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Original article

Evaluation of Knowledge and Practice Toward Cystic Fibrosis Disease Among Medical Students and the Residents of Western Libya

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Abstract
Cystic fibrosis (CF) is the most common severe autosomal recessive disorder worldwide, affecting an estimated 162,428 individuals. The incidence in Libya remains unknown due to limited diagnostic capacity, particularly the lack of sweat test facilities. Public and professional awareness are essential for early detection and management. This study aimed to evaluate the level of CF awareness among residents of Western Libya, identify potential knowledge gaps, and provide baseline data for future awareness programs. A cross-sectional survey was conducted among the general public and medical students in western Libya. A 17-item questionnaire, developed in English and translated into Arabic, was distributed both electronically and in print. Items assessed CF knowledge, attitudes, and awareness sources. An additional targeted questionnaire was administered to medical students who are likely to encounter CF patients in their clinical practice. Data were analysed using descriptive statistics and Chi-square tests for associations. Of 485 respondents, 340 (70.1%) had heard of CF, primarily via the internet/media (55%). Knowledge levels were moderate overall, with females scoring higher than males. Awareness varied by gender and age but showed no significant difference across other demographic groups. Participants demonstrated positive attitudes toward CF, including informed marital decisions, indicating an understanding of its genetic nature. However, substantial knowledge gaps were identified among both the general public and medical students. Although attitudes toward CF were generally positive, awareness remains insufficient in western Libya, even among future healthcare providers. Targeted educational initiatives are necessary to enhance knowledge, facilitate earlier diagnosis, and improve patient outcomes.
Keywords: *Cystic Fibrosis, Knowledge and Practice, Medical Students, Public.*

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Introduction

Cystic fibrosis (CF) is among the most common fatal genetic disorders, contributing to high morbidity and mortality in both children and adults. In the United States, CF affects approximately 40,000 individuals, with more than 1,000 new cases diagnosed annually. The disease is an autosomal recessive condition caused by pathogenic variants in the *cystic fibrosis transmembrane conductance regulator* (*CFTR*) gene [1]. Mutations in *CFTR* disrupt sodium absorption and chloride transport across airway epithelial cells, resulting in increased water absorption, reduced airway surface liquid, and the accumulation of thick, viscous mucus. This impaired mucociliary clearance promotes chronic bacterial colonisation, persistent airway inflammation, and progressive lung damage [2,3]. Beyond the respiratory system, CF affects multiple organs. Pancreatic involvement leads to malabsorption, while liver disease can progress to biliary cirrhosis. Obstruction of the vas deferens causes male infertility, and abnormal sweat gland function results in excessive salt loss. Despite its multisystem nature, most morbidity and mortality are attributable to bronchiectasis, small airway obstruction, and progressive respiratory failure [4]. In developed countries, neonatal screening programs enable early diagnosis, timely initiation of treatment, and preservation of lung function [5,6], with median survival exceeding 40 years [7]. In contrast, in Libya [8–9] and much of the Middle East [10], the absence of widespread diagnostic capabilities, particularly sweat chloride testing, impedes accurate prevalence estimation and delays treatment initiation [8–10]. Survival rates in these regions are estimated to be nearly half those in developed countries [6]. Cystic fibrosis continues to be a global health problem that presents major challenges to healthcare systems. Public awareness of genetic disorders such as CF is essential for prevention, early detection, and effective management. However, knowledge about CF remains limited, with significant gaps in understanding its pathophysiology, inheritance, and treatment [7]. Even among medical students, future healthcare providers, awareness may be suboptimal. The existing literature highlights an urgent need for targeted educational initiatives to address these deficiencies [6,7,11].

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Material and methods

Study design and setting

A cross-sectional study was conducted among medical students and residents in western Libya between December 2024 and June 2025.

Study instruments

Two questionnaires were used. The first, completed by 485 participants from the general population in western Libya, comprised 17 items designed to assess attitudes, perceptions, and awareness regarding cystic fibrosis (CF). It included sociodemographic variables (gender, age, nationality, district of residence, marital status, and educational level), as well as items assessing CF-related knowledge, awareness, and attitudes.

The second questionnaire targeted 160 medical students and was adapted from the validated CF Knowledge and Practice (CF-KP) questionnaire. It aimed to evaluate knowledge and practices among students who may be involved in the care of CF patients. Both instruments were initially developed in English and translated into Arabic, with back-translation to ensure accuracy. Items were presented as "yes/no" or multiple-choice questions, with some allowing more than one correct answer.

