*Original Article*

# Assessment of Libyan Population Knowledge about the Environmental Carcinogens: Cross-Sectional Study

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## Abstract

Background; Cancer is a major public health issue that affects people all over the world and regarded as one of the main causes of death.

Aims; the study aims to evaluate Libyans' knowledge about cancer etiology, risk factors, and environmental carcinogens.

Methods; this cross-sectional study was conducted among 328 Libyan participants aged 18 and above, from the first of January until the 27th of April 2021.  Data was collected through online questionnaire which was validated through content validity and reliability tests.

Results; the majority of participants were female (77.1%) and 94.5% were either graduate or post-graduate. The participants who have a medical background had significantly higher knowledge scores for cancer etiology, risk factors, and environmental carcinogens.

Conclusions; Despite the fact that the Libyan public appears to be well-informed on cancer risk factors, implementing a comprehensive cancer-related information campaigns in schools, businesses, and society is highly suggested. Efforts should focus on cancer-related infections, which has been linked to an elevated cancer risk.  More studies on the prevalence of carcinogenic exposure in society, both in terms of time and amounts, is needed.

**Keywords:** Cancer, cancer knowledge, environmental carcinogens, risk factor, awareness, Libyan population.

## Introduction

Cancer is a leading cause of death for children, adolescents, and adults around the world. The estimated new cases and deaths due to cancer in the United States in 2020 are almost 1,806,590 new cases and 606,520 deaths (1). In 2018, cancer accounted for approximately 9.6 million deaths, or one in six deaths (1). Cancer may occur at any age and can affect any part of the body, it begins with genetic changes in a single cell which then grows out of control (2). Many studies have been conducted to identify the causes of cancer (3; 4). Studies have revealed that cancers are caused by hereditary factors and acquired (environmental) factors. Hereditary factors come from parents and cannot be modified, but environmental factors are potentially modifiable (4; 5).

Environmental factors (also known as environmental carcinogens) have been linked to cancer development in some epidemiological studies (6; 4). The term "carcinogens" generally refers to substances that potentially raise the risk of cancer. It's possible that the term refers to a single chemical or physical component. Single chemical factors like benzene; fibrous minerals like asbestos; metals; and physical agents like x-rays (6). Physical factors such as being overweight or obese, being physically inactive, and/or eating poorly. According to the World Cancer Research Fund International, around one-third of cancer cases in high-income nations are caused by physical causes, implying that they may be avoided (7).

Many people die from malignancies that may have been avoided. With existing risk factor information, it is possible to avoid at least one-third of the ten million cancer cases that occur each year throughout the world, particularly cancers associated to tobacco (8). People are unfortunately unaware of the risk factors for cancer, and cancer prevention strategies such as early diagnosis by screening and treatment of precancerous lesions (9; 10). Knowledge about warning signs of cancer in relation to early detection and prevention has been surveyed in a few countries (9; 10). Lack of proper knowledge about cancer in common people as well as health workers and failure to involve the people in the cancer education programs are the main causes of delayed attendance of cancer cases and consequent poor outcome (10; 11).

None of these studies have been undertaken in Libya, as far as we know. As a result, the goal of this study was to evaluate Libyans' knowledge concerning cancer and frequent environmental carcinogens.

## Methodology

A cross-sectional survey was conducted from the first of January until the 27th of April 2021. As a result of the high prevalence rate of COVID-19 cases at that time, it was preferred to collect data through an online

questionnaire. The study tool was developed by the authors; they explained the purpose of the study at the beginning of questionnaire, then asked for the participants' consent. So those who agreed to participate in the study, continued to the next parts. The questionnaire comprised two main parts; the first part included demographic characteristics of participants, which are gender, age, education, residence area, working field, and income. The second part of the study focused on the awareness of various environmental carcinogens in relation to cancer prevention, which was classified as general knowledge about cancer, knowledge of early symptoms and signs of cancer, causes of cancer, knowledge of cancer risk factors, and environmental causes of cancer development.

