Libyan Journal of
Public Health Practices

Volume 1 Number 1, June (2024)

LJPHP

Message from the Editor in Chief

Welcome to the inaugural electronic edition of the Libyan Journal of Public Health and its Practices (LJPHP) in June 2024. LJPHP will be published as an online journal, providing access to a broader audience interested in public health issues and challenges. Our core mission at LJPHP is to disseminate high-quality, peer-reviewed scientific papers in the field of public health and serve as a platform for diverse perspectives on critical matters and policies.

As the editor-in-chief, I eagerly anticipate the publication of research that challenges prevailing paradigms and approaches in public health practice. I strongly encourage authors to submit their innovative ideas fearlessly, fostering solutions to current health challenges. This commitment ensures that LJPHP gains acceptance and respect as a prestigious academic journal, influencing public health practices not only in Libya but also across the region.

Our editorial board comprises esteemed members from various disciplines related to public health. Additionally, we maintain collaborative relationships with experts, ensuring a balanced blend of guidance from academics, researchers, and practitioners. My heartfelt gratitude goes to all authors, reviewers, and editors for their unwavering support.

Best regards,

Editor-in-Chief
Prof. Mohamed H. Buzgeia

Concept paper on the Social and Community approach of Child Healthcare (SCACH)

Professor emeritus: Ibrahim A. Betelmal (FRCP, DTCH, DCH)

Advisor to the vice president of the university of Benghazi for medical faculties, expert and former WHO official

It is well known that in many communities, children's healthcare relies mainly on hospital-based services. In many countries in the world, hospital-based services generally do not cover more than 20% of health services; 80% should be covered by primary health care within other healthcare facilities such as child health centres, well-baby clinics, mother-and-child (MCH), polyclinics, health visitors, and trained parents. Despite many communities still relying on hospital-based services, we contend that this approach is inadequate. Hospital-centric systems generate significant waste and frequently lead to adverse health effects for the population. Consequently, we advocate for an alternative approach. This different approach is called the Social and Community Approach to Child Healthcare (SCACH) and is what we will be discussing in this paper. SCACH has been adopted by many experts specialising in child healthcare in pursuit of more efficient and effective outcomes. Through the goals of health promotion and pre-emptive paediatric care, as well as taking part in curative pediatric care and pediatric abilitation, SCACH provides more effective and suitable healthcare solutions and outcomes for children and their families.

Our proposed approach adopts the idea that the beginning of health care for a child begins at home. It also focuses on the importance of the mother's role in detecting any defects in the child's health. This approach promotes early and proper intervention. The focus shifts to the role of primary health care in the community, including health centres, MCH centres, well-baby clinics, school and preschool health services, adolescent health care, and community institutions.

Additionally, our proposed approach emphasizes the importance of health promotion, health protection, preventive pediatrics, and health awareness and education. SCACH focuses on multidisciplinary teams and an integrated and consensual form of childcare, including doctors, nursing staff, social workers, psychologists, psychiatrists, education specialists, and nutritionists.

This is a community-oriented approach based on coordination and cooperation with hospitals. This program is being applied in many countries and was tried in the city of Benghazi, in Libya, in the late

eighties and nineties of the last century in what was called at the time the Child Health Research Centre, where the idea of a multidisciplinary team was adopted from inside and outside the hospital. Many health problems were addressed that had not been addressed before. These issues included field surveys for the early detection of many diseases that pose a risk to the child's future health, such as congenital hypothyroidism.

Child abuse and non-accidental injury: In this program, we relied on the efforts of social workers, psychologists, and psychiatrists for children with chronic diseases who needed to stay in the hospital for long riods of time. It was the role of the multidisciplinary team of social workers, psychologists, psychiatrists, nutritionists, and teaching and education specialists to complete the teaching program within the hospital, including taking exams.

SCACH was applied by social science research, studies, and surveys in cooperation with many national, regional, and international institutions and organizations. SCACH was based on supporting health awareness and education programs and using community media devices. This approach benefited greatly from international experiences, especially the experience of the London Institute of Child Health. The Institute was organically, professionally, and academically linked to the Great Orment Street Children's Hospital in London.

The roles of Professor Morley and Professor Abraham were historically distinguished in adopting the concept of comprehensive child health care, focusing on research, studies, community care, integration, and compatibility with hospital medical care. SCACH greatly benefited from the experiences of the World Health Organisation (WHO) and the United Nations Children's Fund (UNICEF). Especially when it comes to the integrated management of children's illnesses (IMCI) program which was officially approved in 1996. Many countries have adopted it. The IMCI program focuses on the role of the home, especially the role of the mother, as the first line of care for the child's health, including early diagnosis and early intervention. It then moves to healthcare centres at various levels, and in severe cases, it relies on a referral system to hospitals.

Pre-emptive paediatric medicine is based on the philosophy of foresight and advanced anticipation of health problems that the child may face in the future and taking appropriate warnings, measures, and plans for them. It should be highlighted that one of the pioneers of this vision is Dr. Al-Sadiq Abdel-AlAl (Qasr Al-Aini Hospital—Cairo).

SCACH emphasizes the importance of social determinants of health (SDH). This is a concern for many international organizations, as this trend was led by Sir Michel Marmot. This trend emphasizes the importance of social factors and their impact on public health and children's health in particular. These factors included housing, income, education, environment, food, and social and psychological pressures. The medical effects of SDH may outweigh the positive and negative aspects of common

medical problems. Community partnership with stakeholders through meetings, exchange of experiences, and social support. This partnership includes civil society leaders, the media, clubs, and cultural centres. SCACH embraces the importance of continuous training for all crews and their collaborators to build their capabilities and improve their performance.

In conclusion, the social and community approach to child healthcare aims to support health and medical institutions concerned with child health. By providing them the opportunity to adopt this approach. The inclusion of comprehensive healthcare for the child in all its aspects, including the child's development, growth, and health potential at present and in the future. We also aspire to provide these medical institutions with the benefit of all the expertise at the global level and apply it to the local level. We hope that SCACH will be adopted, which will have a significant impact on children's health, happiness, and well-being, as called for by the Sustainable Development Goals (SDGs), which are guided by the third goal.

Acknowledgement

The author would like to thank Dr. Suad Alnasfi, teaching staff member, Department of Family and Community Medicine, Faculty of Medicine, University of Benghazi; Dr. Mohamed Elkawafi, teaching staff member, Faculty of Biomedical Science, University of Benghazi; and Siraj Wanes Belgassm, medical student at Libya International Medical University.

Table of Contents

Libyan Journal of Public Health Practices (LJPHP)

Journal homepage:
https://journals.uob.edu.ly/LJPHP/index

Incidence of Central Line-Associated Bloodstream Infections (CLA-BSIs) in the Intensive Care Unit (ICU) at Benghazi Medical Centre

Amal Mukhtad[1], Asma Elramly[2,3], Amina Al Kadiky [4], Noura Al Mahguob [4], Heba Eshaim [4], Asia Al Musraty [4]

[1] Department of Occupational Health, Faculty of Public Health, University of Benghazi
[2] Department of Medical Technology, College of Science & Technology Gamines
[3] Alakeed Laboratory for Medical Analysis_ Benghazi, Libya
[4] Department of Environmental Health, Faculty of Public Health, University of Benghazi

ARTICLE INFO

Article history:
Received 19/3/2024
Revised 19/5/2024
Accepted 31/5/2024

Keywords:
Central Line-Associated Blood Stream Infection
Intensive Care Unit
Risk factors
Bundle
Nosocomial infections

ABSTRACT

Critically ill hospitalized patients have a significant risk of developing nosocomial bloodstream infections; most of these BSIs are usually from an intravascular device, Central-line-associated bloodstream infection is one of the most important problems in intensive care units worldwide. The study aimed to measure the incidence, risk factors, and most frequent causative organisms of central line-associated bloodstream infections in the Medical Intensive Care Units at Benghazi Medical Centre. This prospective study included 124 patients and was conducted between September 2021 and February 2022 in the Medical Intensive Care Units at Benghazi Medical Centre. The data was collected by using two research tools, worksheet for recording the data on each ICU patient with a central line and blood samples collected from patients using strict aseptic technique and sterile equipment. The total incidence rate of CLA-BSI in internal Intensive Care Units at Benghazi Medical Centre was 12.4/1000 CL-days, and the infection rate of CLA-BSI in patients' blood cultures after CVC insertion was 11.3%. Gram-negative bacteria were the most causative microorganisms by 54.4%, and 45.6% of the infection was gram-positive bacteria. *Klebsiella pneumoniae* was the most causative microorganism in gram-negative bacteria by 35%. While 28.1% of gram-positive bacteria were *Staphylococcus aureus*. *Klebsiella pneumoniae* and *Staphylococcus epidermidis* reported resistance to most of the tested antibiotics. CLA-BSI is an important cause of mortality in ICU patients. Patients with CLABSIs can have a longer hospital stay and higher health care costs. Thus, implementing standard infection prevention practices for critically ill patients is highly recommended.

*Corresponding author. Amal Ali Mukhtad
E-mail address: amal.mukhtad@uob.edu.ly

1. Introduction

Critically ill hospitalized patients have a significant risk of developing a nosocomial bloodstream infection (BSI); most of these BSIs are primary and usually originate from an intravascular device. Central venous catheters (CVCs) are commonly used in intensive care units (ICUs). Yet, insertion a catheter can pose a risk of infections to patients caused by complications that can lead to death. Infections risks consist of femoral or internal jugular rather than subclavian catheterization; paying no attention to sterile barrier precautions during catheterization; not using personal protective equipment including a mask, sterile gown, sterile gloves(1).

The International Nosocomial Infection Control Consortium (INICC) reported that Central line-associated bloodstream infection (CLABSI) rates in intensive care units (ICUs) of developing countries are higher than in the developed world. It is stated that the pooled rate of CLA-BSI in the INICC's ICUs of Latin America, Asia, Africa, and Europe, 4.9 per 1000 central line days, is nearly 5-fold higher than the rate reported from comparable US ICUs included in their last report. Actually, out of all kinds of hospital acquired infections, CLA-BSIs have the highest mortality rate ranging from 12% to 25%. Patients with CLA-BSIs can experience longer hospital stay, higher health care costs and attributable mortality(2)(3).

Each year, hundreds of millions of patients are affected by Healthcare-Acquired Infections (HAIs) throughout the world(4). These infections can significantly increase morbidity and mortality in developed and developing countries(5). Seriously ill patients are mainly susceptible to serious complications as a result of HAIs, expected risk factors including progressively more invasive medical technology and complex medical procedures, increasing immunocompromised status and old age, chronic diseases, length of stay at hospital, and the increasing incidence of antimicrobial resistance(6). In the United States, the CDC estimates that 5% to 10% of hospitalized patients can develop HAI(7). CLA-BSI is the most common cause of HAI in the blood-stream, an estimated 250,000 bloodstream infections happen every year, and most are associated to the presence of intravascular devices(8). CLA-BSIs are serious but can often be prevented when evidence-based guidelines are tracked for the insertion and maintenance of central lines. Following Infection control guidelines can significantly decrease the risk of infection and mortality in patients(9). In developing countries, mortality rates may be as high as 50%(6). For instance, a study in Egypt was conducted in the ICUs of 3 hospitals at Cairo University, and CLA-BSI rates varied widely, from 2.9 to 14.3 per 1,000 central line-days, with an overall rate of 9.1/1,000 central line-days(10). Also a study in Libya conducted in Al Jumhoria hospital over a period of 24 month (2009-2010) on 937 patients, who developed BSIs were admitted to different medical units of the hospital including Coronary care units (CCU), isolation units (ISO), neurological units (B.C), Medicine units (B.B), intensive care units (ICU), gynecology units (G.B), oncology units and hematology units (B.A). It has been found that the rate of BSIs in 2009 was (28%), while the rate of infection in 2010 was (27%) with the highest percentages (61%) in ICU in 2009, however in 2010 the infection rate was lower (52.5%). This study also showed methicillin resistant S. aureus (MRSA) represented (5.7%) from all bacterial isolates tested. However, methicillin resistant coagulase negative Staphylococci occurred high percentage (27.4%) than MRSA.(11)

Available statistics on the global impact of CLA-BSIs have been more restricted, mainly in many resource-constrained areas. Low- and middle-income countries usually do not have adequate resources to conduct CLABSI investigation and lack continuous improvement strategies for optimal patient care. Researchers who have attempted to quantify CLABSI rates in developing countries have found these rates to be much higher than those in developed countries, and their impact on patients and health care delivery systems is both severe and undervalued(12).

This study aimed to measure the incidence, risk factors and most frequent causative organisms of central line-associated bloodstream

infections (CLA-BSI) in the Internal (Medical) Intensive Care Units (ICUs) at Benghazi Medical Centre (BMC), Benghazi, Libya.

2. Methodology

2.1 Study Design

A prospective cohort study was conducted in which all patients admitted for more than 48 hours between September 2021 to February 2022 to Internal (Medical) ICU of Benghazi Medical Centre (BMC) were monitored for the occurrence of CLA-BSI. The study population was 124 cases out of 1100.

2.2 Study Population

The infection surveillance cohort consisted of all patients admitted to the medical ICUs who had central venous lines for at least 48 hours (3). The infection surveillance was carried out over a period of 6 months from September 2021 to February 2022.

2.3 Study Tools:

2.3.1 Work sheet:

This sheet was used to collect the data on each ICU patient with a central line including:

a-Administrative data: patient's name, medical record number, hospital admission date, ICU admission date and discharge date.

b- Demographic data: Gender, age, medical history and co-morbidities.

c-Admission diagnosis: for instance, Chronic Obstructive Pulmonary Disease (COPD), liver cell failure, heart failure, immuno-compromised state, end-stage renal disease, Diabetes Mellitus (DM), hypertension, neurodevelopmental problems. smoking, and chronic.

d- Data about Insertion devices: Type of catheter, insertion site, duration of catheter placement, hospitalization days before ICU admission, length of stay, previous hospitalization, inserted medical devices at admission, repeated central line insertion during the same ICU admission.

e- Central Line-Associated Bloodstream Infection (CLA-BSI) criteria: Date of suspected CLA-BSI, symptoms [e.g: fever, chills and hypotension] and laboratory criteria.

f-Outcome of stay in the ICU: e.g: discharge, death, transfer to another ward or transfer to another hospital.

2.3.2 Blood Tests:

Blood cultures and sensitivity were collected from ICU patients, who have any signs of manifestations of sepsis or incidence of central line-associated bloodstream infection (CLA-BSI). Blood samples collected using strict aseptic technique and sterile equipment, were inoculated into blood culture bottles that promotes the growth of aerobic and anaerobic microorganisms.

2.4 Inclusion Criteria:

All ICU patients with a central venous catheter in the hospital had no infection at the time of admission.

2.5. Exclusion Criteria:

- Patients who died or were discharged within 48 hours of admission.
- Patients without a central venous line were excluded.

2.6 Data analysis:

1. Worksheet: data quantitatively analyzed the Statistical Package for Social Sciences (SPSS), and presented in simple frequency tables, and chart were used in data presentation to provide visual simplicity for presented data. A chi-square test was used to compare quantitative data between groups, The adjusted risk factors for CLA-BSI were obtained using the logistic regression analysis. The dependent variable was the presence or absence of CLA-BSI in all the patients. A p-value < 0.05 was considered as a significance.