Pilot testing and validation

To ensure clarity, the questionnaire was piloted among 25 students, and feedback was used for refinement. Content validity was assessed by three subject matter experts, who evaluated item relevance and importance to the study objectives.

Data collection procedures

Participants completed the questionnaires either in person under the supervision of the researcher or online via a secure Google Forms link. For online respondents, the survey's first page provided information on the study objectives, the voluntary nature of participation, and the right to withdraw before submission. No names or personal identifiers were collected, and questionnaires were handled exclusively by the research team to maintain confidentiality.

Ethical considerations

The study protocol was approved by the Department of Molecular Biology and Biochemistry, Faculty of Sciences, Sabratha University. No patient samples or identifiable personal data were collected.

Data analysis

Data were coded in Microsoft Excel and analysed using SPSS version 26 (IBM Corp., Armonk, NY, USA). Categorical variables were summarised as frequencies and percentages. Associations between demographic or occupational variables and CF knowledge/attitudes were assessed using the Chi-square test, with $p < 0.05$ considered statistically significant.

Results

Demographic data

A total of 485 individuals participated in the study. Female participants outnumbered males, with 396 females representing 81.6% of the sample (Table 1). Ages ranged from 15 to 45 years, with the majority (67.7%) being under 25 years of age. All respondents were Libyan nationals residing in Western Libya, and most held a college degree (n = 468; 96.5%).

Responses about cystic fibrosis knowledge among the participants

Of the total sample, 340 participants (70.1%) reported having heard of cystic fibrosis (CF) (Table 2). The remaining 145 respondents (29.9%) were excluded from subsequent knowledge and attitude questions. Awareness was higher among females than males, and increased with educational level, 77.5% among postgraduates, 71.7% among graduates, and

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58.8% among those with intermediate education. No significant differences were observed between age groups, with approximately 70% in each group reporting prior awareness (Table 2).

Table 1. Baseline demographic characteristics of the respondents

Variables		Number
Gender	Female	396
	Male	89
Age group	Age 15-25	372
	Age 26-40	106
	Age 40+	7
Education		
Postgraduate	35	7.2
Graduate	433	89.3
Intermediate	17	3.5
Total	485	100

Table 2. Responses about cystic fibrosis knowledge among the participants

Questions	**Respond**	**(n=485) %**	**M (n=89) %**	**F (n=396) %**	**Postgrad (n=35) %**	**Graduate (n=433) %**	**Intermediate (n=17) %**	**Age group 15-24 (n=372) %**	**Age group 25-40 (n=106) %**	**Age group 40+ (n=7) %**
Have you heard of CF before?	Yes	70.1	64	71.5	77.1	70	58.8	69.6	71.7	71.4
	No	29.9	36	28.5	22.9	30	41.2	30.4	28.3	28.6
			(P > 0.05)		(P > 0.05)			(P > 0.05)		

Sources of Information and General Knowledge

Among those aware of CF, the internet and media were the most frequently reported sources of information (55%), except for participants over 40 years of age, who most often learned about CF in school (50%) (Table 3). Females were more likely than males to report the internet and media as their primary information source. Most respondents (82.6%) correctly defined CF, and 85.6% recognized it as an inherited disorder, with no significant differences between demographic groups. Approximately two-thirds correctly identified heredity as the cause of CF, with older participants demonstrating greater knowledge.

Exposure to CF Patients and Specific Knowledge Items

The majority of participants under 40 years had never seen a CF patient (93.8%), compared with only 25% of those over 40. Knowledge of genetic risk was low, with only 2.9% correctly identifying that all children of parents with CF will also have the disease. This was significantly higher among participants over 40 years (50%). About half (47.4%) knew the estimated life expectancy for individuals with CF, and 85.6% recognized complications such as malnutrition, liver disease, and digestive problems. However, 70.6% were unaware that CF has no cure, with all participants over 40 years answering this question correctly.

Preventive Measures and Attitudes Toward Genetic Testing

Approximately two-thirds of respondents identified genetic counselling as the appropriate action for a person of childbearing age diagnosed with CF, with 100% awareness among those over 40 years. Similarly, 62.9% recognized premarital screening as the most effective preventive measure, again with full awareness in the over-40 age group. Most participants (89.7%) agreed that premarital CF testing is necessary to prevent affected births.