The questionnaire was distributed across various official groups and pages on different social media platforms. Data was collected from adult people (18 and above) from different geographical areas in Libya. Content validity and reliability tests were conducted to evaluate the questionnaire appearance in terms of readability, feasibility, and consistency. The content validity was checked with the assistance of a cancer epidemiologist and a public health expert. Afterward, the questionnaire was piloted and validated on a sample of 35 participants, those participants were the first 35 people who answered the online questionnaire. The pilot study was performed to determine the level of difficulty in answering the questions and the time needed for administration. Data from the pilot

survey was analyzed using IBM SPSS version 27 to test the internal consistency. The Cronbach's alpha value was 0.79 for the whole questionnaire, which indicated that the questionnaire was good for use.

The data was transferred to a Microsoft Word excel sheet before being exported to IBM SPSS version 27. As a preliminary data analysis, a descriptive statistical analysis was performed to ascertain the socio-demographic characteristics of the participants. In addition, an analysis of variance (ANOVA) was conducted to identify any socio-demographic variances in the knowledge score for cancer knowledge, cancer causes, general cancer risk factors, and various environmental carcinogens. The knowledge score was obtained through the total sum of right answers given by the participants.

**Results**

Overall, 334 participants filled out the questionnaire. Six of them were excluded because they are not Libyans. Consequently, 328 Libyan participants aged 18 and above were included in this study. The socio-demographic characteristics of the respondents are shown in Table 1. More than 77% of study participants were females, and nearly 94.5% of the participants were either graduated or post-graduated.

**1) Analysis of variance showing respondents' demographic predictors of cancer awareness**

Socio-demographic variances in the knowledge score for cancer were identified by using ANOVA and the

results are presented in Table 2. Six questions about cancer beliefs were asked of the participants in this section. Generally, the results showed that most demographic characteristics were not significantly associated with cancer awareness, except for the field of work. Therefore, those who worked in the medical field had a significantly higher awareness score of cancer than those who were from other fields.

**2) Analysis of variance showing respondents' demographic predictors of awareness of cancer etiology**

Socio-demographic variances in the knowledge score for causes of cancer were also identified by using ANOVA, the results of which are presented in Table 3. Similar to the knowledge score of general knowledge of cancer, those who had a medical background and worked in the medical field had significantly higher knowledge of cancer etiology than those from other fields.

**3) Analysis of variance showing respondents' demographic predictors of awareness of cancer risk factors**

Similarly, ANOVA was used to identify the socio-demographic variances in the knowledge score for risk factors of cancer, which are environmental carcinogens, genetic factors, infectious factors, physical factors, lifestyle factors, and age (Table Correspondingly, those who were from the medical field could recognize more risk factors for cancer than those from other fields.

**4) Analysis of variance showing respondents' demographic predictors of awareness of environmental carcinogens**

Finally, socio-demographic variances in the knowledge score for the environmental risk factor of cancer were also identified using ANOVA, the results of which are presented in Table 5. And similar to previous results, those who have a medical background had significantly higher knowledge scores for environmental carcinogens.

**5) Awareness of smoking risk factor**

Almost 93.9% among the participants were aware that smoking of cigarettes and shisha are one of the main risk factors of cancer. Though, about 10.1% of the participants were still either smokers or passive smokers.

**6) Source of knowledge about cancer**

The results showed number of sources that Libyan people used to

get information about cancer; the social media was the most familiar way that provided them with facts about cancer (Figure 1)

Table 1 Socio-demographic characteristics of respondents (N=328).

| Socio-Demography | | % |
|---|---|---|
| **Gender** | Male | 22.9 |
| | Female | 77.1 |
| **Age** | 18 -25 | 26.5 |
| | 26 – 45 | 63.1 |
| | 46 – 65 | 9.5 |
| | 66 and more | 0.9 |
| **Education** | No formal education | 1.2 |
| | Primary and secondary | 4.3 |
| | Graduate | 56.7 |
| | Post-graduate | 37.8 |
| **Residence area** | West of Libya | 84.8 |
| | East of Libya | 2.1 |
| | South of Libya | 6.1 |
| | Living abroad | 7.0 |
| **Field of work** | Medical | 47.9 |
| | Non-medical | 52.1 |
| **Income** | No income | 23.5 |
| | Less than 500 | 9.1 |
| | 500 – 999 | 30.5 |
| | 1000 – 3000 | 31.7 |
| | More than 3000 | 5.2 |

Table 2 Analysis of variance showing respondents' demographic predictors of cancer awareness.