2. Steps for calculating the central line-associated bloodstream infection/central venous catheter-related BSI rate: All patients admitted to Internal ICU were daily monitored by physicians' round for the development of nosocomial BSI, which was required to meet at least one of the following criteria:

First Criteria: Patient has a predictable pathogen cultured from blood cultures and the organism cultured from blood is not related to an infection at another site.

Second Criteria: Patient has at least one of the following signs or symptoms: fever (> 38°C), chills, or hypotension (3).
The signs and symptoms of infection appear 48 hours after admission, and there are no signs or symptoms of infection at the time of admission, demonstrated by the patient's history and clinical examination.

Incidence rate also known as incidence density rate, is determined by taking the total number of new cases of an event/cases and dividing that by the sum of the person-time of risk population.

$$\text{CLA-BSI incidence rate} = \frac{\text{No. of CLA-BSI Cases}}{\text{No. of central line days}} \times 1000$$

3. Specimen's laboratory analysis: blood cultures and sensitivity were analyzed in specialized laboratory Al-Akeed which is certified by National Centre for Disease Control Libya. All bacterial isolates were stained using Gram staining technique to differentiate between Gram negative or Gram positive. Culture media used were blood Agar, Chocolate Agar, MacConkey Agar.

2.6 Ethical considerations:

There were no ethical issues and this study was conducted after submitting an official application paper from Benghazi Medical University to BMC Hospital and it was officially approved for data collection and sampling from patients. Data were coded, and the anonymity of the data was maintained during the statistical analysis.

3. Results

Overall, 1100 patients were admitted to the internal ICU in the follow-up period (6 months); 52% of all the patients admitted had CVC insertion (572 patients).
The age categories of the studied patients ranged from 18-92 years (mean ± SD was 58.2 ± 14.6 years), the median hospital stay before ICU admission was 2 days, and the median ICU stay was 5 days.

The total incidence rate of CLA-BSI in internal ICU at BMC during period from (September 2021 to February 2022) was 12.4/1000 CL-days, the infection rate of CLA-BSI patients' blood cultures after CVC insertion was 11.3%.
Table 1 shows risk factors for Central Line Associated Bloodstream Infection CLA-BSI among the Intensive Care Unit ICU patients during the period from September 2021 to February 2022. 75% of patients were male and the rest were female; specifically, 44.0% of all male patients admitted had infected while 49.0% of all female patients admitted had infected.

The p-value of this case was not significant and out of range by 0.09. Also, the p-values for previous hospitalization, COPD, Liver failure, Heart failure, Immunosuppression, and Neurological disease patients were non-significant and were in the range (0.3 to 0.9) which is mean low severity of CLA-BSI occurrence for all these patients.

Finally, higher risk factors and severity of occurrence of CLA-BSI were observed with Renal failure, DM, and Hypertension, where the p-values were 0.01, 0.02, and 0.03, respectively.
Table 2 shows relationships between ICU length of stay and the occurrence of CLA-BSI in patients. It was one of risk factors that increase infection rate of CLABSI long stay in ICU >5days with significant value 0.04. The central venous line also had higher risk factor for rise rate of CAL-BSI (57%) than other inserted medical devices with significant p-value 0.03. Also one of risk factors was insertion CVC site. Subclavian insertion of a CVC has high infection rate of CLA-BSI (14%) compared with other sites of CVC insertion with significant p-value 0.02.
Table 3 shows the multivariate logistic regression model analysis of risk factors for CLA-BSI in ICU patients, ICU stay of 5 days or more, renal failure, DM, hypertension, and CVC.

Table 1: Risk factors for CLA-BSI among ICU patients from (September 2021 to February 2022) (n= 124)

Variables	Infection No.%	No Infection No.%	Chi-square	P-value (P< 0.05)
Gender			0.5	0.09
Male (n=75)	33 (44)	42 (56)		
Females (n=49)	24 (49)	25 (51)		
Previous hospitalization (n=14)	8 (57)	6 (43)	0.4	0.3
COPD*(n=12)	5 (42)	7 (58)	0.004	0.8
Liver failure (n=17)	1(6)	16 (94)	0.2	0.6
Heart failure (n=42)	2 (9)	40 (91)	0.1	0.7
Immunosuppression (n=7)	2 (29)	5 (71)	0.002	0.9
Renal failure (n=48)	5 (10)	43 (90)	6.3	0.01*
DM (n=43)**	23 (53)	20 (47)	4.9	0.02*
Hypertension (n=19)	5 (26)	14 (74)	3.4	0.03*
Neurological disease (n=3)	1(33)	2 (67)	0.002	0.9

*No.:Number, *COPD: Coronary Obstructive Pulmonary Disease; **DM: Diabetes Mellitus

Table 2: Relationships between ICU length of stay and the occurrence of CLA-BSI in patients

Variable	Infection No. %	No Infection No. %	Chi-square	P-value < 0.05
ICU length of stay				
< 5 days (n=39)	13 (33)	26 (67)	3.6	0.04*
>5days (n=85)	44 (52)	41 (48)		
Inserted Medical devices				
Urinary catheter (n=25)	9 (36)	16 (64)	1.0	0.3
Central venous line (n=92)	52 (57)	38 (41)	3.2	0.03*
Mechanical Ventilation (n=7)	2 (29)	5 (10)	0.3	0.5
Site of CVC Insertion				
Jugular (n=107)	5 (5)	102 (95)		
Subclavian (n=14)	2 (14)	12 (86)	2.9	0.02*
Femoral (n=3)	1 (33)	2 (67)		
Place od Admission	-	-		
Unknown (n=0)	1 (20)	4 (80)	1.2	0.3
Other hospital (n=5)	13 (43)	17 (57)		
Same hospital (n=30)	3 (4)	85 (96)		
Home (n=89)				

Table 3: Logistic Regression Model Analysis of Risk Factors for CLA-BSI in ICU patients

Variable	No. of cases with risk factor/ all participants	No. of cases with risk factor/ all cases with CLA-BSI	P-Value <0.5	Odds Ratio	95% Confidence Interval
ICU stay of at least 5 days	44/57	85/124	0.002	5.9	1.6 – 14.6
Renal Failure	5/57	48/124	0.04	2.3	1.1 -9.6
DM*	23/57	43/124	0.02	4.2	1.2- 12.6
Hypertension	5/57	19/124	0.03	3.4	1.0 – 11.4
CVC*	52/57	92/124	0.001	6.3	2.1 – 16.3

*No.:Number, *CVC: Central Venous Catheter; **DM: Diabetes Mellitus.

The total participants were 57, and the highest risk factors were associated with CVC, ICU stay of at least 5 days, and DM cases with a total of 52, 44, and 23 respectively. However, only 10 cases were reported with renal failure, and hypertension. Regarding the CLA-BSI cases, there were a total of 124 patients and the highest risk factors were associated with CVC, ICU stay of at least 5 days, renal failure, and DM cases with number of cases 92, 85, 48 and 43 respectively, while only 19 were reported with hypertension.

Overall, the P-Values for the variable's ICU Stay of at least 5 days, renal failure, DM, hypertension, and CVC were significant with values 0.002, 0.04, 0.02, 0.04, and 0.001 respectively. The outcome of admitted patients, (94) 75.8% were discharged to the same hospital, (7) 5.7% were discharged to another hospital, (9) 7.2% were discharged home, and (14)11.3% of the patients died.

In Figure 1 *Staphylococcus aureus* showing methicillin resistance character against Oxacillin (Oxacillin resistance MRSA).

Figur 2 shows the distribution of the microorganisms identified in patients' blood culture after CVC insertion. The identified bacteria were *Klebsiella pneumoniae* approximately 20 (36.1%), *staphylococcus aureus* approximately 16 (28.1%), *Enterobacter spp* 11 (19.3%), *Staphylococcus Epidermidis* 10 (17.5%). Thus, 54.4% infection was caused by gram negative bacteria, while 45.6% of the infection was caused in in gram positive bacteria.

Table 4 shows distribution of gram- negative isolates according to susceptibility to antimicrobials agents. Most isolates of *K. pneumoniae* were 100% resistant to most antibiotic. However, the result of antibiotic sensitivity testing showed that K. pneumoniae isolate was sensitive to colistin, doxycycline and levofloxacin respectively. *Enterobacter Spp* also were resistance to most of antibiotic except Ciprofloxacin, Amikacin, Vancomycin, and Oxacillin.

Table 5 shows the distribution of gram- positive isolates according to susceptibility to antimicrobials agents. Most isolates of *S. aureus* were almost sensitive to most antibiotic. However, *S. aureus* isolate was resistant to ceftriaxone, clarithromycin, gentamycin and ceftazidime. *S. epidermidis* also were resistance ceftriaxone, clarithromycin, gentamycin and ceftazidime. According to the results were shown from tables 5,6. gram-negative bacteria had more resistance to the antibiotics.

Figure 1: Oxacillin resistance (MRSA)

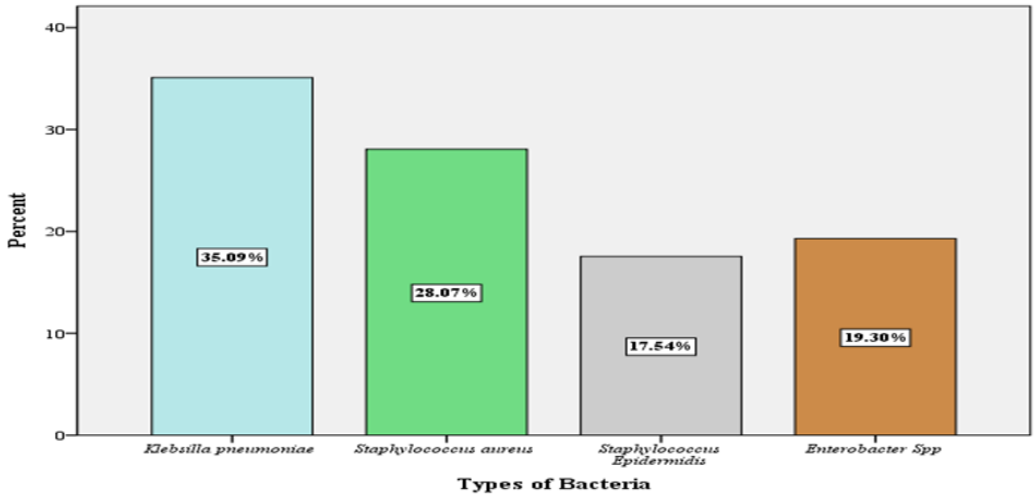

Figure 2: Distribution of the microorganisms identified in patients' blood culture after CVC insertion of (n=124)

Table 4. Distribution of Gram- Negative isolates according to susceptibility to antimicrobials agents

Antibiotic	Susceptible		Intermediate		Resistance	
	***K. Pneumoniae* (n=20)**	***Enterobacter Spp* (n=11)**	***K. Pneumoniae* (n=20)**	***Enterobacter Spp* (n=11)**	***K. Pneumoniae* (n=20)**	***Enterobacter Spp* (n=11)**
Imipenem	-	-	5	-	15	R
Ceftazidime	-	-	-	-	R	R
Ciprofloxacin	-	4	-	-	R	7
Vancomycin	2	1	-	1	18	9
Augmentin	-	-	-	4	R	7
Gentamycin	-	-	-	-	R	R
Doxycycline	18	-	2	-	-	R
Oxacillin	-	1	-	1	R	10
Levofloxacin	13	-	3	-	4	R
Amikacin	1	2	2	-	17	9
Meropenem	-	-	-	-	R	R
Ertapenem	-	-	-	-	R	R
Vancomycin	-	-	-	-	R	R
Clarithromycin	-	-	-	-	R	R
Ceftriaxone	-	-	-	-	R	R
Cefotaxime	-	-	-	-	R	R
Septime	-	-	-	-	R	R
Piperacillin/Tazobactam	-	-	-	-	R	R
Colistin	19	-	1	-	-	R

Table 5. Distribution of Gram- Positive isolates according to susceptibility to antimicrobials agents

Antibiotic	Susceptible N (%)		Intermediate N (%)		Resistance N (%)	
	***S. aureus* (n=16)**	***S. epidermidis* (n=10)**	***S aureus* (n=16)**	***S epidermidis* (n=10)**	***S aureus* (n=16)**	***S. epidermidis* (n=10)**
Imipenem	3	6	2	4	11	-
Ceftazidime	-	-	-	-	R	R
Ciprofloxacin	16	7	-	3	-	-
Vancomycin	12	2	-	7	4	1
Augmentin	7	5	-	3	9	2
Gentamycin	-	-	-	-	R	R
Doxycycline	16	10	-	-	-	-
Oxacillin	1		1		14	10
Levofloxacin	9	8	7	1	-	1
Amikacin	8	3	5	7	3	-
Meropenem	5	-	11	-	-	R
Linezolid	2	-	9	-	5	R
Clarithromycin	-	5	-	4	R	1
Ceftriaxone	-	-	-	-	R	R

4. Discussion

Although, CLA-BSI incidence and infection rates in the current study findings were higher than rates in many evidence in developed studies(13)(14)(15), lower CLA-BSI rates were reported comparing to other several studies(13)(16-20) and 11.3% of the patients died. The higher rate of CLA-BSI in this study than in developed countries could be explained by the fact that ICU patients in developing countries are at an increased risk for infection

4.1 CLA-BSI related Risk Factors:

The current study shows the risk factors for CLA-BSI among the ICU for 124 patients during the period from September 2021 to February 2022. These risk factors were displayed a higher possibility of CLA-BSI for renal failure, DM, and hypertension patients. But, a study was conducted in Egypt in 2018, was showed a high-risk factor for heart failure patients with p-value 0.01(16).

This study also finds that relationships between ICU length of stay and the occurrence of CLA-BSI in patients who longer stay in the intensive ICU, increase chance of CLA-BSI infection. It was also found that the most inserted medical devices that increase the incidence of CLA-BSI are the central venous line, while a study conducted in Egypt in 2018 found that mechanical ventilation was the most common device that causes CLA-BSI, with a rate of (5.4%) and p-value (0.02)(16).

It was also found in the current research that the most common CVC insertion site which increases the incidence of CLA-BSI is the subclavian, while in a study conducted in Jordan in 2019, the incidence of CLA-BSI was high in the femoral CVC site with rate (51.9%) and p-value (0.01)(20).

Another study conducted in (Cairo, Egypt), similar to this result, where the most common CVC insertion site that increases the incidence of CLA-BSI is the subclavian CVC site with a rate (11.3%) and Value (0.02)(21).

In the multivariate logistic regression analysis, an ICU stay of 5 days or more, renal failure, DM, hypertension, and CVC were the only independent risk factors for the occurrence of CLA-BSI in ICU patients. Other studies agreed a statistically significant association between the occurrence of CLA-BSI in ICU patients with ICU stay of 5 days scores or more(16)(19)(20).