Regarding marital decision-making, 83.2% stated that a partner's genotype would influence their choice to marry, yet 72.9% would still marry a partner with CF. When asked about the most appropriate action for couples whose genotypes

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predispose them to have a child with CF, 85% selected genetic counselling. A significant gender difference was noted, with 77.2% of males incorrectly identifying separation as the preferred option.

Table 3. Assess the knowledge and attitude regarding CF among the participants

Question	Answer	n= 340 %	M n=57 %	F n=283 %	Age 15-24 n= 266 %	Age 25-40 n= 70 %	Age 40 + n= 70 %
Q1/Have you heard of CF before?	Yes	100	16.7	83.2	78	20.5	1.1
	No	0	0	0	0	0	0
Q2/From where have you heard about CF?	Health care worker	12.6	14.1	12.4	9.4	24.3	25
	Friends	3.2	7	2.5	2.6	5.7	0
	Internet/media	55	47.4	56.5	59.4	40	25
	Family	9.5	15.7	8.1	12	0	0
	Scholl	19.7	15.7	20.5	16.5	30	50
			P < 0.05		P < 0.05		
Q3/ /What is Cystic fibrosis disease?	Cystic fibrosis is a chronic multisystem disease that causes lung and gastrointestinal symptoms.	82.6	73.7	84.5	81	88	100
	Cystic fibrosis causes chronic diarrhea and seizures	0	0	0	0	0	0
	I don't know	17.4	26.3	15.5	19	12	0
			P > 0.05		P > 0.05		
Q4/What is Cystic fibrosis disease	Inherited blood disorder	85.6	78.9	86.9	83.5	92.8	100
	Infectious disease	9.1	12.3	8.5	10.5	4.3	0
	Sexually transmitted	5.3	8.8	4.6	6	2.9	0
			P > 0.05		P > 0.05		
Q5/What is the cause of CF?	Acquired	11.7	12.3	11.7	13.9	4.3	0
	Hereditary	68.5	64.9	69.3	65.4	78.6	100
	I don't know	19.7	22.8	19	20.6	17.1	0
			P > 0.05		P > 0.05		
Q6/How frequently do you see children who have cystic fibrosis?	Once every month	6.2	8.8	5.7	3.4	12.9	75
	Once every 3 months	0	0	0	0	0	0
	Never	93.8	91.2	94.3	96.6	87	25
			P > 0.05		P < 0.05		
Q7/How is CF diagnosed?	Genetic test	10.3	24.5	26.1	6.8	21.4	50
	Sweat chloride test	4.7	5.3	4.6	4.9	4.3	0
	Chest X-ray	6.2	5.3	6.4	5.3	10	0
	All of the above	78.8	64.9	62.9	83	64.3	50
			P > 0.05		P > 0.05		
Q8/What is the risk for children to become Cystic Fibrosis patients if both parents are CF patients?	All the children	2.9	5.3	2.5	2.6	1.4	50
	A quarter of the children	32.5	21.1	34.6	33.5	28.6	25
	Half of the children	2	1.7	2.1	2.6	0	0
	I Don't Know	62.6	71.9	60.8	61.3	70	25
			P > 0.05		P < 0.05		
Q9/What is the estimated life expectancy of people	75 years	14.1	6	6.4	6.8	5.7	0
	20 years	33.3	27.9	27.2	27.4	27.1	50
	5 years	5.3	14.1	14.5	15.8	10	0