| Characteristics | Sample Size | Mean (95% Confidence Interval) | Analysis Of Variance (ANOVA) |
|---|---|---|---|
| GENDER | | | |
| Male | 75 | 4.1(3.7-4.4) | F= 2.7 |
| Female | 253 | 4.4 (4.2-4.6) | P= 0.9 |
| AGE | | | |
| 18 -25 | 87 | 4.6(4.3 – 4.8) | F= 2.4 |
| 26 – 45 | 207 | 4.2(4.0 – 4.4) | P= 0.6 |
| 46 – 65 | 31 | 4.7(4.2 – 5.2) | |
| More than 66 | 3 | 4.3(4.2 – 4.5) | |
| EDUCATION | | | |
| No formal education | 4 | 5.2(3.7 – 6.7) | F= 2.1 |
| Primary & secondary | 14 | 5.0(4.4 – 5.5) | P = 0.9 |
| Graduate | 186 | 4.4(4.2 – 4.6) | |
| Post-graduate | 124 | 4.2(3.9 – 4.4) | |
| RESIDENCE AREA | | | |

| West of Libya | 278 | 4.4(4.2 – 4.5) | F = 1.8 |
| East of Libya | 7 | 3.8(2.4 – 5.3) | P = 0.1 |
| South of Libya | 20 | 4.3(3.6 – 5.0) | |
| Living abroad | 23 | 3.7(2.9 – 4.5) | |
| FIELD OF WORK | | | |
| Medical | 157 | 4.5 (4.3 – 4.7) | F = 7.4 |
| Non-medical | 171 | 4.1 (3.9 – 4.3) | P = 0.007 |
| INCOME | | | |
| No income | 77 | 4.6 ( 4.4 – 4.8) | F = 1.6 |
| Less than 500 | 30 | 4.1 ( 3.4 – 4.7) | P = 0.1 |
| 500 – 999 | 100 | 4.2 ( 3.9 – 4.4) | |
| 1000 – 3000 | 104 | 4.3 (4.0 – 4.6) | |
| More than 3000 | 17 | 4.5 ( 3.9 – 5.2) | |

Table 3: Analysis of variance showing respondents' demographic predictors of awareness of cancer etiology.

| Characteristics | Sample Size | Mean (95% Confidence Interval) | Analysis Of Variance (ANOVA) |
| --- | --- | --- | --- |
| GENDER | | | |
| Male | 75 | 4.2 (3.8 – 4.5) | F= 0.6 |
| Female | 253 | 4.3 (4.1 – 4.5) | P= 0.4 |
| AGE | | | |
| 18 -25 | 87 | 4.4 (4.1 – 4.7) | F= 0.7 |
| 26 – 45 | 207 | 4.2 (4.0 – 4.5 ) | P= 0.5 |
| 46 – 65 | 31 | 4.3 (3.8 – 4.9) | |
| More than 66 | 3 | 3.3 (-2.9 – 9.5) | |
| EDUCATION | | | |
| No formal education | 4 | 4.2 ( 1.8 – 6.6) | F = 0.2 |
| Primary & secondary | 14 | 4.3 (3.4 – 5.2) | P = 0.8 |
| Graduate | 186 | 4.3 (4.1 – 4.6) | |
| Post-graduate | 124 | 4.2 (3.9 – 4.5) | |
| RESIDENCE AREA | | | |
| West of Libya | 278 | 4.3 (4.1 – 4.5) | F = 3.99 |
| East of Libya | 7 | 2.5 (1.3 – 3.7) | P = 0.008 |
| South of Libya | 20 | 4.8 (4.0 – 5.5) | |
| Living abroad | 23 | 4.4 (3.6 – 5.2) | |
| FIELD OF WORK | | | |
| Medical | 157 | 4.8 (4.6 – 5.0) | F = 45.3 |
| Non-medical | 171 | 3.8 (3.6 – 4.0) | P = 0.000 |
| INCOME | | | |
| No income | 77 | 4.6 ( 4.3 – 4.8) | F = 3.02 |
| Less than 500 | 30 | 3.7 ( 3.1 – 4.2) | P = 0.01 |
| 500 – 999 | 100 | 4.3 (4.0 – 4.6) | |
| 1000 – 3000 | 104 | 4.1 (3.8 – 4.4) | |
| More than 3000 | 17 | 4.8 (4.1 – 5.5) | |