4.2 Infection Rate and Bacteriological Profile:

The current study showed 45.6% of the infection was represented in gram positive bacteria, and 54.4% infected with gram negative

bacteria. An evidence in Libya was mentioned that of all positive cases of the bacterial isolates for BSI occurrence of gram-positive bacteria reached (52.9%), and the percentage of gram-negative was reported as (40.6%)(12). The highest distribution of the microorganisms identified in patients' blood culture was gram negative bacteria (*Klebsiella pneumoniae*), While a study conducted (in Brazil) in 2019 had the highest results for gram-positive bacteria (*Staphylococcus aureus*) the rate 15.4% and was lower results for (*Klebsiella pneumoniae*) the rate 12.8%, while a study in India (2016) had similar outcomes to the current study, where the highest results were for (*Klebsiella pneumoniae*) the rate 40%. The study in Brazil in 2019 showed many species of bacteria that cause CLA-BSI, such as *Pseudomonas aeruginosa , Staphylococcus aureus, Klebsiella, pneumoniae, Enterobacter spp., Acinetobacter spp*., Fungi, *Candida albicans, Staphylococcus epidermidis, Candida albicans, Enterococcus faecalis, Staphylococcus coagulase negatives, Klebsiella* (18). While the study in India in 2016 showed species such as *Klebsiella pneumoniae, Pseudomonas aeruginosa, Acinetobacter species, Stenotrophomonas maltophilia, Proteus species, Pantoea agglomerans, Sphingobacterium maltivorum, Porphyromonas species, Staphylococcus aureus, Enterococcus faecium, Enterococcus faecalis* (14). Only four species showed in the present study *Klebsiella pneumoniae, staphylococcus aureus, Enterobacter spp, staphylococcus Epidermidis*. The reason for the appearance of a small number of bacteria that cause CLA-BSI in present study because of the limited collected samples through 6 months in one healthcare facility. In addition, infection control surveillance and hospital accreditation are not mandatory at the national level and compliance with the rules of infection control programs is poor. In contrast, gram-positive skin organisms are frequently the most reported causative microorganisms of bloodstream infections (16)(17).

In the current study, gram-negative bacteria had more resistance to the antibiotics. Most isolates of *K. pneumoniae* were 100% resistant to most of antibiotic (Urgent threat). However, the result of antibiotic sensitivity testing showed that *K. pneumoniae* isolate was sensitive to colistin, doxycycline and levofloxacin respectively. *Enterobacter Spp* also were resistance to the most of antibiotic except ciprofloxacin, amikacin, vancomycin, and oxacillin.

The study findings are in agreement with study was held on hospitalized blood stream infection in adult patient in aljumhuriya hospital-Benghazi, Libya in year 2009-2010, the isolate gram-negative antimicrobials showed high degree of resistance to ampicillin (92%), piperacillin (82%). Unlike other results in same study whereas showed high degree of susceptibility to imipenem (92%), meropenem (90%), and Intermediate to augmentin (11.5%). Most isolates of *S. aureus* were almost sensitive to most of antibiotic. However, the result of antibiotic sensitivity testing showed that *S. aureus* isolate was resistant to ceftriaxone, clarithromycin, gentamycin and ceftazidime. *S. epidermidis* also were resistance ceftriaxone, clarithromycin, gentamycin and ceftazidime. This study findings are in agreement with study was held on hospitalized blood stream infection in adult patient in aljumhuriya hospital-Benghazi Libya in year 2009-2010 the isolate gram-positive antimicrobials showed high degree of susceptible to ciprofloxacin (90%) while the result is not the same in intermediate(11).

5- Conclusion

The current study revealed that Gram-negative organisms are the most common organisms associated with the incidence of CLA-BSI in ICU patients. K. pneumoniae was the most common causative agent for CLA-BSI episodes in medical ICU patients. It may be cautious to turn our attention to infections caused by these other pathogen groups that may require different approaches to prevention, for instance, optimizing central line maintenance practices. (8) In contrast, Gram-positive skin organisms are often the most commonly reported causative microorganisms of bloodstream infections, in particular aurus. The infection rate is considerably higher than that in recent studies

from developed countries. Preventive measures based on CDC guidelines should be reserved for patients with an expected longer stay in the ICU, and educational programs on antiseptic techniques and catheter installation and maintenance are essential to reducing infection rates. More research is needed.

Acknowledgements

We would like to thank Dr. Walaa Hashima and Dr. Ahlam Elkadiki who work at BMC for their cooperation and assistance during conducting this study.

Conflict of interest

The authors declare that there is no conflict of interest.

References

1- Frasca, D., Dahyot-Fizelier, C., & Mimoz, O. (2010). Prevention of central venous catheter-related infection in the intensive care unit. Critical care (London, England), 14(2), 212. https://doi.org/10.1186/cc8853
2- Mishra, S. B., Misra, R., Azim, A., Baronia, A. K., Prasad, K. N., Dhole, T. N., Gurjar, M., Singh, R. K., & Poddar, B. (2017). Incidence, risk factors and associated mortality of central line-associated bloodstream infections at an intensive care unit in northern India. International journal for quality in health care: journal of the International Society for Quality in Health Care, 29(1), 63–67. https://doi.org/10.1093/intqhc/mzw144
3- Bloodstream Infection Event (Central Line-Associated Bloodstream Infection and non-central line associated Bloodstream Infection). Device-associated Module, BSI. Centers for Disease Control and Prevention, CDC. January 2019. Available at http://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf
4- WHO. 2011. Report on the Burden of Endemic Health Care-Associated Infection Worldwide. 2011. Available at: http://whqlibdoc.who.int/publications/2011/978 924 1501507_eng.pdf
5- Alshahrani, K. M., Alhuwaishel, A. Z., Alangari, N. M., Asiri, M. A., Al-Shahrani, N. A., Alasmari, A. A., Alzahrani, O. J., Ayedh, A. Y., & Qitmah, M. M. (2023). Clinical Impacts and Risk Factors for Central Line-Associated Bloodstream Infection: A Systematic Review. Cureus, 15(6), e40954. https://doi.org/10.7759/cureus.40954
6- The Joint Commission. Preventing Central Line-Associated Bloodstream Infections: A Global Challenge, a Global Perspective 2012 May; http://www.PreventingCLABSIs.pdf
7- CDC (2010); Healthcare-Associated Infections (HAIs): The Burden. (Updated Dec 13, 2010.) Accessed on Mar 16, 2012. http://www.cdc.gov/HAI/burden.html
8- CDC/center for disease and control and prevention (2010), Klebsiella pneumoniae in Healthcare Settings https://www.cdc.gov/hai/organisms/klebsiella/klebsiella.html
9- Mermel LA. Prevention of intravascular catheter-related infections. Ann Intern Med 2000; 132(5): 391-402. [http://dx.doi.org/10.7326/0003-4819-132-5-200003070-00009] [PMID: 10691590]The Open Public Health Journal, 2018, Volume 11 Malek et al.
10- El-Kholy, A., Saied, T., Gaber, M., Younan, M. A., Haleim, M. M., El-Sayed, H., El-Karaksy, H., Bazara'a, H., & Talaat, M. (2012). Device-associated nosocomial infection rates in intensive care units at Cairo University hospitals: first step toward initiating surveillance programs in a resource-limited country. American journal of infection control, 40(6), e216–e220. https://doi.org/10.1016/j.ajic.2011.12.010
11- Akarem A., Elrammly A., Alemam H., Abdul sammad M, Alammari J., & Gwirif S.(2019).Nosocomial Blood Stream Infections in Adult Patients Admitted to Al jumhoria Hospital -Benghazi-Libya.EPH - International Journal of Applied Science.1(1):1-16.
12- Rosenthal, V. D., Bijie, H., Maki, D. G., Mehta, Y., Apisarnthanarak, A., Medeiros, E. A., Leblebicioglu, H., Fisher, D., Álvarez-Moreno, C., Khader, I. A., Del Rocío González Martínez, M., Cuellar, L. E., Navoa-Ng, J. A., Abouqal, R., Guanche Garcell, H., Mitrev, Z., Pirez García, M. C., Hamdi, A., Dueñas, L., Cancel, E., … INICC members (2012). International Nosocomial Infection Control Consortium (INICC) report, data summary of 36 countries, for 2004-2009. American journal of infection control, 40(5), 396–407. https://doi.org/10.1016/j.ajic.2011.05.020
13- Tarpatzi A., Avlamis A, Papaparaskevas J., Daikos G, Stefanou I., Katsandri A., Vasilakopolou A., Chatzigeorgiou K & Petrikkos G. (2012) Incidence and risk factors for central vascular catheter_related bloodstream infections in a tertiary care hospital. Microbiologica-Quarterly Journal of Microbiological sciences.35(4):429_435.
14- Sulong A., A Jalil N., Ramli R & Yusoff M. (2013). Central line-Associated Blood Stream Infections:Surveillance And Incidence In Intensive Care Unit At A Malaysian Medical

Centre.Internet Journal of Infectious Diseases.2 (2):1-6.

15- Grady Np O., Alexander M ,Dellinger Ep,Gerberding JL ,Heard SO ,Maki DG,etc al ;(2011). Centers for Disease control and prevention Guidelines for the prevention of intravascular catheters related infections. MMWR Recomm Rep,May 1; 52(9): e162–e193

16- Misra, S. B., Misra, R., Azim, A., Baronia A, Prasad K., Dhole T., Gurjar M., Singh R., & Poddar B. (2017). Incidence, risk factors and associated mortality of central line-associated bloodstream infections at an intensive care unit in northern India. International Journal for Quality in Health Care, 29(1), 63–67. https://www.jstor.org/stable/48519124

17- Malek A., Abouseif H., AbdElaziz Kh., Allam M & Fahim H., (2018):Incidence Of Central Line-associated Bloodstream Infections In Intensive Care Units In A Private Hospital(Cairo-Egypt). The Open Public Health Journal. 11. 562-571

18- Gaid E., Assiri A., McNabb S. & Banjar W.(2020). Device-associated nosocomial infection in general hospitals, kingdom of Saudi arabia 2013-2016.Journal of epidemiology and global health .9(1), 1-12

19- Nahla, K. S., Manal, I. S., & Gehan, M. A. (2020). Central line-related bloodstream infections and microbiological study in an Egyptian Ministry of Health Hospital. African health sciences, 20(1), 158–167. https://doi.org/10.4314/ahs.v20i1.21

20- Mazi, W. A., Abdulwahab, M. H., Alashqar, M. A., Aldecoa, Y. S., Bahat, Z. R., Suaking, J. L., Saeed, A., Yassin, O. S., Mahfouz, S. A., & Senok, A. (2021). Sustained Low Incidence Rates of Central Line-Associated Blood Stream Infections in the Intensive Care Unit. Infection and drug resistance, 14, 889–894. https://doi.org/10.2147/IDR.S290791

21- Yoshida, T., Silva, A. E. B. C., Simões, L. L. P., & Guimarães, R. A. (2019). Incidence of Central Venous Catheter-Related Bloodstream Infections: Evaluation of Bundle Prevention in Two Intensive Care Units in Central Brazil. The Scientific World Journal, 2019, 1025032. https://doi.org/10.1155/2019/1025032 164.

Libyan Journal of Public Health Practices (LJPHP)

Journal homepage:

https://journals.uob.edu.ly/LJPHP/index

Multi-Drug-Resistant *Enterobacteriaceae* Causing Urinary Tract Infections At Al- Marj Teaching Hospital

Ghada Ali S. Abbas[1], Salah Ali Mohammed Salih [2*], Guma MK Abdeldaim[1]

[1] Department of Medical Microbiology, Faculty of Medicine, University of Benghazi, Libya
[2] Department of Medical Microbiology, Faculty of Medicine, Elmarj, University of Benghazi, Libya

ARTICLE INFO

Article history:
Received 1/6/2024
Revised 9/6/2024
Accepted 20 /6/2024,

Keywords:
UTI
Escherichia coli
Klebsiella pneumoniae
Multi-drug-resistant
ESBL

ABSTRACT

Urinary tract infections (UTIs) are one of the most common infections in hospitals. Studies on the causative agents of UTIs in Libya and their susceptibility to antimicrobials are few and were mainly carried out in the two main cities in Libya, Tripoli and Benghazi. The study aims to identify the Gram-negative bacteria that cause UTIs at Al-Marj Teaching Hospital as well as determine the antibiotic sensitivity (AST) of the isolated bacteria. Between March and September 2018, 163 urine samples were collected from the inpatients at the AL-Marj teaching hospital. The samples were inoculated onto CLED agar and incubated at 37ºC for 24 hours. The phoenix system was used for the identification of bacteria and AST. Of 163 samples, significant growth was seen in 50 samples (30.6%). Of them, 27 were Gram-positive and 23 were Gram-negative, which comprised *Escherichia coli* 16 (32 %), *Klebsiella pneumoniae* 6 (12%), and *Citrobacter freundii* 1 (2.0%). The percentage of extended spectrum beta lactamase (ESBL) producers in *E. coli* and *K. pneumoniae* was observed to be 68.7% and 50%, respectively. While carbapenamase producers were observed to be 6.2% for *E. coli* and 16.6% for *K. pneumoniae*. The highest resistance rates were against Ampicillin (86.9%), Cephalothin (82.6%), Cefuroxime (73.9%), Cefepime (69.5%), Ampicillin-Clavulanate, and Ceftriaxone (65.2%), respectively. In conclusion, *E. coli* and *K. pneumoniae* were the most common microorganisms causing UTIs. The increased prevalence of multi-drug-resistant organisms limits the available treatment options for infections caused by these organisms. Therefore, the identification and reporting of ESBL-producing organisms is crucial for clinical decision-making.

[*] Corresponding author: Salah Ali Mohammed
E-mail address: salahali8178@gmail.com

1. Introduction

Urinary tract infection (UTI) is the most common infectious disease in clinical practice [1]. It can affect various parts of the urinary tract. Although both males and females are exposed to the infection, women are more affected due to their morphology and reproductive physiology [2]. It ranges from the presence of bacteria in urine without symptoms (asymptomatic bacteriuria), to a wide variety of symptoms ranging from mild bacteraemia, sepsis, or even death [3]. This problem is spread across all age groups. However, different factors, including race, genetic factors, age, gender, sexual activity, nocturnal enuresis, and circumcision in boys, may influence the appearance of UTIs [4].

The major causative organisms responsible for most UTI cases are bacteria, mainly Gram-negative species [5]. Therefore, the pathogens traditionally associated with UTI are known to change many of their features, particularly due to their antimicrobial resistance (AMR) patterns [6].

The increase of AMR in bacterial pathogens is of worldwide concern; uropathogens are showing higher rates of resistance, according to the SENTRY Antimicrobial Surveillance program. Particularly, the rising prevalence of AmpC-lactamases and extended spectrum beta lactamase (ESBL) producing microbes raises concerns about multidrug resistance [7]. Since the initiation of antimicrobial therapy in UTI is empirical, a huge need for AMR exists at local, national and international levels. But this has to be balanced with the inappropriate usage of broad-spectrum antibiotics leading to the emergence of resistant strains [8]; therefore the knowledge of the AMR patterns of common uropathogens is required [9].

This study conducted at Al-Marj teaching hospital in Libya, aimed to investigate the bacterial identification and antimicrobial susceptibility patterns of urinary pathogens using Phoenix BD.

2. Methodology

2.1. Study area and data collection

A total of 163 urine samples were collected from inpatients AL-Marj teaching hospital, between March 2018 and September 2018. The samples comprised of 115 midstream urine, 14 suprapubic aspiration and 33 catheter specimens and one by bag of urine collection. These samples were directly taken to the laboratory for standard microbiological analysis.

2.2. Isolation and identification of *Enterobacteriaceae*

After the collection of the samples (approximately 10 ml) in sterile containers, the samples were examined within 2 hrs, as described by Pezzlo et al [10]. A standard bacteriological loopful (0.01ml) of urine was directly inoculated and spread over the surface of sterile agar on a CLED agar plate, then incubated aerobically at 37°C for 24 hours [11].