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living with Cystic fibrosis disease?	40 years	47.4	51.9	51.9	50	57.2	50
			P > 0.05		P > 0.05		
Q10/What medical complications are caused by Cystic fibrosis disease?	Malnutrition	2.4	3.5	2.1	2.3	5.7	0
	Liver disease	7.3	7	7.4	7.9	27.1	25
	Digestive issues	4.7	8.8	3.9	4.1	10	0
	All of the above	85.6	80.7	86.6	85.7	57.2	75
			P > 0.05		P > 0.05		
Q11/Is there a cure for Cystic fibrosis disease? ؟	Yes	20.3	24.6	19.4	27.8	27.2	0
	No	29.4	31.6	29	18.1	31.4	100
	I Don't Know	50.3	43.8	51.6	54.1	41.4	0
			P > 0.05		P < 0.05		
Q12/What is the appropriate action for a person of childbearing age diagnosed with Cystic fibrosis?	Preventive medicine	29.1	40.4	26.8	30.5	25.7	0
	Exercise	1.2	1.7	1.1	1.1	1.4	0
	Vitamins	4.1	7	3.5	4.5	2.9	0
	Genetic counseling	65.6	50.9	68.6	63.9	70	100
			P > 0.05		P > 0.05		
Q13/Which of the following is a preventive measure for CF?	Medical advice	17.1	15.8	17.3	17.7	15.7	0
	Pre-marital screening	62.9	66.7	62.2	60.9	68.6	100
	I don't know	20	17.5	20.5	21.4	15.7	0
			P > 0.05		P > 0.05		
Q14/Do you think doing the pre-marital screening for CF is necessary?	Yes	89.7	84.2	90.8	90.2	87.1	100
	No	10.3	15.8	9.2	9.8	12.9	0
			P > 0.05		P > 0.05		
Q15/Can your partner's genotype influence the decision to marry them?	Yes	83.2	80.7	83.7	82.7	84.3	100
	No	16.8	19.3	16.3	17.3	15.7	0
			P > 0.05		P > 0.05		
Q16/If your partner has CF, are you going to marry them?	Yes	27.1	29.8	73.5	26.3	28.6	50
	No	72.9	70.2	26.5	73.7	71.4	50
			P > 0.05		P > 0.05		
Q17/What should a couple do if they discover that their genotypes predispose them to give birth to a child with CF?	Separating	5.6	77.2	4.2	4.9	8.6	0
	Consult a doctor (Genetic Counselling)	85	12.3	86.6	85.7	81.4	100
	I Don't Know	9.4	10.5	9.2	9.4	10	0
			P < 0.05		P > 0.05		

Responses about cystic fibrosis knowledge among medical students

A total of 160 medical students completed the questionnaire, 97% of whom were under 40 years of age, with females comprising 87.5% of the group. Overall, their knowledge was low. Only 21% correctly answered whether there is a risk of having a CF child if one parent has the disease. Misconceptions regarding fertility were common, with 24% correctly identifying that not all males with CF are fertile and 16% recognizing that women with CF can become pregnant.

Only 11% knew that CF is hereditary. Less than half (47%) correctly stated that both parents must be carriers for a child to be affected, and 39% recognized that carriers are not affected by the disease. However, 88% knew that carrier parents can have a healthy child, and 82% were aware that such parents are at risk of having a child with CF (Table 4).

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Table 4. Responses about CF knowledge among medical students

Question	Answer	no	%	M (n=20) %	F (n=140) %	Age 15-24 (n=98)%	Age 24+ (n=62)%
Is there a risk of having a CF child if one parent has CF?	Yes	127	79	80	79.3	79.6	79
	No	33	21	20	20.7	20.4	21
Are all CF male patients fertile?	Yes	39	24	25	24.3	27.6	21
	No	121	76	75	75.7	72.4	79
Can CF women become pregnant?	Yes	135	84	90	87.9	79.6	91.9
	No	25	16	10	12.1	20.4	8.1
Is CF a hereditary disease?	Yes	18	11	90	87.9	86.7	93.5
	No	142	89	10	12.1	13.23	6.5
Does a CF carrier transmit the CF gene to all their children?	Yes	18	12	35	18.6	25.5	17.7
	No	127	88	65	81.4	74.5	82.3
Must both parents of the CF child be carriers?	Yes	75	47	50	46.4	45.9	51.6
	No	85	53	50	53.6	54.1	48.4
Is a CF carrier affected (ill)?	Yes	98	61	65	60.7	73.5	43.5
	No	62	39	35	39.3	26.5	56.5
Is there a risk of a future sibling of a CF child being a carrier?	Yes	164	82	55	80.7	75.5	80.6
	No	36	18	45	19.3	24.5	19.4
Is there a risk of having a CF child if both parents are carriers?	Yes	146	91	80	92.9	90.8	91.9
	No	14	9	20	7.1	9.2	8.1
Is there a risk of having a CF child if only one parent is a carrier?	Yes	107	67	60	60.7	68.4	66.1
	No	53	33	40	39.3	31.6	33.9

Discussion

Responses about cystic fibrosis knowledge among the participants.

This study represents the first investigation assessing knowledge of cystic fibrosis (CF) in the northwest region of Libya and possibly the country as a whole. The rationale for conducting this research stems from the paucity of data on CF incidence in Libya, compounded by diagnostic challenges due to the limited availability of essential facilities, such as sweat chloride testing [8]. Existing knowledge gaps among specialist physicians further hinder a comprehensive understanding of CF, contributing to limited public awareness. The reviewed literature underscores an urgent need for enhanced public education and improved awareness regarding CF.