**Table 4:** Analysis of variance showing respondents' demographic predictors of awareness of cancer risk factors

| Characteristics | Sample Size | Mean (95% Confidence Interval) | Analysis Of Variance (ANOVA) |
| --- | --- | --- | --- |
| GENDER | | | |
| Male | 75 | 5.0 (4.3 – 5.6) | F= 2.6 |
| Female | 253 | 5.5 (5.2 – 5.8) | P= 0.1 |
| AGE | | | |
| 18 -25 | 87 | 5.7 (5.2 – 6.2) | F= 1.0 |
| 26 – 45 | 207 | 5.3 (4.9 – 5.6 ) | **P= 0.3** |

| 46 – 65 | 31 | 5.3 (4.4 – 6.3) | |
| More than 66 | 3 | 3.6 (-3.9 – 11.2) | |
| EDUCATION | | | |
| No formal education | 4 | 5.2 ( -0.1 – 10.6) | F = 0.3 |
| Primary & secondary | 14 | 5.2 (4.0 – 6.3) | P = 0.7 |
| Graduate | 186 | 5.5 (5.2 – 5.9) | |
| Post-graduate | 124 | 5.2 (4.8 – 5.7) | |
| RESIDENCE AREA | | | |
| West of Libya | 278 | 5.4 (5.1 – 5.7) | F = 1.1 |
| East of Libya | 7 | 3.7 (1.8 – 5.5) | P = 0.3 |
| South of Libya | 20 | 5.6 (4.3 – 6.8) | |
| Living abroad | 23 | 5.6 (4.5 – 6.7) | |
| FIELD OF WORK | | | |
| Medical | 157 | 6.4 (6.1 – 6.8) | F = 59.1 |
| Non-medical | 171 | 4.4 (4.1 – 4.8) | P = 0.000 |
| INCOME | | | |
| No income | 77 | 5.7 ( 5.2 – 6.2) | F = 1.3 |
| Less than 500 | 30 | 5.1 ( 4.3 – 5.9) | P = 0.2 |
| 500 – 999 | 100 | 5.5 (5.0 – 6.0) | |
| 1000 – 3000 | 104 | 5.0 (4.5 – 5.5) | |
| More than 3000 | 17 | 6.1 (5.2 – 6.2) | |

## Table 5: Analysis of variance showing respondents' demographic predictors of awareness of environmental carcinogens

| Characteristics | Sample Size | Mean (95% Confidence Interval) | Analysis Of Variance (ANOVA) |
|---|---|---|---|
| GENDER | | | |
| Male | 75 | 8.8 (7.8 – 9.7) | F= 6.4 |
| Female | 253 | 10.1 (9.6 – 10.5) | P= 0.01 |
| AGE | | | |
| 18 -25 | 87 | 10.0 (9.1 – 10.8) | F= 0.4 |
| 26 – 45 | 207 | 9.8 (9.3 – 10.3) | P= 0.7 |
| 46 – 65 | 31 | 9.1 (7.6 – 10.7) | |
| More than 66 | 3 | 8.6 (-5.0 – 22.3) | |
| EDUCATION | | | |
| No formal education | 4 | 8.2 ( 0.3 – 16.1) | F = 0.2 |
| Primary & secondary | 14 | 10.2 (7.8 – 12.5) | P = 0.8 |
| Graduate | 186 | 9.8 (9.2 – 10.3) | |
| Post-graduate | 124 | 9.8 (9.1 – 10.4) | |
| RESIDENCE AREA | | | |
| West of Libya | 278 | 9.6 (9.2 – 10.1) | F = 2.3 |
| East of Libya | 7 | 7.8 (4.9 – 10.8) | P = 0.07 |
| South of Libya | 20 | 11.6 (10.1 – 13.0) | |
| Living abroad | 23 | 10.2 (8.4 – 12.0) | |
| FIELD OF WORK | | | |
| Medical | 157 | 11.3 (10.8 – 11.8) | F = 56.3 |
| Non-medical | 171 | 8.4 (7.8 – 8.9) | P = 0.000 |
| INCOME | | | |
| No income | 77 | 10.2 (9.3 –11.0) | F = 0.6 |
| Less than 500 | 30 | 9.3 (7.77 – 10.8) | P = 0.5 |
| 500 – 999 | 100 | 9.6 (8.8 –10.3) | |
| 1000 – 3000 | 104 | 9.7 (8.9 – 10.4) | |
| More than 3000 | 17 | 6.1 (5.2 – 6.2) | |
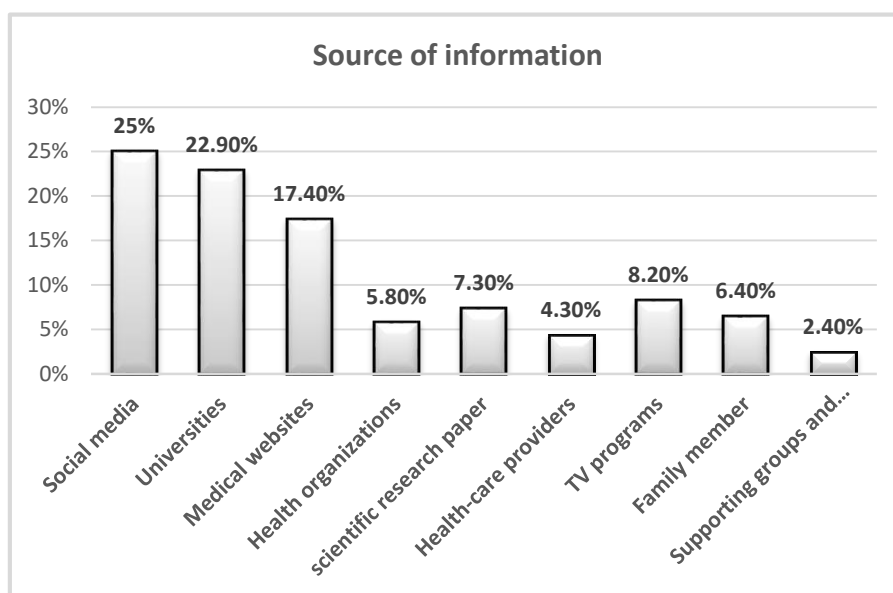
*Figure 1: Source of knowledge about cancer*