On the second day, if there is pure and significant bacterial growth, a Gram stain is applied to know the Gram reaction of the isolates, and then the isolates were sub-cultured on blood agar in preparation for their identification by the Phoenix system. On the third day and upwards, the BD Phoenix system for identification (ID) and antimicrobial susceptibility testing (AST) was used according to the manufacturer's recommendations. A colony of the culture on the blood agar was taken by swab and mixed with the ID solution to match the turbidity of a 0.5 McFarland standard by using a Crystal Spec nephelometer. Twenty-five microliters of the mixture were transferred to an AST bottle, and one drop of ID indicator was added to the AST tube and mixed gently. The panel was then loaded into the instrument within 30 min of inoculation for identification and antibiotic susceptibility [12,13].

2.3. Statistical analysis:

Data were analyzed using SPSS (Statistical Package for Social Sciences (statistics for windows, version 23.0. Armonk, NY: IBM Corp). Descriptive data was compared using Chi-Square and its alternative Fisher exact test

were used, and graphs and tables were created to demonstrate results.

3- Results

Out of the 163 urine specimens examined, 103 (63.6%) were collected from females, while 60 (36.4%) were collected from males. The specimens were collected from individuals spanning various age groups, ranging from a few days old to ninety years old with mean age of 40 years, as indicated in table 1.

Out of 163 urine samples, 50 samples were had significant bacterial growth, of them 35 (70%) were from female individuals and 15 (30%) were from male individuals.

The distribution of positive samples based on age and gender reveals that the age group associated with sexual activity in females (21-40 years) exhibited the highest prevalence of UTIs, as depicted in table 2.

The overall prevalence of the uropathogens was 50 (30.9%), as shown in figure 1.

Table 1. The distribution of samples among different age groups

Age (years)	NO. of samples	Percentage %
< 20	50	30.7 %
21-40	53	32.5 %
41-60	29	17.8 %
61-90	31	19.0 %
Total	163	100 %

Table 2. Association between gender and presence of significant growth among different ages

Age	Gender		Total	*P value*
	Male	Female		
< 20	8	4	12	0.0036*
21- 40	1	13	14	
41- 60	3	7	10	
61-90	4	10	14	
Total	15	34	50	

Using Fisher Exact test , * Statistically significant of females sexually active age.

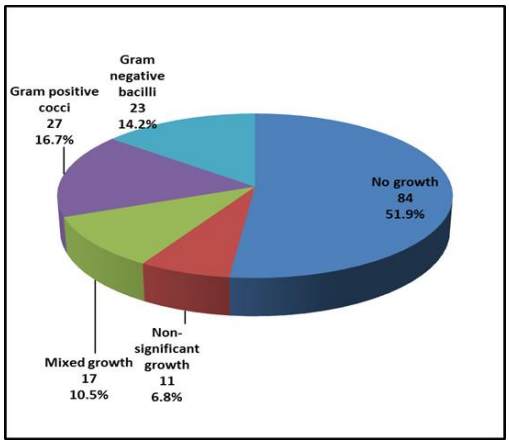

Figure 1. Percentages of bacterial growth

Table 3. Frequency and types of Enterobacteraece isolated from urine culture

Organism	NO. of samples	Percentage %
E. coli	16	32 %
K. pneumonia	6	12 %
C. freundii	1	2 %
Total	23	46 %

The majority of the pathogenic microorganisms isolated in this study belonged to the *Enterobacteriaceae* family. *E. coli* was identified as the most common causative agent of UTIs 16 (32 %), followed by *K. pneumoniae* 6 (12 %), and *C. freundii* 1 (2.0%) as shown in table 3.

The antimicrobial resistance and sensitivity profile of the isolated organisms showed that all the bacterial isolates were resistant against commonly used antibiotics. The highest resistant rate was Ampicillin 88.6%, Cephalothin 82.6%, Cefepime 69% and Ampicillin-Clavulanate and ceftriaxone 65%.

While all isolates were found to have less resistance to Amikacin, Ertapenem, Imipenem, Nitrofurantoin, and Piperacillin-Tazobactam with 4.3% each, as shown in figure 2.

There are some cross-resistance and cross-sensitivity that are nearly complete for Ciprofloxacin and Levofloxacin.

E. coli were higher resistance which constitute 33 (67.34%) of all isolated bacteria against the most type of antibiotics (58.85 %) and the highest resistance was seen among Cephalothin (87.5%), Ampicillin (81.3%), Cefuroxime (80.0%), Ceftriaxone (68.8%), Aztreonam (62.5%), in the other hand *K. pneumoniae* has highest resistance to ampicillin (83.3%), ampicillin-clavulanate (83.3%), Aztreonam (66.7%), as shown in figure 3 and 4. Different resistant strains of Enterobacteraece were produced ESBL and carpenamase where highest resistance found in strains of *E. coli* produced ESBL and carpenamase are 11 (68.75%) and 1 (6.2%) while in *K. pneumonia* 3 (50%) and 1 (16.6) respectively as shown in table 4.

4- **Discussion**

The emergence and prevalence of multi-drug-resistant *Enterobacteriaceae* (MDR-EB) causing UTIs carriage a significant challenge to healthcare systems worldwide. The study analyzed 163 urine specimens, with 50 samples showing significant bacterial growth. The prevalence of UTIs was higher in females (70%) compared to males (30%). The age group associated with sexual activity in females (21-40 years) exhibited the highest prevalence of UTIs. These findings are consistent with previous studies that have reported higher rates of UTIs among women and sexually active individuals [14,15].

The majority of the isolated uropathogens belonged to the *Enterobacteriaceae* family, with *E. coli* being the most common causative agent of UTIs (32%), followed by *K. pneumoniae* (12%) and *C. freundii* (2.0%). These results align with local study in Teaching Hospital in Zawiya city [16] and also in Messalata Central Hospital, Libya [17]. As well as with global trends where *E. coli* is frequently implicated as the primary pathogen causing UTIs [18].

Antimicrobial susceptibility testing revealed alarmingly high rates of resistance among the isolated organisms against commonly used antibiotics. The highest resistance rates were observed for Ampicillin, Cephalothin, cefepime, Ceftraxone and Ampicillin-Clavulanate. These findings highlight the urgent need for antibiotic stewardship programs and surveillance of antimicrobial resistance in healthcare settings [19].

Interestingly, the isolated organisms showed sensitivity to Daptomycin, indicating its potential as alternative treatment options for MDR-EB infections. These findings are consistent with previous studies that have reported the effectiveness of this antibiotics against MDR-EB strains [20,21].

Cross-resistance and cross-sensitivity were observed among certain antibiotics. For example, Ciprofloxacin and Levofloxacin. Additionally, Cefotaxime and Ceftriaxone displayed nearly complete cross-resistance and cross-sensitivity. These findings highlight the importance of selecting appropriate antibiotics based on their individual susceptibility profiles [22].

Further analysis of the resistance profiles showed that *E. coli* exhibited the highest resistance rates among all isolated bacteria, particularly against Cephalothin, Ampicillin, Cefuroxime, Ceftriaxone, and Aztreonam. *K. pneumoniae* displayed the highest resistance rates against Ampicillin, Ampicillin-clavulanate, and Aztreonam. The findings are consistent with a study conducted in Tripoli [3]. These results are also consistent with global trends, as both *E. coli* and *K. pneumoniae* are well-known MDR-EB pathogens associated with UTIs and other healthcare-associated infections [23].

Furthermore, the study identified strains of *E. coli* and *K. pneumoniae* that produced extended-spectrum β-lactamases (ESBL) and carbapenemases. The prevalence of ESBL-producing *E. coli* was 68.75%, while carbapenemase production was identified in 6.2% of *E. coli* strains. Among *K. pneumoniae* isolates, 50% produced ESBL, and 16.6% produced carbapenemases. These findings indicate the presence of highly resistant strains capable of hydrolyzing a broad range of β-lactam antibiotics, further complicating treatment options [24].

The high prevalence of MDR-EB strains causing UTIs at Al-Marj teaching hospital underscores the urgent need for infection control measures, antimicrobial stewardship programs, and improved surveillance to combat the spread of drug-resistant pathogens. Implementing strategies such as regular monitoring of resistance patterns, optimizing antibiotic prescribing practices, and promoting infection prevention measures can help mitigate the impact of MDR-EB infections [25] (WHO, 2019).

5- Conclusions

In conclusion, this study provides valuable insights into the prevalence, bacterial identification, and antimicrobial resistance patterns of MDR-EB causing UTIs at Al-Marj teaching hospital in Libya. The results highlight the alarming rates of antibiotic resistance among uropathogens and emphasize the need for evidence-based strategies to guide appropriate antibiotic use and prevent the further dissemination of drug-resistant strains.

Acknowledgement

We would like to express our great appreciation to the management of Al-Marj teaching hospital, as well as the laboratory staff, for their support and cooperation throughout the research period.

Conflict of Interest

No conflict of interest was declared by the authors.

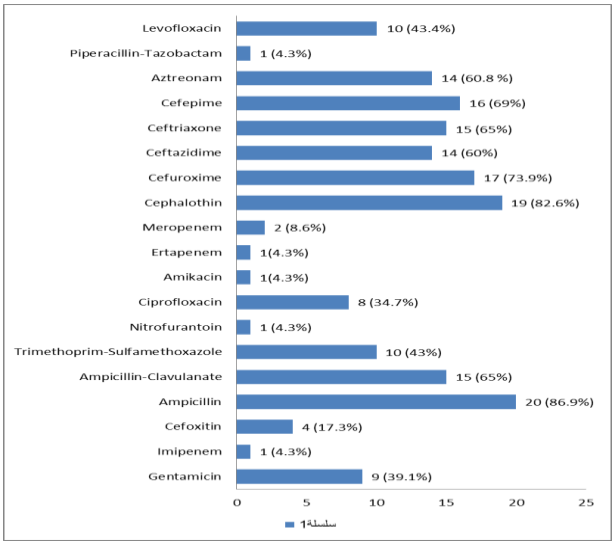

Figure 2: Antimicrobial resistance and sensitivity profile of the isolated *Enterobacteraece*

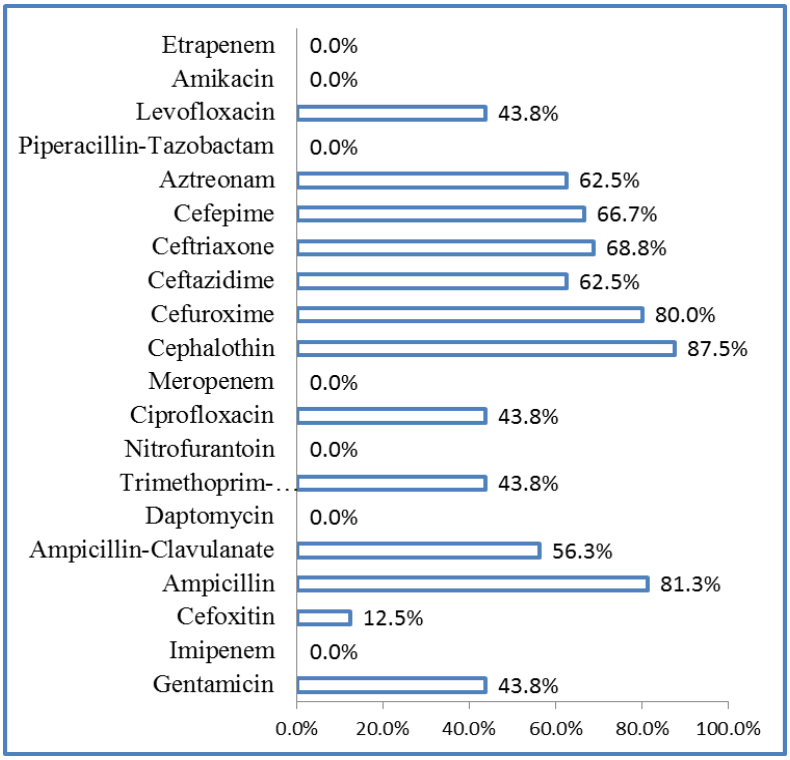

Figure 3: Antibiotics resistance profile for *E. coli*

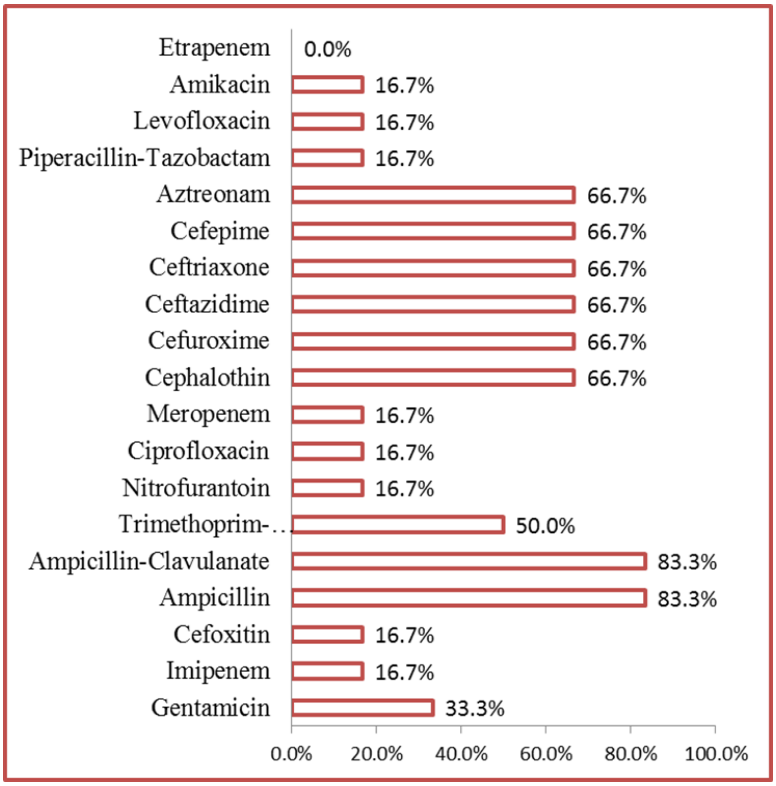

Figure 4: Antibiotics resistance profile for *K. pneumoniae*

Table 4. Resistant strains *Enterobacteraece* produced ESBL

Organism	n	%	Total
E. coli (ESBL)	11	68.75 %	16
*K. pneumoniae (*ESBL)	3	50%	6
E. coli (Carbapenamase producer)	1	6.2%	16
K. pneumoniae (Carbapenamase producer)	1	16.6%	6

