. While 97% of volunteers did not previously provide a DNA sample in a scientific study, this percentage was increased into 98.5% in an investigative case. From the total amount of 208 married individuals with under age children, 28.8% showed their cooperation if DNA sample from their under age children was needed; nevertheless, 63.4% of them refused and 7.7% gave the inconclusive answer “may be”. The responses to knowledge statements are shown in Table 3.

*Table 3. Responses to knowledge statements*

Knowledge statements responses	Yes n (%)	No n (%)	A little bit n (%)	May be n (%)
Are you aware of forensics definition?	160 (40%)	192 (48%)	48 (12%)	
Are you aware of forensics disciplines?	110 (27.5%)	260 (65%)	30 (7.5%)	
Are you aware of DNA Profiling definition?	144 (36%)	236 (59%)	20 (5%)	
Did you previously provided a DNA sample in a scientific study?	12 (3%)	388 (97%)		
Did you previously provided a DNA sample in an investigative case?	6 (1.5%)	394 (98.5%)		
Only married with under age children, do you give your permission to your under age children to provide a DNA sample if needed?	60 (out of 208) (28.8%)	132 (out of 208) (63.4%)		16 (out of 208) (7.7%)

Note: n - Frequency; % - Percentage

*Perception statements responses*

Concerning the sensitivity, almost the two-thirds of the study participants (66.5%) thought that the used techniques are not accurate. Moreover, when asked about the results reliability, 65% of the participants responded negatively. In addition, almost 73% of the study participants had concerns about the confidentiality of their personal data. As well, the majority of the participants (88%) did not recognize the relative association between the forensics and the law. Finally, more than the two-thirds of the surveyed participants (74%) did not agreed to provide a DNA sample whether to enroll in the national DNA database or to participate in a scientific research. The responses to perception statements are listed in Table 4.

*Table 4. Responses to perception statements*

Perception statements responses	Yes n (%)	No n (%)
Do you think used techniques are accurate?	134 (33.5%)	266 (66.5%)
Do you think results are reliable?	140 (35%)	260 (65%)
Do you think personal data is confidential?	114 (28.5%)	286 (72.5%)
Do you understand the relative association between the forensics and the law?	48 (12%)	352 (88%)
Do you provide a DNA sample whether to enroll in the national DNA database or to participate in a scientific research?	104 (26%)	296 (74%)

Note: n - Frequency; % - Percentage

*Knowledge and perception correlated responses to participant characteristics*

The associations between the level of knowledge of forensic science and participant characteristics as well as the level of perception of forensic science and participant characteristics were under study. The relationships between the comprehension of forensic science definition as well as the intention to provide a DNA sample versus participant features were illustrated in Table 5. The results showed that 46.31% of the females were aware of forensics definition versus 46.66% of the males. Also, a percentage of 42.10% of females willing to donate a DNA sample was obtained versus 35.23% for the males. Regarding the age, the forensics notion was understood by 56.77% of the participants under 40 years versus 32.05% of the participants above 40 years. On the other hand, 48.30% of the participants under 40 years accepted to provide a DNA sample versus only 26.92% of the participants above 40 years. As for the marital status, the test showed that 44.28% and 50% of singles versus 50% and 43.23% of married individuals were respectively familiar with forensics concept and accepted to provide a DNA sample. While 58% of the participants residing in Beirut and Mount Lebanon were aware of the forensics definition, only 32.5% of participants residing in Bekaa, North, and South Lebanon do. Similar percentages of 37.5% and 33.33% for Beirut and Mount Lebanon residents then for Bekaa, North, and South Lebanon residents were obtained respectively when they were asked to provide a DNA sample. Concerning the education factor, only 24.09% of participants among the school option were aware of forensics. Unlike this low level of awareness, a much higher level of awareness was identified among 62.83% of participants included in the university option. Similarly, a low percentage of 19.27% and high percentage of 53.98% were respectively obtained for those included in the school and the university options concerning the willingness to provide a DNA sample. In addition, the results showed that 29.62% of the unemployed individuals knew the forensics definition and 35.18% of them accepted to donate. Nevertheless, the employed individuals results showed concerning both the forensics definition and the willingness to donate a DNA sample 53.42% and 40.10% percentages respectively.

*Table 5. Statistical significance of knowledge and perception*

Participants characteristics	Knowledge	Perception
Sex		
Male	$p = 0.960$	$p = 0.322$
Female		
Age		
<40	$p < 0.001^*$	$p < 0.001^*$
≥40		
Marital status		
Single	$p = 0.574$	$p = 0.248$
Married		
Residency		
Beirut, Mount Lebanon	$p = 0.024^*$	$p = 0.906$
Bekaa, South, North		
Education		
School	$p < 0.001^*$	$p < 0.001^*$
University		
Profession		
Unemployed	$p = 0.001^*$	$p = 0.170$
Employed		

Note:  $p$  -  $p$  value; \* - statistically significant at  $p < 0.05$

## DISCUSSION

A poor engagement of the public in the forensic science comprehension had been highlighted by several studies worldwide (Salam et al., 2020; Mateen et al., 2021). The objective of this present study is to describe the status of public awareness of forensic science among Lebanese population and to assess its knowledge and perception extent.