In our study, 340 out of 485 participants (70.1%) reported prior awareness of cystic fibrosis (CF), a proportion comparable to the 64% reported in a public awareness survey conducted in Italy [7]. This similarity suggests a moderate level of CF knowledge in diverse populations, despite geographical and cultural differences. The predominant source of information among our respondents was the Internet and media (55%), which reflects global trends in health information-seeking behaviours, particularly among younger individuals who constitute the majority of our sample. Female participants reported a higher reliance on these digital sources, consistent with studies indicating greater online health engagement among women.

By contrast, Braido and colleagues found that traditional media, television (47%) and print media (13%), remained the primary information channels among their Italian cohort, with only 2% citing the Internet [7]. These differences likely arise from variations in participant demographics, especially age, as younger individuals tend to prefer digital platforms over traditional media. Additionally, differences in regional media penetration and health education infrastructure may influence these trends. For instance, in countries with limited Internet accessibility or lower digital literacy, television and print media continue to be vital sources of health information.

Moreover, personal contact with CF patients as an information source was low in both studies (8% in Braido et al. and similarly minimal in ours), highlighting the relatively low visibility of the disease in the general population. Physician communication also accounted for a small proportion of awareness (3% in Braido et al.), suggesting a potential gap in healthcare-provider-driven education on CF. This underscores the importance of targeted public health initiatives and

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clinician engagement to enhance CF awareness, especially in regions with limited diagnostic and treatment facilities like Libya. Taken together, these findings emphasize the evolving landscape of health information dissemination and the critical role of tailored educational strategies that consider demographic and technological factors to effectively raise CF awareness across diverse populations.

Among participants familiar with cystic fibrosis (CF) before the study, 82.6% correctly defined the disease, with no significant differences observed across demographic groups. This finding aligns closely with a study conducted in the southwest region of Saudi Arabia, where 76.7% of respondents provided an accurate definition of CF [6]. Furthermore, 85.6% of participants recognized CF as an inherited disorder, and approximately two-thirds correctly identified the genetic cause of the disease. These figures exceed those reported in both the Asseri and Braido studies, where only 66.7% and 20% of participants, respectively, understood the hereditary nature of CF [6,7].

Notably, most participants under 40 years of age (93.8%) reported never having encountered a CF patient, compared to just 25% of respondents over 40 years. This disparity may reflect the low prevalence of diagnosed CF cases in Libya, potentially due to underdiagnosis and misclassification as asthma. Supporting this, Asseri reported that 50.6% of primary care physicians surveyed were unable to distinguish between asthma and CF [6].

Regarding diagnostic knowledge, 78.8% of our participants correctly answered the question "How is CF diagnosed?", indicating relatively good awareness. This contrasts with findings from the Alrefaei study in Saudi Arabia, where 67% of healthcare workers were unaware of genetic testing procedures for inherited diseases [11]. Braido et al. reported even lower diagnostic awareness in their population: only 16% recognized the sweat test and genetic testing as fundamental for CF diagnosis, whereas 39% and 31% identified lung CT scans and blood tests, respectively, as relevant diagnostic tools [7].

Despite this, about two-thirds of our sample were unaware that carrier status could be determined through a blood test. Moreover, only 2.9% of participants knew that all children of two CF-affected parents would have the disease, a knowledge gap mostly limited to respondents over 40 years, who generally had greater field experience. This observation aligns with Braido's findings that higher education correlates with increased understanding of CF transmission [7].

Regarding prognosis, 47.4% correctly estimated the life expectancy of individuals living with CF, surpassing Braido's reported 33%, but falling short of the 68.6% awareness level documented in Saudi healthcare workers, likely due to differences in participant composition [6,7]. Consistent with Asseri's findings, our participants demonstrated strong knowledge of CF complications; 85.6% recognized malnutrition, liver disease, and digestive problems as common sequelae, with no significant variation across demographic groups.

A majority of participants (70.6%) were unaware that there is currently no cure for cystic fibrosis (CF). This knowledge gap was significantly associated with age, as all participants over 40 years correctly identified the incurability of the disease. This disparity likely reflects greater professional experience among older respondents. Approximately two-thirds of participants recognized that genetic counselling is the appropriate course of action for individuals of childbearing age diagnosed with CF, with 100% awareness observed in those over 40 years. These findings contrast with the results of Alrefaei et al., where only 55.2% of respondents believed that parents affected by a genetic disorder could have healthy children [11].