n= number of organisms

References

1. Sekmenli T, Kara F. Association of vesicoureteral reflux and renal scarring in urinary tract infections. Pediatr Int. 2018;116(4):542-547.
2. Ashur AB, El Magrahi H, Elkammoshi A, Alsharif H. Prevalence and antibiotics susceptibility pattern of urine bacterial isolates from Tripoli Medical Center (TMC), Tripoli, Libya. Iberoam J Med. 2021;3(3):221-226.
3. Salem MA, et al. Bacterial Profile of Urinary Tract Infection and Antimicrobial Susceptibility Pattern Among Patients Attending at Bushra. J Microbiol Infect Dis. 2018;7(4):2671-2675. doi: 10.17554/j.issn.2224-3992.2018.07.788
4. Feld LG. Urinary Tract Infections and Vesicoureteral Reflux in Infants and Children. Pediatr Infect Dis J. 2013;31(11):451. doi: 10.1542/pir.31-11-451
5. Birnie K, et al. Comparison of microbiological diagnosis of urinary tract infection in young children by routine health service laboratories and a research laboratory: Diagnostic cohort study. PLoS One. 2017;12(2):e0171113.
6. Bagchi I, Jaitly NK, Thombare VR. Microbiological evaluation of catheter-associated urinary tract infection in a tertiary care hospital. People J Sci Res. 2015;8:23-9.
7. Baloch BK, et al. Antibiotic Antibiogram in Patients with Complicated Urinary Tract Infections in Nephrology Unit of South Waziristan. Cureus. 2022;14(10).
8. O'Grady MC, et al. Empirical treatment of urinary tract infections: how rational are our guidelines? J Antimicrob Chemother. 2019;74(1):214-217.
9. Prais D. Bacterial susceptibility to oral antibiotics in community-acquired urinary tract infection. Arch Dis Child. 2003;88(3):215-218.
10. Pezzlo M. Laboratory diagnosis of urinary tract infections: guidelines, challenges, and innovations. Clin Microbiol Newsl. 2014;36(12):87-93.
11. Hilt EE, et al. Urine is not sterile: use of enhanced urine culture techniques to detect resident bacterial flora in the adult female bladder. J Clin Microbiol. 2014;52(3):871-876. doi: 10.1128/JCM.02876-13
12. Hara CMO. Evaluation of the Phoenix 100 ID/AST System and NID Panel for Identification of Enterobacteriaceae, Vibrionaceae, and Commonly Isolated Nonenteric Gram-Negative Bacilli. J Clin Microbiol. 2006;44(3):928-933. doi: 10.1128/JCM.44.3.928
13. Carroll KC, et al. Evaluation of the BD Phoenix automated microbiology system for identification and antimicrobial susceptibility testing of staphylococci and enterococci. J Clin Microbiol. 2006;44(6):2072-2077.
14. Khawcharoenporn T, Vasoo S, Singh K. Urinary tract infections due to multidrug-resistant Enterobacteriaceae: prevalence and risk factors in a Chicago emergency department. Emerg Med Int. 2013;2013:258517.
15. Mazzariol A, Bazaj A, Cornaglia G. Multi-drug-resistant Gram-negative bacteria causing urinary tract infections: a review. J Chemother. 2017;29(sup1):2-9.
16. Abujnah AA, et al. Multidrug resistance and extended-spectrum β-lactamases genes among Escherichia coli from patients with urinary tract infections in Northwestern Libya. Libyan J Med. 2015;10(1).
17. Mohammed MA, et al. Prevalence and antimicrobial resistance pattern of bacterial strains isolated from patients with urinary tract infection in Messalata Central Hospital, Libya. Asian Pac J Trop Med. 2016;9(8):771-776.
18. Vachvanichsanong P, McNeil EB, Dissaneewate P. Extended-spectrum beta-lactamase Escherichia coli and Klebsiella pneumoniae

urinary tract infections. Epidemiol Infect. 2021;149:e12.

19. Llor, C., Bjerrum, L., & Strandberg, E. L. Microbiology of urinary tract infections in primary care patients: a cross-sectional study in the community in Spain and Sweden. BMC Family Practice. 2020; 21(1), 1-9.
20. Gales, A. C., Seifert, H., Gur, D., Castanheira, M., & Jones, R. N. Antimicrobial susceptibility of Gram-negative bacteria isolated from patients hospitalized in intensive care units in United States and European hospitals. 2019; 2009–2011). Diagnostic Microbiology and Infectious Disease, 73(4), 328-334.
21. Kuti, J. L., Patel, A. A., Coleman, C. I., & Nicolau, D. P. Antimicrobial activity of daptomycin against gram-negative pathogens: Results from SURVEILLANCE studies. Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy. 2020; 40 (9), 839-847.
22. Magiorakos, A. P., Srinivasan, A., Carey, R. B., Carmeli, Y., Falagas, M. E., Giske, C. G., & Monnet, D. L. Multidrug-resistant, extensively drug-resistant and pandrug-resistant bacteria: an international expert proposal for interim standard definitions for acquired resistance. Clinical Microbiology and Infection. 2012;18 (3), 268-281.
23. Pitout, J. D., Nordmann, P., & Poirel, L. Carbapenemase-producing Klebsiella pneumoniae, a key pathogen set for global nosocomial dominance. Antimicrobial Agents and Chemotherapy. 2018; 62(1), e01019-17.
24. Paterson, D. L., & Bonomo, R. A. Extended-spectrum β-lactamases: a clinical update. Clinical Microbiology Reviews. 2018; 18(4), 657-686.
25. World Health Organization. (2019). Antimicrobial resistance: Global report on surveillance. WHO

Libyan Journal of Public Health Practices (LJPHP)

Journal homepage:
https://journals.uob.edu.ly/LJPHP/index

Psychological Impact of Derna Floods: A Comparative Study between Benghazi and Derna Medical Students

Asma S. Salem[1]*, Hala F. Benghasheer[2], Saud F. Alnasfi[3], Yathrep O Alkhbulli[3]

[1,3] Family and Community Medicine Department, Faculty of Medicine, University of Benghazi, Libya
[2] Dental Public Health and Preventive Dentistry Department, Faculty of Dentistry, University of Benghazi, Libya
[3] Microbiology and Immunology Department, Faculty of Medicine, University of Zawia, Libya

ARTICLE INFO

Article history:
Received 18/5/2024
Revised 7/6/2024,
Accepted 17 /6/2024,

Keywords:
Depression
Anxiety
Medical students
Flood
Libya

ABSTRACT

Psychological morbidities, including depression and anxiety, have been linked to flood exposure. The current study aimed to assess and compare the psychological effects of the Derna floods among medical students in the affected and non-affected areas and identify associated factors related to the crisis among medical students at Derna and Benghazi Universities. A cross-sectional study was conducted through a web-based questionnaire. The demographic characteristics, generalized anxiety disorder (GAD-7) scale, and patient health questionnaire (PHQ-9) scale were used to collect data. The data were analyzed using the Statistical Package for the Social Sciences (SPSS). All statistical analyses were performed at $P < 0.05$. A total of 707 completed web-based questionnaires were included in the analysis, of which female responses constituted 477 (67.5%) and male responses constituted 230 (32.5%). The prevalence of depression among students from Derna University was higher (76.0%) as compared to those from the University of Benghazi (64.5%). The depression score was significantly higher ($P = 0.001$) in Derna students (mean = 14.65, SD = 6.3) compared to Benghazi students (mean = 12.64, SD = 6.7). Derna students also had significantly higher anxiety scores (mean = 14.42, SD = 4.4) compared to Benghazi students (mean = 12.23, SD = 4.8, $p = 0.0001$). The mean score for depression was significantly higher among female and preclinical-year students ($p = 0.0001$). A startlingly high prevalence of anxiety and depression symptoms was evident among medical students after the Derna disaster. Effective intervention strategies are crucial in supporting the mental health of affected individuals and facilitating recovery and rebuilding.

* Corresponding author: Asma S Salem
E-mail address: asma.salem@uob.edu.ly

1. Introduction

Disasters are a complicated worldwide issue; they are an inescapable part of our lives.[1] They can be either man-made or natural, and they can disrupt the social and psychological well-being of the population. Natural disasters such as earthquakes, floods, and hurricanes can wreak havoc on communities and create lasting impacts on people's mental health.[2] Numerous detrimental effects of flooding on human health include a higher chance of drowning, injury, and property loss. People are also exposed to various health-related issues, from morbidity to mortality.[3]

Psychological morbidities including depression, anxiety, suicidal thoughts, and post-traumatic stress disorder (PTSD) have been repeatedly linked to flood exposure.[4,5] Individuals impacted by the floods may anticipate experiencing short-term psychological anguish. Although the majority of individuals recover from these stress reactions, a sizable minority will continue to experience mental health issues.[6]

Depressive disorders and anxiety are among the leading causes of the overall global burden of disease and disability. Psychological disorders significantly affect the quality of life, including the physical and psychosocial domains.[7] Moreover, medical students are more susceptible to developing emotional disturbances. This could be due to the stress associated with the academic environment, the pressure to succeed, or the difficulty of balancing their studies with other aspects of life. Furthermore, this can lead to depression, anxiety, and other mental health issues.[8,9,10]

The catastrophic flooding in eastern Libya (Derna) in September 2023 caused widespread destruction, with whole neighborhoods flushed away and thousands of people killed. It has been anticipated that medical students who reside in locations devastated by the recent floods could be psychologically distressed. It is commonly established that for numerous individuals, experiencing some degree of distress in response to these events is acceptable and understandable, however, it might additionally end in more chronic mental health issues.[8]

Medical students are a part of the population during the disaster, and measuring the psychological impact of a disaster on them can help to identify potential mental health issues that need to be addressed. It can also provide a better understanding of the psychological effects of disasters on the larger population.

Therefore, the current comparative study aims to assess the psychological effects of the Derna flood among two populations of affected and non-affected individuals. As well as to determine the risk factors that can increase the psychological effect among medical students, such as previous mental problems and loss of relatives in the Derna crisis.

2. Methodology

2.1. Study Design and Sampling

This was a cross -sectional study. The study population comprised of undergraduate medical students at Benghazi University, and Derna University (the flood-affected area). who consented to participate by filling out the questionnaire link.

The sample was recruited through a probability proportional to size sampling (PPS) technique. Among 5134 medical students enrolled at Benghazi University in 2023, 515 were recruited randomly (proportion 1:10), while the total number of medical students enrolled in the same year at the University of Derna was 980 students; 192 were randomly recruited in the study (proportion 1:5).

2.2. Data Collection

The data was collected through e-links using Google Forms over the period from October 15th to November 30th ,2023 (after a month of flood disaster). Students who volunteered to participate electronically submitted their consent after being informed of the study's objectives.

The patient health questionnaire (PHQ-9)[11] scale was applied to measure the level of depression (Appendix 1). The Generalized Anxiety Disorder 7 (GAD-7)[12] scale, which is the most frequently used anxiety measure in clinical practice and research due to its

diagnostic reliability and efficiency, was used to quantify the level of anxiety (Appendix 2). Excellent internal consistency has been shown by the well-validated GAD-7 screening instrument (Cronbach's · = 0.911).

2.3. Statistical Analysis

The Statistical Package for the Social Sciences (SPSS), Version 25 has been employed to analyze the data. Standard deviation, mean, frequency, and percentages have all been employed to record descriptive statistics. Comparison differences in proportions were assessed using the chi-square test, whereas comparisons in means were assessed using the independent sample t-test. All statistical analyses were performed at a *P* value less than 0.05. The odds ratio (OR) and confidence interval (CIs) were used to determine the association in terms of which odds are larger and by how much between depression and risk factors, which in this study are identified as having relatives or friends who were flood victims, lost of any family members in the flood, and suffer from any psychological problems before.

3. Results

A total of 707 completed web-based questionnaires were included in the analysis, of which female responses constituted 477 (67.5%) and male responses constituted 230 (32.5%). Table 1 presents the sample characteristics of the participating medical students; around 41.4% were from the age group (22-25). The majority of students 675 (95.5%), were of Libyan nationality. More than two-thirds (72.8%) of students were from the University of Benghazi, compared to 27.2 % from Derna University. The discussion can be conducted in several sub-chapters.

The overall prevalence of depression was 67.6% among the medical students, with 18.8% who reported severe depression. One quarter (25.7%) had moderately severe depression, followed by 23.1% with moderate depression and 20.2% with mild depression (Table 2). The prevalence of depression among students from Derna University was higher (76.0%) as compared to those from the University of Benghazi (64.5%),

Regarding anxiety, the overall prevalence was 74.1%, with more than one-third reporting severe and moderate levels of anxiety, 39.9% and 34.2%, respectively.

Table 1: Sociodemographic Characteristics of Participants

Sociodemographic Characteristics	Number (%)
Gender	
Male	230 (32.5%)
Female	477 (67.5%)
Nationality	
Libyan	675 (95.5%)
Non-Libyan	32 (4.5%)
Age Groups	
18-21 years	190 (26.9%)
22-25 years	293 (41.4%)
> 25 years	224 (31.7%)
Academic Year	
First-year	103 (14.6%)
Second year	148 (20.9%)
Third year	113 (16.0%)
Fourth-year	122 (17.3%)
Fifth year	97 (13.7%)
Intern	124 (17.5%)
University	
University of Benghazi	515 (72.8%)
Derna University	192 (27.2 %)
Total	707 (100%)

Table 2: Participant distribution based on depression severity using PHQ9

Depression	N (%)		
	Benghazi	Derna	Total
No Depression	19	2	21
0	3.7%	1.0%	3.0 %
Minimal	52	13	65
1-4	10.1%	6.8%	9.2%
Mild	112	31	143
5-9	21.7%	16.1%	20.2 %
Moderate	121	42	163
10-14	23.5%	21.9%	23.1%
Moderately	124	58	182
severe	24.1%	30.2%	25.7%
15-19			
Sever	87	46	133
20-27	16.9%	24.0%	18.8%
Clinical	332	146	478
depression ≥	64.5%	76.0%	67.6%
10			
Total	515	192	707
	100.0%	100.0%	100.0%

Regarding anxiety, the overall prevalence was 74.1%, with more than one-third reporting severe and moderate levels of anxiety, 39.9% and 34.2%, respectively. On the other hand, minimal and mild levels of anxiety were reported by 4.8% and 21.1%, respectively (Table 3). The prevalence of anxiety among students from Derna University was higher (85.9%) as compared to those from the University of Benghazi (69.7%). Figure 1 shows the prevalence of clinical depression and anxiety (score>10) among medical students from both universities.

Results indicated that depression was significantly higher (P = 0.001) in Derna students (mean =14.65, SD 6.3) compared to Benghazi students (mean 12.64, SD= 6.7).

Derna students (Mean= 14.42, SD= 4.4) compared to Benghazi students (Mean= 12.23, SD= 4.8), p = 0.0001 (Table 4).

Table 3: Participant distribution based on Anxity severity using GAD-7

Anxiety	**N (%)**		
	Benghazi	**Derna**	**Total**
Minimal	30	4	34
0-4	5.8%	2.1%	4.8%
Mild	126	23	149
5-9	24.5%	12.0%	21.1%
Moderate	181	61	242
10-14	35.1%	31.8%	34.2%
Sever	178	104	282
15-21	34.6%	54.2%	39.9%
Clinical anxiety ≥ 10	359	165	524
	69.7%	85.9%	74.1%
Total	515	192	707
	100.0%	100.0%	100.0%

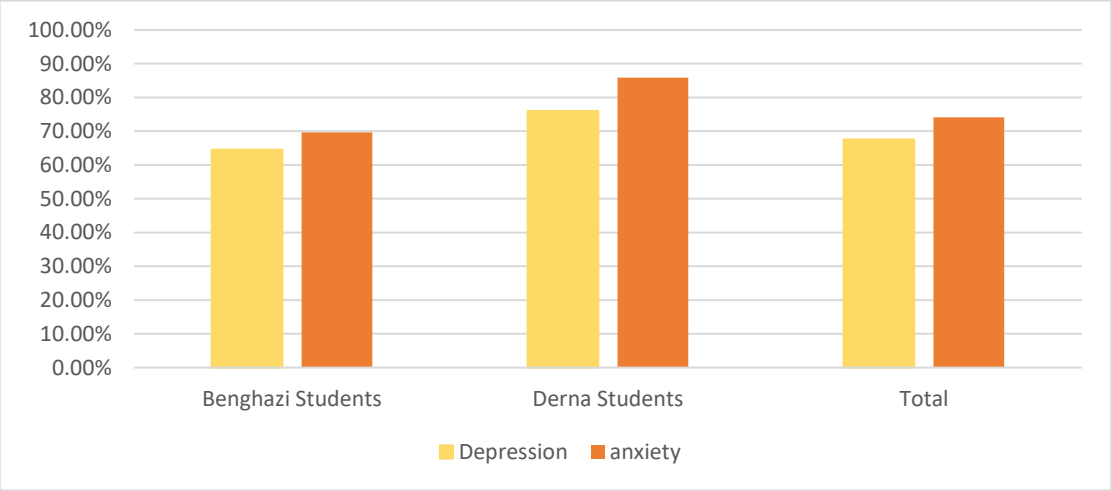

Figure 1: Prevalence of clinical depression and anxiety (score>10)

Subsequent analysis revealed that, in comparison to male students, female students displayed significantly higher mean scores for anxiety and depression (mean = 13.70, SD=6.3) vs. 12.12, SD=7.2), p = 0.05; for anxiety (mean = 13.96, SD=4.6) vs. 10.46, SD=4.2), p = 0.0001 (Table 4).