This survey outcomes indicated that no significant difference between males and females was detected concerning neither the knowledge nor the perception. Similar conclusion was obtained regarding the association between first the marital status and the knowledge and second the marital status and the perception. The difference between the singles and the married individuals was not significant. As a consequence, the gender and the marital status factors had no impact on the knowledge and the perception of forensic science. On the other hand, a significant difference among the <40 and ≥40 years groups was obtained for both statements. Similarly, the school and the university groups showed a significant difference for both statements also. By deduction, the younger and more educated participants were more aware about forensic science and more likely to provide a DNA sample. Although the residents in Beirut and Mount Lebanon showed a higher level of knowledge of forensic science than the ones residing in Bekaa, South, and North Lebanon, all the five governorates residents presented no significant difference concerning their abstention to provide a DNA sample. As for the profession characteristic, the unemployed individuals' awareness was found lower than the employed ones. Yet, there is no significant difference among them regarding their avoidance to provide a DNA sample.

The present study has investigated which groups of the public community have poorer knowledge and perceptions of forensics. One of the suggested solutions this paper presents is the need of awareness campaigns targeting these specific groups. In addition, efforts should be focused on modifiable factors such as the education characteristic that directly influence the public knowledge and perception. These results are supported by the fact that forensic science is relatively a new field in Lebanon. Moreover, forensics major in Lebanon is restricted to only few universities. This research findings indicates that 60%, 72.5%, and 64% of the volunteers has no or a little idea about the forensic science, the forensics subdivision, and the DNA profiling definition respectively. The public views were most likely inadequate and not sufficient mainly due to the fact that the public opinion is largely

influenced by the media and the fictional investigative television programs rather than the scientific implemented facts (Hawkins & Scherr, 2017; Ley et al., 2010). Public perspectives about DNA profiling are necessary since they can help minimize the loss of its evidentiary values in the justice system (Kloosterman et al., 2015). While 3% of the participants had previously provided a DNA sample in a scientific study, only 1.5% of them had previously provided a DNA sample in an investigative case. Somehow, this leads to a poorer knowledge of the forensic science justifying this lack of awareness. That issue reflects also how much the parents cooperate in case a DNA sample of their under age children was required when 71.1% of them refused or were inconclusive. Increasing the knowledge of potential participants can contribute in the misconceptions corrections (Evet, 2014). Each statement used in the present survey represents an opportunity to improve their knowledge.

The emotional reflection of how the volunteers feel, fear, and prefer is translated by the public perception (Salam et al., 2020). The high percentage of 74% not willing to provide DNA is mainly linked to the fact that 66.5%, 65%, 72.5%, and 88% think that used techniques are not accurate, results are not reliable, personal data are not confidential, and the relative association between the forensics and the law is not clear respectively. The willingness of study participants to provide a DNA sample was not overwhelming. Many reasons were given by the survey participants to the data collector who tried to encourage them to learn more about the topic and thus enhance their level of knowledge. While a large part of the volunteers was afraid from the study side effects, another large part thought that this is an invasion of their privacy and expressed some trust issues. A smaller group showed concerns about getting exposed to possible contamination, and few participants explained about the bad experience they went through while donating a blood sample in a previous test refusing thus to participate in any other scientific study. By consequence, a strategy aimed to increase the public awareness regarding the importance of forensics is necessary to reduce their concerns, decrease the frequent gaps in their personal knowledge, and encourage their future participation.

## CONCLUSION

This research aims to investigate the knowledge and the perception of the forensic science among the Lebanese public community. Although younger, employed, more educated people, and individuals residing in cities showed a better awareness of forensics and intention to provide a DNA sample, there is an essential need to improve the general public comprehension of ethical requirements, legal regulations, and basic used techniques in forensics. To raise the level of public awareness, this study offers few suggestions such as the need to increase the availability of the forensics major in the universities, some specialized education programs at schools, a better media participation, and well organized visits to specific forensic laboratories. However, this test is encountered by many limitations such as the hesitation of some participants to ask the data collector for further scientific explanation leading possibly to inaccurate responses. Since it is very early to decisively predict the level of awareness and the rates of participation, nationwide surveys have to be more launched. As a conclusion, enormous efforts to expand the Lebanese public awareness of the forensic science are critically needed.

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