## Discussion

Cancer is a major public health issue that affects people all over the world and regards one of the main causes of death. Cancer mortality is expected to rise to 12.9 million by 2030 as a result of deficiency of major worldwide initiatives to enhance cancer control and changing health behavior patterns (12). In reality, cancer-related cultural beliefs may have a negative influence on cancer awareness and, as a result, cancer control. It may deter people from participating in cancer screening tests and preventative strategies, which consequently may lead to a rise in cancer incidence.

A study performed in the United States highlighted fatalistic ideas about cancer and found a link between these beliefs and cancer preventative activities such as quitting smoking, eating healthy, and exercising regularly (13). Another research was carried out in the United Arab Emirates (UAE) revealed UAE citizens' fatalistic

attitudes about cancer, whereas 92.8 % of the population believed that cancer was the major cause of death (14). Meanwhile, 78 % of our research participants identified cancer as a fatal disease, nevertheless 79.6 % of the individuals felt that cancer may be cured. This indicates that the Libyan people has a high level of cancer knowledge and awareness. Except of the employment field, our research found that demographic variables had no significant relationship with cancer awareness. Medical professionals had much better awareness score of cancer knowledge than those in other disciplines, which might be attributed to their job experience. Those with medical backgrounds also demonstrated more understanding of cancer etiology, risk factors, and environmental carcinogens than those with non-medical backgrounds. According to the literature, medical and paramedics have higher level of cancer knowledge and awareness than

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non-medics (14; 15). This necessitates the support of successful educational programs and the extension of cancer awareness efforts among people of all backgrounds. Public education has been found to be helpful in influencing lifestyle changes and it regards as a key component of cancer prevention efforts. It's worth noting that our participants' educational levels had no effect on their cancer knowledge ratings. Participants with greater degrees of education have comparable knowledge to those with lower levels of education. In line with these findings, a research achieved in the United Arab Emirates found that education level had no impact on cancer knowledge (14). However, a previous study performed by Hweissa to assess the awareness of cervical cancer and socio-demographic variations among Libyan women found that recall and recognition of cervical cancer symptoms and risk factors were higher in women who had a higher level of education.(16)