Regarding marital decisions, 83.2% of respondents indicated that a partner's genotype would influence their choice to marry. Additionally, 62.9% identified premarital screening as the most effective preventive measure for CF, with full awareness among participants over 40 years. This rate surpasses that reported by Braido et al., in which only 20% of participants were aware of CF's preventability [7]. Furthermore, 89.7% of our respondents agreed that premarital testing is necessary to prevent CF-affected births, with no significant differences across demographic groups. These results align with those of Janssens and colleagues, who found that 67.2% of parents of CF patients recognized carrier screening's primary goal as avoiding the birth of children with CF [12]. However, only 45% of Braido's participants suggested that genetic testing should be conducted prenatally for all parents [7].

Responses about cystic fibrosis knowledge among medical students

The lack of adequate knowledge and consequent delayed diagnosis of high-burden diseases such as cystic fibrosis (CF) contributes significantly to increased morbidity and mortality. Given that medical students are the future healthcare providers, targeted educational interventions by health organizations are essential to enhance their understanding of CF and ultimately improve patient outcomes.

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Overall, knowledge of CF among participants was unsatisfactory, with medical students demonstrating particularly low awareness. Only 21% correctly answered the question, "Is there a risk of having a CF child if one parent has CF?" This contrasts with the findings of Alrefaei et al., where 55.2% of respondents believed that parents affected by genetic diseases could have healthy children [11]. Moreover, the majority of students incorrectly responded to questions regarding fertility in CF patients; only 24% accurately acknowledged that not all male CF patients are fertile, and just 16% recognized that women with CF can conceive. These results differ markedly from those reported in a Polish study involving CF patients, where 88% and 97% correctly answered the same questions, respectively [13].

Furthermore, only 11% of students in our study identified CF as a hereditary disease, compared to 95% in Chomik et al.'s research [13]. Similarly, 47% of our respondents understood that a child must inherit carrier status from both parents to be affected, whereas 85% of participants in the Polish study were aware of this fact. Additionally, only 39% of our students knew that carriers are unaffected by the disease, in contrast to 95% in the Chomik study. Conversely, most participants (88%) recognized that carrier parents may have healthy children, and 82% understood the risk of having a CF-affected child if both parents are carriers, figures substantially higher than the 35% reported in the Polish cohort [13].

Genetic and reproductive information remains complex and challenging to comprehend, which is reflected in the students' poor performance on questions related to reproduction, sexual health, and the likelihood of bearing healthy offspring. Most respondents were unaware that a majority of males and females with CF experience infertility or subfertility. This knowledge gap underscores the urgent need for enhanced genetics education within medical curricula to better prepare future clinicians for managing CF and counselling affected families.

Conclusion

This study found that participants in western Libya possess a basic level of knowledge about cystic fibrosis (CF) and generally exhibit a positive attitude toward premarital screening and responsible marriage decisions, indicating a foundational understanding of the disease. However, a substantial proportion of respondents believe that premarital screening for CF is unnecessary, and many remain unaware of whether CF is curable. Knowledge levels varied by sex and age group, resulting in an overall moderate awareness of CF. The questionnaire also revealed significant knowledge gaps among both the general public and medical students.

If unaddressed, these misconceptions and deficiencies in CF knowledge could contribute to increased disease burden and suboptimal therapeutic outcomes. Therefore, the findings underscore the urgent need to develop targeted educational programs for medical students and the wider public to improve disease-specific understanding.

Finally, implementation of premarital and newborn screening programs for CF is strongly recommended, particularly in populations at increased risk. Additionally, expanding access to diagnostic facilities, including sweat chloride testing, is essential to facilitate early detection and improve management of CF in Libya.

Limitations

This study has certain limitations, where the sample was predominantly young and highly educated, with a large proportion of females, which may limit the generalizability of the findings to the broader Libyan population, particularly older adults and those with lower educational attainment.

Limited access to diagnostic facilities and a lack of nationwide epidemiological data on CF in Libya constrain a comprehensive assessment of disease awareness and its impact. Future studies employing longitudinal designs and more diverse sampling strategies are warranted to address these limitations.

Conflict of Interest

I declare that I have no conflicts of interest related to this research. I have no personal or financial relationships that could influence my work.

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