Additionally, the mean depression score for pre-clinical students had been determined to be significantly higher than that of clinical students (mean = 14.35, SD = 6.7) vs. (mean = 12.54, SD = 6.5), p = 0.001). Pre-clinical and clinical year students' mean anxiety scores, however, did not change significantly (p > 0.05; Table 4).

The association between depression and risk factors is displayed in Table 5. Having friends or family who were affected by flooding (X2=11.34, df=1, P=0.0001), losing any family

members (X2=4.5, df=1, P=0.03), and having psychiatric issues in the past (X2=5.58, df=1, P=0.01) were all substantially linked to depression. Medical students who had family members harmed by flooding were 0.89 times more likely to experience depression (OR=0.89, 95% CI=0.849-0.946), and those who had previously experienced psychological issues were nearly three times as probable to experience depression (OR=2.92, 95% CI=1.154-7.409). Those who had flood victims in their own families were two times as likely to experience depression (OR=2.09, 95% CI=1.353-3.230).

A significantly higher proportion of females and students from Derna University had long-term symptoms than males and those from Benghazi University (p=0.0001). As shown in Table 6, female students were almost twice as likely to have long-term symptoms (OR=1.85, 95% CI=1.335-2.587), and the likelihood of long-term complaints is almost threefold (3.89) higher for individuals from Derna University (OR=3.65, 95% CI=2.360-5.671).

4. Discussion

It is well documented that the prevalence of depression and anxiety among medical students is significantly higher than among their peers in other specialties due to the stress of their studies and the pressure to succeed.[7] The estimates of the prevalence of depression and anxiety in medical students range from 1.4% to 73.5%.[13,14] The present study revealed an overall substantially higher prevalence rate of depressive and anxiety symptoms 67.6% and 74.1%, respectively, than that reported in the other studies among medical students.[15] Overall, the regional distribution demonstrated that the Middle East reported the highest incidence of depression among medical students (31.8%), followed by North America (30.3%), Asia (30.1%), South America (26.8%), and Europe (20%).[16] It was reported that medical students in Middle Eastern nations, notably Libya, had the greatest depression rates.[17]

Moreover, the current study indicated a higher prevalence (76.0%) of clinical depression (PHQ score ≥ 10) as compared with a previous study conducted among medical students before the flood at Derna University, where the prevalence of clinical depression was 56%.[18]

The high prevalence in this study could be explained by the fact that natural disasters such as flooding can exacerbate these conditions. The prevalence of depression and anxiety among medical students during flooding can be influenced by various factors such as the disruption of academic activities, displacement from homes, financial stress, and increased workload due to disaster response efforts.[19]

Table 4: Comparison of Depression and Anxiety based on gender, university, study year

	Characteristics	Mean (SD)	T statistic	95% CI		P Value
				Lower	Upper	
Depression	Male	12.12 (7.2)	-2.821	-2.674	-0.478	0.05*
	Female	13.70 (6.3)				
	Benghazi University	12.64 (6.7)	-3.595	-3.102	-0.910	0.0001***
	Derna University	14.65 (6.3)				
	Pre-clinical years	14.35 (6.7)	3.480	0.787	2.825	0.001**
	Clinical years	12.54 (6.5)				
Anxiety	Male	10.46 (4.2)	-9.970	-4.193	-2.812	0.0001***
	Female	13.96 (4.6)				
	Benghazi University	12.23 (4.8)	-5.503	-2.967	-1.406	0.0001***
	Derna University	14.42 (4.4)				
	Pre-clinical years	13.18 (4.9)	1.476	-0.183	1.295	0.141
	Clinical years	12.63 (4.6)				

*P<0.05, **P<0.01, ***P<0.001,
Independent samples t-test was used to compare means

Table 5: Association between depression and risk factors

Risk factors		Depression Count (%) No	Depression Count (%) yes	X^2 (df)	P value	Odds Ratio 95% Confidence Interval OR	Lower Bound	Upper Bound
Do you have relatives or friends who were flood victims?	No	71 67.0%	296 49.3%	11.34 (1)	0.001***	2.09	1.353	3.230
	Yes	35 33.0%	305 50.7%					
have you lost any of your family members in the flood?	No	16 100.0%	138 78.4%	4.30 (1)	0.03*	0.89	0.849	0.946
	Yes	0 0.0%	38 21.6%					
Do you suffer from any psychological problems before?	No	101 95.3%	525 87.4%	5.58 (1)	0.018**	2.92	1.154	7.409
	Yes	5 4.7%	76 12.6%					

Table 6: Duration of symptoms (short or long-term) and association with gender, place of residence, academic year level

Do the previously mentioned symptoms persist	N (%) No (Short)	N (%) Yes (Long)	X^2 (df)	P value	Odds Ratio 95% Confidence Interval OR	Lower Bound	Upper Bound
Male	95 42.0%	135 28.1%	13.66 (1)	0.001	1.859	1.335	2.587
Female	131 58.0%	346 71.9%					
Benghazi University	198 87.6%	317 65.9%	36.62 (1)	0.001	3.658	2.360	5.671
Derna University	28 12.4%	164 34.1%					
Pre-clinical years	78 34.5%	173 36.0%	1.14 (1)	0.706	0.938	0.674	1.307
Clinical years	148 65.5%	308 64.0%					
Total	226 (32.0%)	481 (68.0%)					

*P<0.05, **P<0.01, ***P<0.001
The chi-square test was used to compare proportions

This is further supported by our results, where the depression and anxiety scores were significantly higher among medical students from the affected city (Derna) as compared to those from the non-affected city (Benghazi). Natural disasters have been found to have a significant effect on mental health, leading to disorders such as generalized anxiety disorder (GAD), depression, substance use, post-traumatic stress disorder (PTSD), and adjustment disorder.[20]

Additionally, it has been observed that female medical students exhibit higher levels of depression and anxiety relative to their male counterparts. The current findings are in line with the conclusions of multiple previous studies conducted in various nations and areas, which include Pakistan, India, Turkey, and the Middle East, which have noted significant gender variations in the prevalence of anxiety, with females being more likely than males to experience it. [21,16,22 23,24]

Besides the role of biological factors, e.g. hormonal fluctuations, that could make female medical students more susceptible to mood disorders. One of the possible explanations for this difference is the unique stressors and challenges that female medical students may face. Studies have shown that female medical students often juggle multiple roles, such as

student, caregiver, and potentially mother or spouse, which can lead to increased stress and pressure.[25] Additionally, societal expectations and stereotypes about gender roles may contribute to higher levels of perfectionism and self-doubt among female medical students, which can exacerbate feelings of anxiety and depression.[26]

According to the results of the current study, medical students in their preclinical year reported higher levels of depression and anxiety than their clinical year peers. This result was consistent with past research carried out in Libya and other contexts.[18,27,28] This phenomenon can be attributed to various factors, including the rigorous academic demands, adjustment to a new learning environment, lack of clinical exposure, and uncertainty about future career prospects. The transition from preclinical to clinical years typically involves increased patient interaction, hands-on clinical experience, and a sense of progress toward becoming a practicing physician. These changes can reduce stress and anxiety levels among medical students as they gain more practical skills and confidence in their abilities.[29]

Furthermore, preclinical years are characterized by heavy coursework loads, long study hours, and frequent examinations, which can lead to burnout and mental health issues if not properly managed. The lack of direct patient contact during this phase may also contribute to feelings of isolation and detachment from the ultimate goal of practicing medicine. In contrast, clinical years provide students with opportunities for real-world application of knowledge, mentorship from experienced clinicians, and a clearer sense of purpose in their medical education journey.[30]

Evidently, in the setting of Libya generally and in Derna and Benghazi specifically, students witnessed the distressing calamities of civil conflict, ISIS resistance,[31] and COVID-19 lockdowns,[32] these events harmed medical students. Medical schools need to prioritize the mental health and well-being of their students by offering support services, promoting work-life balance, and fostering a culture of open communication about mental health issues. By addressing the unique challenges especially faced by females and preclinical year students and providing resources for coping with stress and anxiety, institutions can help mitigate the negative impact on student mental health during this critical stage of medical education.

In this study, it was revealed that the development of depression was significantly associated with several risk factors, including having relatives or friends who were flood victims, missing any family members in the flood, and suffering from any previous psychological issues. The results we obtained additionally demonstrate that the experience of secondary stressors is influenced differentially by gender and by living in a region affected by flooding. This is consistent with a previous study conducted in England demonstrated that secondary stressors had been associated with likely psychological issues following flooding.[33]

5. Conclusions

According to the current findings, there is a startlingly high prevalence of anxiety and depression symptoms among medical students after the Derna disaster. Overall, addressing the mental health challenges faced by medical students is crucial for promoting their well-being and success in their academic and professional pursuits.

Effective intervention strategies, such as critical incident stress management and psychological first aid, are crucial in supporting the mental health of affected individuals and facilitating recovery and rebuilding. Medical schools and healthcare institutions need to recognize these disparities and provide adequate support and resources, especially for female and preclinical-year medical students to address their mental health needs.

Identifying preventative and therapeutic approaches for this population requires additional research. Prospective research designs should be considered in future epidemiological studies to enable the same individuals to be evaluated over time and to yield more pertinent data.

Conflict of Interest

The authors did not disclose any conflicts of interest.

References

22- Makwana N. Disaster and its impact on mental health: A narrative review. J Family Med Prim Care. 2019;8(10):3090-3095. Published 2019 Oct 31. doi:10.4103/jfmpc.jfmpc_893_19.

23- Leal Filho, W., Krishnapillai, M., Minhas, A., Ali, S., Alverio, G. N., Ahmed, M. S. H., ... & Kovaleva, M. Climate change, extreme events and mental health in the Pacific region. International Journal of Climate Change Strategies and Management, 2023;15(1), 20-40. doi.org/10.1108/IJCCSM-03-2022-0032

24- Alderman, K., Turner, L. R., & Tong, S. Floods and human health: a systematic review. Environment International,2012; 47: 37-47. doi:10.1016/j.envint.2012.06.003.

25- Ahern M, Kovats RS, Wilkinson P, Few R, Matthies F. Global health impacts of floods: epidemiologic evidence. Epidemiol Rev. 2005;27:36-46. doi:10.1093/epirev/mxi004.

26- Mason V, Andrews H, Upton D. The psychological impact of exposure to floods. Psychol Health Med. 2010;15(1):61-73. doi:10.1080/13548500903483478

27- Fernandez A, Black J, Jones M, et al. Flooding and mental health: a systematic mapping review. PLoS One. 2015;10(4):e0119929. Published 2015 Apr 10. doi:10.1371/journal.pone.0119929

28- Rotenstein LS, Ramos MA, Torre M, et al. Prevalence of Depression, Depressive Symptoms, and Suicidal Ideation Among Medical Students: A Systematic Review and Meta-Analysis. JAMA. 2016;316(21):2214-2236.doi:10.1001/jama. 2016.17324.

29- Nair M, Moss N, Bashir A, et al. Mental health trends among medical students. Proc (Bayl Univ Med Cent). 2023;36(3):408-410. Published 2023 Mar 16. doi:10.1080/08998280.2023.2187207

30- Abdulghani HM, AlKanhal AA, Mahmoud ES, Ponnamperuma GG, Alfaris EA. Stress and its effects on medical students: a cross-sectional study at a college of medicine in Saudi Arabia. J Health Popul Nutr. 2011;29(5):516-522. doi:10.3329/jhpn.v29i5.8906.

31- Hill MR, Goicochea S, Merlo LJ. In their own words: stressors facing medical students in the millennial generation. Med Educ Online. 2018;23(1):1530558. doi:10.1080/10872981.2018.1530558

32- Kroenke, K., Spitzer, R. L., & Williams, J. B. W. Patient Health Questionnaire-9 (PHQ-9), 1999. [Database record]. APA Ps,cTests. https://doi.org/10.1037/t06165-000

33- Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B.. Generalized Anxiety Disorder 7 (GAD-7), 2006. [Database record]. APA PsycTests. https://doi.org/10.1037/t02591-000

34- Mirza AA, Baig M, Beyari GM, Halawani MA, Mirza AA. Depression and Anxiety Among Medical Students: A Brief Overview. Adv Med Educ Pract. 2021;12:393-398. Published 2021 Apr 21. doi:10.2147/AMEP.S302897

35- Prinz P, Hertrich K, Hirschfelder U, de Zwaan M. Burnout, depression, and depersonalization--psychological factors and coping strategies in dental and medical students. GMS Z Med Ausbild. 2012;29(1):Doc10. doi:10.3205/zma000780

36- Ahmed I, Banu H, Al-Fageer R, Al-Suwaidi R. Cognitive emotions: depression and anxiety in medical students and staff. J Crit Care. 2009;24(3):e1-e7. doi:10.1016/j.jcrc.2009.06.003

37- Puthran R, Zhang MW, Tam WW, Ho RC. Prevalence of depression amongst medical students: a meta-analysis. Med Educ. 2016;50(4):456-468. doi:10.1111/medu.12962

38- Gold JA, Hu X, Huang G, et al. Medical student depression and its correlates across three international medical schools. World J Psychiatry. 2019;9(4):65-77. Published 2019 Jul 15. doi:10.5498/wjp.v9.i4.65

39- Almzainy, S., & Srgewa, A. Prevalence of Depressive Symptoms among Medical Students of Faculty of Medicine, Derna. AlQalam Alq J Med App Sci. 2023; 6 (2):726-732. Available from: https://journal.utripoli.edu.ly/index.php/Alqalam/article/view/405

40- Ahmad, J., Sadia, H. Natural Disasters. In: Haring, R., Kickbusch, I., Ganten, D., Moeti, M. (eds) Handbook of Global Health. Springer, Cham. 2020; https://doi.org/10.1007/978-3-030-05325-3_100-1

41- Keya TA, Leela A, Habib N, Rashid M, Bakthavatchalam P. Mental Health Disorders Due to Disaster Exposure: A Systematic Review and Meta-Analysis. Cureus. 2023;15(4):e37031. Published 2023 Apr 2. doi:10.7759/cureus.37031

42- Silva V, Costa P, Pereira I, et al. Depression in medical students: insights from a longitudinal study. BMC Med Educ. 2017;17(1):184. Published 2017 Oct 10. doi:10.1186/s12909-017-1006-0

43- Bert F, Lo Moro G, Corradi A, et al. Prevalence of depressive symptoms among Italian medical students: The multicentre cross-sectional "PRIMES" study. PLoS One. 2020;15(4):e0231845. Published 2020 Apr 17. doi:10.1371/journal.pone.023184

44- Memon I, Omair A, Barradah OM, et al. Measurement of Exam Anxiety Levels Among Medical Students and Their Association With the Influencing Factors. Cureus. 2023;15(7):e41417. Published 2023 Jul 5. doi:10.7759/cureus.41417