In addition, other studies conducted to assess breast cancer awareness and knowledge, which found clear relationship between educational level and cancer knowledge. Among these studies, breast cancer awareness interventions were found to be helpful at increasing breast cancer awareness, knowledge, and educational levels, which were favorably connected to breast self-examination attitude and attendance at breast cancer screenings (17; 18; 19). The real impact of educational degrees on cancer knowledge in general cannot be determined because those studies were confined to breast cancer awareness

among a specific demographic (women). As a result, cancer awareness campaigns must be pushed to broader public, regardless of their educational backgrounds.The current study was also assessed the awareness of Libyan people of familiar cancer causes and risk factors as part of this study. The majority of our participants believed that cancer is a complex disease with environmental, genetic, and lifestyle factors being the most important influences on cancer development. They were also able to correctly report some specific cancer-associated risk factors such as smoking, sun exposure, lack of physical activity, some infections (e.g., HPV), low fiber diets, and low fruit intake. A research conducted in England indicated intriguing disparities in cancer-related risk factor knowledge among broad ethnic groups (e.g., Asian, Black, and Chinese), with cancer-related risk factor awareness among those groups being lower than in typical UK samples (20). This displays the Libyan people's resilience. In comparison to affluent nations such as the United Kingdom, this illustrates the Libyan population's high degree of awareness regarding cancer risk factors.

Ultraviolet, nuclear radiation, X-ray, pesticides, benzene, nephthalamine, asbestosis, human papillomavirus (HPV), and hepatitis virus were all accurately identified by the majority of the participants. Despite the fact that it is common knowledge that cancer is an age-related disease and that diabetes raises the risk of certain cancers such as colorectal, breast, and bladder cancer, only a few of our participants were able to recognize them as a risk factor.

Similarly, an American study found that the general public in the United States had a poor understanding of age, and other factors as diet and multiple sex partners as risk factors for common

Cancers such as colon, breast, and cervical cancer (21). This emphasizes the need for more effective cancer risk factor education initiatives among our community.

Smoking is a strong risk factor for a variety of cancers, and most notably lung cancer (22). In addition, cigarette smoke contains more than 60 recognized carcinogens (22). Nearly all of the participants were aware that smoking cigarettes and shisha is one of the leading causes of cancer. Nonetheless, approximately 10.1% of the participants were smokers or passive smokers. Smoking normally starts in adolescent or early adulthood, with the first cigarettes being consumed in social situations. The majority of adolescent smokers feel they can stop smoking at any time and for an extended period of time. They will lose their ability to make an informed decision about whether or not to smoke in the future. Furthermore, cigarette marketing methods might inspire people. Whereas marketing and advertising may enhance the likelihood of young people starting to smoke, while anti-smoking campaigns in our society could be somewhat poorly conducted.

Social media adds a new dimension to healthcare by providing a platform for the public, patients, and health professionals to communicate about health-related topics, with the potential to improve health outcomes. Our

study showed that the social media was the most familiar way that

Provided them with facts about cancer. According to a study on the usage of social media to enhance breast cancer awareness, social media is the favorable choice of spreading breast cancer awareness (23). Media use should be adapted to the age group, degree of education, language, and cultural barriers. Furthermore, given that nearly half of the survey participants were between the ages of 18 and 46, it's not unexpected that the media was the most popular source of information.

## Study Limitations

This study utilized a convenience sample strategy, which may affect the results' generalizability. The survey could not be done face-to-face because of COVID-19 pandemic; thus it was constructed as an online questioner. Furthermore, because 77.1 % of the participants were female, the study's gender demographic may not be completely representative. As a result, the extent of gender-related variations in cancer knowledge and attitudes in Libyan society may be underestimated by our findings .

## Conclusion

Despite the fact that the Libyan public appears to be well-informed on cancer risk factors, the creation of comprehensive cancer-related information campaigns in schools, businesses, and society is highly suggested. Efforts should focus on

cancer-related infections and also smoking, which has been linked to an

Elevated cancer risk. More studies on the prevalence of carcinogenic exposure in society, both in terms of time and amounts, is needed. Also, study into how community- and government-led cancer preventive programs influence awareness levels may be conducted. Moreover, future research should examine whether there are any gender disparities in terms of cancer knowledge and awareness of various screening programs   .

Conflict of Interest

The authors have no conflict of interest to report .

Ethical approval

The study protocol was approved by Libyan National Committee for Biosafety & Bioethics, the Ministry of Higher Education and Scientific Research

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