45- Ahmad, A., Hassan, Z., Ahmad, B., Tariq, K., & Saeed, S.. Anxiety and perceived stress among students due to covid-19 pandemic in Lahore. The

Rehabilitation Journal. 2023; 7(02):512-517. doi: 10.52567/trj.v7i02.83

46- Backović DV, Zivojinović JI, Maksimović J, Maksimović M. Gender differences in academic stress and burnout among medical students in final years of education. Psychiatr Danub. 2012;24(2):175-181. Available from: https://pubmed.ncbi.nlm.nih.gov/22706416/

47- Delgado-Herrera M, Aceves-Gómez AC, Reyes-Aguilar A. Relationship between gender roles, motherhood beliefs, and mental health. PLoS One. 2024;19(3):e0298750. doi:10.1371/journal.pone.0298750

48- Suraj SS, Umar BI, Gajida AU, Umar MU. Prevalence and factors associated with depression among medical students in Nigeria. Niger Postgrad Med J. 2021;28(3):198-203. doi:10.4103/npmj.npmj_414_21

49- Alharbi H, Almalki A, Alabdan F, Haddad B. Depression among medical students in Saudi medical colleges: a cross-sectional study. Adv Med

50- Educ Pract. 2018;9:887-891. Published 2018 Dec 4. doi:10.2147/AMEP.S182960

51- Dahlin ME, Runeson B. Burnout and psychiatric morbidity among medical students entering clinical training: a three-year prospective questionnaire and interview-based study. BMC Med Educ. 2007;7:6. Published 2007 Apr 12. doi:10.1186/1472-6920-7-6

52- Dyrbye LN, Thomas MR, Shanafelt TD. A systematic review of depression, anxiety, and other indicators of psychological distress among U.S. and Canadian medical students. Acad Med. 2006;81(4):354-373. doi:10.1097/00001888-200604000-00009

53- Hamada A, Sökmen M, Zaki Z. Investigating the Libyan Conflict and Peace-Building Process.: Causes and Prospects. In: The Aftermath of the Arab Uprisings. 1st ed. Routledge; 2023:185-218. Doi: 10.4324/9781003344414-10

54- Elhadi M, Msherghi A, Khaled A, et al. Impact of lockdown due to the COVID-19 pandemic on mental health among the Libyan population. PLoS One. 2022;17(4):e0267426. Published 2022 Apr 28. doi:10.1371/journal.pone.0267426

Libyan Journal of Public Health Practices (LJPHP)

Journal homepage:

https://journals.uob.edu.ly/LJPHP/index

Estimating the Pulmonary Artery Pressure: Transthoracic Echocardiography vs. Right Heart Catheterization

Mohamed S. Houssein[1] and Fathi Elbraky [*] [1,2]

[1] Department of Internal Medicine, Faculty of Medicine, University of Benghazi, Benghazi, Libya
[2] Department of Internal Medicine, Benghazi Medical Center, Benghazi, Libya

ARTICLE INFO

Article history:
Received 21/5/2023
Revised 30/5/2024
Accepted 20/6/2024

Keywords:
Pulmonary hypertension
Echocardiography
TTE
RHC

ABSTRACT

Pulmonary hypertension is defined as a mean pulmonary artery pressure (MPAP) ≥ 20 mmHg at rest, measured by right heart catheterization (RHC). The accuracy of measuring PH without invasive procedures remains a challenging task. The current study was aiming to evaluate the correlation between transthoracic echocardiography (TTE) and RHC in estimating pulmonary artery pressure (PAP) and to assess whether TTE can be a reliable tool for diagnosing and following up with patients with PH. This is a cross-sectional study of 29 patients seen at Benghazi Medical Centre diagnosed with PH in order to compare invasively measured PAP to estimated PAP by TTE. The mean age of the patients was 45.6±16.2 years, with female predominance (86.21%). RHC confirmed PH in 26 patients (89.8%), while 3 patients (10.2%) had normal PAP. The mean PAP estimated by TTE was 68.2±26.9 mmHg, significantly higher than that measured by RHC (46.31±26.2 mmHg, $p < 0.05$). Primary PAH was the leading cause of PH, followed by cardiac etiologies. TTE showed a sensitivity close to 100%, a specificity of 50%, and an overall accuracy of 90.6% in estimating PAP compared to RHC. The Pearson correlation coefficient between PAP measured by RHC and TTE was 0.692 ($p < 0.0001$). These findings suggest that TTE might be a valuable non-invasive tool for diagnosing and monitoring PH, though caution is warranted due to the variability observed in specific measurements compared to RHC.

[*] Corresponding author. Fathi Elbraky
E-mail address: fathi.elbraky@uob.edu.ly

1. Introduction

Pulmonary hypertension is defined as mean pulmonary artery pressure (PAP) ≥ 20 mmHg at rest, measured by right heart catheterization (RHC) [1,2]. The accuracy of measuring pulmonary hypertension without the use of invasive procedures is a challenging task in clinical practice [2,3]. It has been established that the RHC is the gold standard method to accurately measure PAP [4,5]. However, its routine use is limited due to multiple factors and that include being an invasive procedure, inherent complications, incurring cost, accessibility to trained cardiologists, and cardiac catheterization laboratory equipped medical center [6, 7].

Transthoracic echocardiography (TTE) is a non-invasive, affordable, and widely available test [8]. Therefore, it's commonly considered as a reasonable initial tool for the initial assessment of patients with pulmonary arterial hypertension (PAH) [9,10,11]. PAH is caused by a heterogeneous group of disorders, and is well known to be associated with higher morbidity and mortality, regardless of the underlying cause [12,13,14]. Using the TTE in the assessment of pulmonary artery systolic pressure can be done by measuring maximum tricuspid regurgitation velocity (TRV) and applying modified Bernoulli equation to convert these values into pressure values; PASP = (Vmax2 × 4) + right atrial pressure (RAP) [15,16,17]. Many clinical studies have calculated the different parameters of TTE and found that there is close correlation in the accuracy of measurements especially peak and mean pulmonary artery pressure as compared to cardiac catheterization [18,19]. While other studies suggest using TTE not only as an initial screening tool but also for the monitoring of the disease progression [20,21,22]. The aim of this study was to evaluate the correlation between TTE and RHC in the estimation of pulmonary artery pressure and whether the use of TTE can be a reliable and accurate tool for the diagnosis and follow-up of patients with PAH.

2. Methodology

A cross sectional study of 29 patients from the rheumatology, pulmonology and cardiology clinics at Benghazi medical center, Benghazi – Libya. All patients were diagnosed with pulmonary hypertension according to the ESC/ERS 2015-2018, and confirmed by RHC in order to compare invasively measured PAP to the estimated PAP by TTE. Pulmonary artery systolic pressure was measured by both TTE first then confirmed by RHC. RHC was performed by using the Swan-Ganz catheter, multi-lumen, balloon tipped, 110 cm long, done under complete aseptic precautions. The route of entry was via the right subclavian vein and plain chest X-ray was done post catheterization to detect any complications.

3. Results and discussion

A total number of 29 patients were included in this study. The mean age was 45.6±16.2 years, ranging from 19 to 79 years old as shown in (figure 1) which was in contrasts with findings from other studies, such as those reporting mean ages of 36.4±15 years, 37 years and 53±14 years [18,19, 20, 21]. The majority of our patients were female 86.21% and 13.79% males, inconsistent with other findings reported from Egypt [20, 22].

All patients in our study exhibited elevated PAP assessed by TTE, the mean PAP by was 68.3±26.9 mmHg ranging from 23 to 125 mmHg. This is much higher than results from an Iraqi study [23], in which a mean PAP of 36±4.9 mmHg was reported, but our results were similar to Seyyedi et al. [24].

The whole sample was assessed for tricuspid valve regurgitation (TR) using TTE, and 75.9% of them had TR where as 24.1% had no valve regurgitation, comparable to meta-analyses reporting TR rates ranging from 33.9% to 56% [25], and contrasting with higher rates seen in other studies [26]. These variations likely stem from differences in PAH etiology, classification, and severity.

All patients underwent RHC to assess their PAP, of all patients 26 (89.9%) had a high PAP ≥ 20 mmHg, on the other hand 3 (10.2%)

patients had a normal PAP (figure3). The mean of PAP by RHC was 46.3±26.2 mmHg ranging from 10 to 110 mmHg. The mean of PAP by TTE was 68.2±26.9mmHg which was higher than RHC estimated PAP at 46.31±26.2 mmHg ($p < 0.05$). The correlation coefficient for PAP by RHC and TTE was 0.692 (p 0.0001) with statistically significant result (figure 2). Sensitivity of TTE as a test to assess PAP was nearly 100%, the specificity was 50% and the accuracy of TTE was 90.6%. Our results is surpassing results reported by Seyyedi SR (sensitivity 89.2%, specificity 42.8%) [24, 27, 28].

Furthermore, different causes and types of pulmonary artery hypertension were studies (tables 1 and 2). The primary type emerged as the leading cause of pulmonary hypertension in our cohort, followed by cardiac-related causes. This finding aligns with the Pan African Pulmonary Hypertension Cohort (PAPUCO) study, which classified the etiologist of pulmonary hypertension according to Simmoneau and colleagues [29, 30, 31]. In their multinational study, primary type accounted for 15.8% of cases, with the majority attributed to left heart disease (68.9%), lung disease (12.0%), chronic thromboembolic PH (1.9%), and unclear/multifactorial causes (15.8%).

Table 1: Distribution of patients with PAH according to causes.

	No	**%**
Old TB + COPD	2	7.69
CTD	9	34.6
Pulmonary fibrosis	1	3.84
Idiopathic	10	38.5
CHD	1	3.84
VHD	2	7.69
Recurrent PE	1	3.84
Total	26	100.0

TB=tuberculosis, COPD=chronic obstructive airway disease, CTD=connective tissue disease, CHD= congenital heart disease, VHD= valvular heart disease, PE= pulmonary embolism.

Table 2: Types of pulmonary arterial hypertension.

Type of PAH (group)	**No**	**%**
1	19	73.1
2	3	11.5
3	3	11.5
4	1	3.9
5	0	0

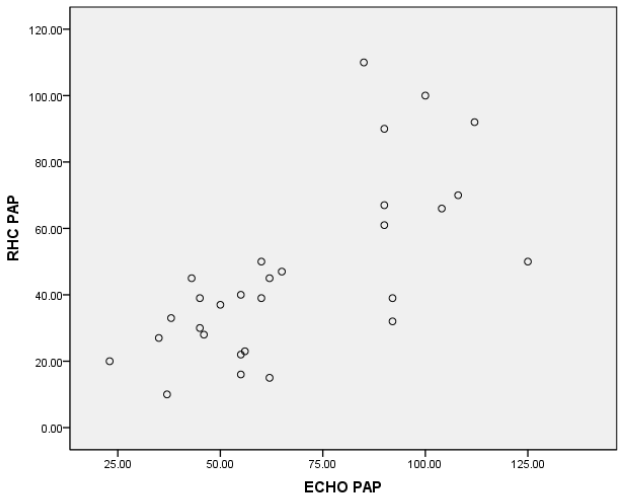

Figure 1: Age distribution of studied patients**.**

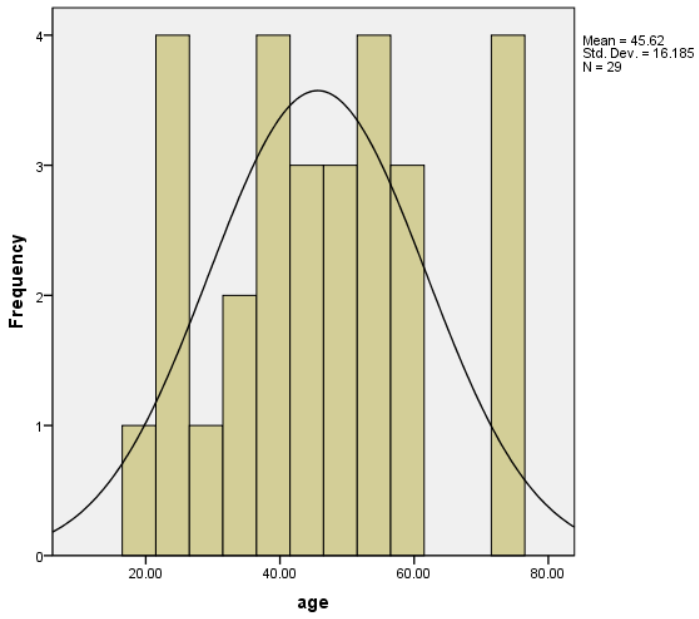

Figure 2: Linear correlation between transthoracic echocardiography PAP and right heart catheterization PAP.

4. Conclusions

The use of TTE in the assessment of PAH has a correlation with RHC. TTE might have a great benefit as a screening test for PH, although it is less specific than RHC.

Conflict of Interest

The authors did not reveal any potential conflicts of interest

References

1. Ni J, Yan P, Liu S et al. Diagnostic accuracy of transthoracic echocardiography for pulmonary hypertension: a systematic review and meta-analysis. BMJ Open. 2019;9(12).
2. Parasuraman S, Walker S, Loudon B et al. Assessment of pulmonary artery pressure by echocardiography—A comprehensive review. IJC Heart & Vasculature. 2016;12:45-51.
3. Fisher M, Forfia P, Chamera E et al. Accuracy of Doppler Echocardiography in the Hemodynamic Assessment of Pulmonary Hypertension. American Journal of Respiratory and Critical Care Medicine. 2009;179(7):615-621.
4. Greiner S, Jud A, Aurich M et al. Reliability of Noninvasive Assessment of Systolic Pulmonary Artery Pressure by Doppler Echocardiography Compared to Right Heart Catheterization: Analysis in a Large Patient Population. Journal of the American Heart Association. 2014;3(4).
5. Er F, Ederer S, Nia A et al. Accuracy of Doppler-Echocardiographic Mean Pulmonary Artery Pressure for Diagnosis of Pulmonary Hypertension. PLoS ONE. 2010;5(12)
6. Galiè N, Humbert M, Vachiery J et al. 2015 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension. European Heart Journal. 2015;37(1):67-119.
7. Lindqvist P, Soderberg S, Gonzalez M et al. Echocardiography based estimation of pulmonary vascular resistance in patients with pulmonary hypertension: a simultaneous Doppler echocardiography and cardiac catheterization study. European Journal of Echocardiography. 2011;12(12):961-966.
8. Henein M, Tossavainen E, A'roch R et al. Can Doppler echocardiography estimate raised pulmonary capillary wedge pressure provoked by passive leg lifting in suspected heart failure. Clinical Physiology and Functional Imaging. 2018;39(2):128-134.
9. Deo Bhatt D, Manoj R, Mahajan R. Estimation of Pulmonary Vascular Resistance: Correlation between Echocardiography and Catheterization Data in Patients with Congenital Heart Disease. Echocardiography. 2012;29(4):478-483.
10. Guazzi M, Tamborini G, Sganzerla P et al. Improved Method of Doppler Estimation of Right Ventricular Systolic Pressure. American Journal of Noninvasive Cardiology. 1992;6(2):75-80.
11. Thangappan K, Guzman-Gomez A, Zafar F et al. To Cath or Not to Cath: Pediatric Lung Transplant Candidates without a Diagnosis of Pulmonary Hypertension. The Journal of Heart and Lung Transplantation. 2021;40(4).
12. Atiq M, Tasneem H, Aziz K. Estimation of Pulmonary Vascular Resistance with Doppler

Diastolic Gradients. Asian Cardiovascular and Thoracic Annals. 2008;16(3):221-225.
13. Moceri P, Chiche O, Dimopoulos K et al. Echocardiographic insights into pulmonary arterial hypertension: the "advantage" of congenital heart disease patients. European Heart Journal. 2013;34(suppl 1).
14. El-Korashy R, Amin Y, Eissa A et al. Echocardiography versus right heart catheterization in class I pulmonary hypertension. Egyptian Journal of Chest Diseases and Tuberculosis. 2014;63(2):419-422.
15. Dimopoulos K, Wort S, Gatzoulis M. Pulmonary hypertension related to congenital heart disease: a call for action. European Heart Journal. 2013;35(11):691-700.
16. Chemla D, Herve P. Derivation of Mean Pulmonary Artery Pressure from Systolic Pressure: Implications for the Diagnosis of Pulmonary Hypertension. Journal of the American Society of Echocardiography. 2014;27(1):107.
17. Finkelhor R, Scrocco J, Madmani M et al. Discordant Doppler Right Heart Catheterization Pulmonary Artery Systolic Pressures: Importance of Pulmonary Capillary Wedge Pressure. Echocardiography. 2013;31(3):279-284.
18. Ghamria ZW, Dweik RA. Primary pulmonary hypertension: an overview and pathogenesis. Cleveland Clinic Journal of Medicine. 2003;70(Suppl. 1).
19. ACCF/AHA. 2009 Expert consensus document on pulmonary hypertension. Journal of the American College of Cardiology. 2009;53(17).
20. Manes A, Palazzini M, Dardi F et al. Female gender and pulmonary arterial hypertension: a complex relationship. Giornale Italiano di Cardiologia. 2012;13(6):448-460.
21. Badesch DB, Raskob GE, Elliott CG et al. Pulmonary arterial hypertension: baseline characteristics from the REVEAL Registry. Chest. 2010;137:376-387.
22. El-Korashy RIM, Amin YM, Eissa AI, Thabet TS. Echocardiography versus right heart catheterization in class I pulmonary hypertension. Egyptian Journal of Chest Diseases and Tuberculosis. 2014;63(2):419-422.
23. AL-Kinani AAA. Clinical study of patients with primary pulmonary hypertension (PPH). Journal of the Faculty of Medicine Baghdad. 2018;60(2):80-84.
24. Seyyedi SR, Mozafari M, Sharif-Kashani B et al. Correlation of Echocardiographic and Right Heart Catheterization Estimations of Pulmonary Artery Systolic Pressure. Tanaffos. 2022 Jan;21(1):78-84.
25. Wang N, Fulcher J, Abeysuriya N et al. Tricuspid regurgitation is associated with increased mortality independent of pulmonary pressures and right heart failure: a systematic review and meta-analysis. European Heart Journal. 2019;40(5):476-484.
26. Chen L, Larsen CM, Le RJ et al. The prognostic significance of tricuspid valve regurgitation in pulmonary arterial hypertension. Clinical Research in Cardiology. 2018;12(4):1572-1580.
27. D'Alto M, Romeo E, Argiento P et al. Accuracy and precision of echocardiography versus right heart catheterization for the assessment of pulmonary hypertension. International Journal of Cardiology. 2017;168:4058-4062.
28. Rich JD, Shah SJ, Swamy RS et al. Inaccuracy of Doppler echocardiographic estimates of pulmonary artery pressures in patients with pulmonary hypertension. Chest. 2017;139:988-993.
29. Fisher MR, Forfia PR, Chamera E et al. Accuracy of Doppler echocardiography in the hemodynamic assessment of pulmonary hypertension. American Journal of Respiratory and Critical Care Medicine. 2009;179:615-621.
30. D'Alonzo GE, Barst RJ, Ayres SM et al. Survival in patients with primary pulmonary hypertension. Results from a national prospective registry. Annals of Internal Medicine. 1991;115:343-349.
31. Thienemann F, Dzudie A, Mocumbi AO et al. The causes, treatment, and outcome of pulmonary hypertension in Africa: insights from the Pan African Pulmonary Hypertension Cohort (PAPUCO) registry. International Journal of Cardiology. 2016;221:205-211.

Libyan Journal of Public Health Practices (LJPHP)

Journal homepage:
https://journals.uob.edu.ly/LJPHP/index

Pattern And Determinants of Health-Related Quality of Life Among Systemic Lupus Erythematosus Patients In Libyan Healthcare Settings

Halima Buni[1]*, Sana Taher Ashur[2], Boshra Nagi[3]

[1,2] Department of Family and Community Medicine, University of Tripoli - Faculty of Medicine
[3] Intern doctor, University of Tripoli - Faculty of Medicine

ARTICLE INFO

Article history:
Received 24/5/2014
Revised 1/6/2024
Accepted 22/6/2024

Keywords:
Determinants
Quality of life
HRQoL
SLE
Libya

ABSTRACT

Systemic lupus erythematosus (SLE) is a long-term autoimmune disease affecting multiple systems in the body and is known to cause considerable morbidity and mortality. This study's objective was to evaluate several Health-related Quality of life **(**HRQoL) dimensions among SLE patients getting treatment in Libyan medical care facilities. Additionally, it examined how certain clinical and socio-demographic variables affect every HRQoL domain. A cross-sectional study was conducted at the Rheumatology Department of the Tripoli University Hospital-Libya during October 2022 and targeted patients with confirmed diagnosis of SLE. Data was collected using a self-reported questionnaire that included the RAND 36-Item Health Survey 1.0 version of the SF-36. The data was analyzed using the SPSS. A total of 50 respondents filled in the questionnaires. The mean age of the participants was 44.79 years (SD=12.31) and 80.0% of them were females. The least impacted HRQoL domains were Physical (mean=72.52, SD=28.04) and Social functioning (mean=66.25, SD=32.26). While the most affected domain was Role limitation due to emotional problems (mean=35.33, SD=41.18). Energy/ Fatigue (p=0.021) and Emotional well-being (p=0.011) scores were significantly higher in males. Physical functioning mean score was significantly higher in unmarried patients (p=0.037). The mean of Role limitation due to emotional problems score(p=0.038) and the Energy/ Fatigue scores were significantly lower in patients with comorbidities (p=0.019). The least impacted HRQoL domains were Physical and Social functioning. While the most affected domain was Role limitation due to emotional problems. The main factors associated with lower HRQoL scores were, female sex, marriage, low monthly income, and presence of comorbidities.

* Corresponding Author.
Email address: halimabuni@gmail.com

1. Introduction

SLE is a chronic multisystemic autoimmune disease that associated with significant morbidity, mortality and poor HRQoL [(1)], which are more pronounced in developing countries [(2)]. HRQoL is a multi-domain concept that assesses patients' overall perception of the impact of the disease and its treatment on their physical, psychological, and socio-economic functions, that are not always fully captured by descriptions of the disease's physiological consequences only [(3, 4)]. In recent years, patient-reported HRQoL has gained more attention in SLE management and is recommended to be evaluated in routine clinical practice. This provides SLE patients the opportunity to be involved in their treatment and to enhance their communication with the multidisciplinary team involved in their care [(4-6)].

It is well known that HRQoL is significantly impaired by the SLE, particularly due to the SLE-associated musculoskeletal and mucocutaneous manifestations. In addition to arthritis, and internal organs involvement, particularly, the heart, lungs, blood vessels, liver, kidneys and nervous system [(6-8)]. However, evidence is limited and inconsistent about the predictive factors of poor HRQoL in SLE patients. In Libya, evidence is lacking about the impact of SLE on patients' HRQoL and about the main clinical and socio-demographic factors influencing the different domains of HRQoL. Therefore, the objective of this study was to evaluate several HRQoL dimensions among SLE patients getting treatment in Libyan medical care facilities. Additionally, it examined how certain clinical and sociodemographic variables affect every HRQoL domain.

2. Methodology

This cross-sectional study was done in October 2022 at the Rheumatology Department of University of Tripoli Hospital in Libya. This hospital was chosen as the research location because it has one of Libya's major Rheumatology departments, which provides comprehensive care for SLE patients. The inclusion criteria for participants were, patients with a confirmed diagnosis of SLE, aged 18 years and older, of both sexes and who are able to give an informed consent. Recently diagnosed patients, with a duration of less than 6 months, pregnant and advanced stage SLE patients, and those who are unable to give an informed consent were all excluded.

Data was collected using a self-reported questionnaire. The first part of the questionnaire covered selected socio-demographic and clinical data. The second part was the Arabic version of the RAND 36-Item Health Survey 1.0 version of the SF-36. The RAND 36 scale assess the HRQoL, it is multidimensional, as it comprises of eight subscales that measure eight quality of life domains including; Physical functioning, Role limitation due to physical health, Role limitation due to emotional problems, Energy/Fatigue, Emotional well-being, Social functioning, Pain and General health. Scoring guidelines provided by Hays and colleagues and recommended by the RAND Corporation for this version were followed [(9)]. Responses on each item were firstly recoded into percentages, so that the highest possible score was 100, and lowest possible score was 0. The higher the score, the more the favorable the outcome. Then, the recoded responses on the items of each subscale were averaged to compute the score of the quality-of-life domain measured by that subscale. To provide a comprehensive evaluation of the important dimensions of HRQoL, each HRQoL domain was treated separately, and no HRQoL overall score or summary scores were created. Despite the prevalent use of the physical domain summary score (PCS), and mental domain summary score (MCS) in previous research, they were not employed here, firstly because the general population parameters needed to standardize the subscales scores for the Libyan population were not available, which preclude the standard PCS and MCS scoring algorithm. Furthermore, there has been a controversy around the methods used for their derivation, and concerns about their performance and accuracy [(10-13)], as well as concerns about the validity of the standard scoring algorithm [(13)] which could lead to misleading interpretation.

Likewise, although several studies employed a total HRQoL score, the scoring guidelines of the scale does not refer to a standard method to generate such a single measure, and studies that reported an overall score have either not specified their method or presented inconsistent methods [(14)]. Data was analyzed using the SPSS, version 26. Cronbach's alpha coefficient was used to assess the internal consistency reliability of each of the RAND 36 subscales. Frequency and percentages were used to present qualitative data. Despite the small sample size, all quantitative data were approximately normally distributed, therefore, mean and standard deviation were used to summarize these data. Pearson's correlation, Independent t test, ANOVA test and Welch's ANOVA test were used in the bivariate analysis. For post hoc multiple comparison, Tukey's honestly significant difference (HSD) post hoc test was used when equal variance assumptions were met, while Tamhane post hoc test was used when data does not meet the assumption of homogeneity of variance. Both p value of less than 0.05, and 95% confidence intervals were considered in the interpretation of the significance of the reported differences. Effect size indices were calculated for the significant findings to quantify the magnitude and the practical significance of the reported differences. Cohen's d effect size (*d*) was used for independent t test, Cohen's f effect size (*f*) was used for ANOVA; using partial Eta-squared (η_p^2), and the adjusted Omega- squared effect size (ω^2) was used for Welch's ANOVA. Interpretation of the results was in accordance with the following rules: Effect size $d < 0.2$ is very small, 0.2 to < 0.5 is small, 0.5 to < 0.8 is medium, and ≥ 0.8 is large; Effect size *f* 0.10 is small, 0.25 is medium, and 0.40 is large. (Cohen 1988); and $\omega^2 < 0.01$ very small, 0.01 to < 0.06 small, 0.06 to < 0.14- medium, ≥ 0.14 large.

3. Results

A total of 50 respondents filled in the questionnaires. The age of the participating patients ranged from 20 to 74 years, with a mean age of 44.79 years (SD= 12.31). Females represented 80.0% of the cases. More than half of the participants were unmarried (64.0%) and unemployed (58.0%), with those who reported a low income (≤ 1,000 LD) constituted 76.0% of the sample. Out of the 50 participants, 21 (42.0%) live outside Tripoli (Table 1)**.**

Table 1: Socio-demographic profile of the SLE patients (n=50)

Variable	f	(%)	Range
Age (years)†	44.79	± 12.31	20-74
Sex			
Males	10	(20.0)	
Female	40	(80.0)	
Nationality (n=46)			
Libyan	45	(97.8)	
Non-Libyan	1	(2.2)	
Marital status			
Unmarried	32	(64.0)	
Married	18	(36.0)	
Number of family members †	6.49	±2.65	2-14
Education level			
Preparatory school or less	14	(28.0)	
High school level or equivalent	21	(42.0)	
University level or equivalent	15	(30.0)	
Employment status			
Unemployed	29	(58.0)	
Employed	21	(42.0)	
Income(in LD)			
≤ 1000	38	(76.0)	
>1000- 1500	8	(16.0)	
>1500	4	(8.0)	
Residency			

Tripoli	29	(58.0)
Outside Tripoli	21	(42.0)
Adequate adherent	37	(74.0)

† (mean ±SD)

The mean age at which SLE was diagnosis was 34.32 years old (SD= 12.24), and 71.4% were diagnosed within a year of the beginning of symptoms, however, 12.2% were diagnosed after more than 5 years of having the symptoms. The mean duration of SLE was 11.85 years (SD= 8.42), with 73.5% of the participants had the disease for at least 6 years. Self-reported adequate adherence to SLE medications was 88.0%, and that for keeping up with follow-up appointments was 74% (Table 2).

Table 2: Clinical profile of the SLE patients (n=50)

Variable	f	(%)	Range
Presence of other chronic disease than SLE			
No	20	(40.0)	
Yes	30	(60.0)	
Age at Onset †	32.40	±11.92	3-64
Age at diagnosis †	34.32	±12.24	3-65
Onset to diagnosis (n=49) †	1.91	±3.26	
≤ 1 Year	35	(71.4)	
2 to 4 years	8	(16.3)	
≥ 5 years	6	(12.2)	
Disease duration (onset to current age) (n=49)†	11.85	±8.42	1-42
> 1 year	4	(8.2)	
2-5 years	9	(18.4)	
≥ 6 years	36	(73.5)	
Adherence to follow-up appointments			
Non adequate adherence	13	(26.0)	
Adequate adherent	37	(74.0)	
Adherence to medications			
Non adequate adherence	6	(12.0)	
Adequate adherent	44	(88.0)	

† (mean ±SD)

Table 3 displays the reliability of each of the eight HRQoL subscales and summarizes the reported scores. All of the RAND 36 subscales had adequate internal consistency reliability as indicated by Cronbach's alpha values larger than 0.7 [15, 16], except for the Energy/Fatigue and General health subscales, where alpha values were low, though acceptable being larger than 0.5 [17]. Both of these subscales had average inter-item correlation values that fall in the optimal range of (0.2-0.4) [18].

The least impacted HRQoL domains in this sample of SLE patients were Physical (mean=72.52, SD=28.04) and Social functioning (mean=66.25, SD=32.26), while the most affected domain was Role limitation due to emotional problems (mean=35.33, SD=41.18). Table 4 shows the relationship between selected socio-demographic characteristics of SLE patients (age, sex, marital status and income) and their HRQoL. Among all HRQoL domains, Energy/Fatigue showed a nearly statistically significant negative and weak correlation with age. Of the eight HRQoL domains, Energy/ Fatigue and Emotional well-being domains were significantly higher in males than in females. The mean Energy/ Fatigue score in males (mean=67.50, SD=17.83) was higher than that in females (mean=51.87, SD=18.59), and the mean difference was statistically significant (p=0.021), with a large effect size, which

Table 3: Health-related Quality of life in SLE patients (n=50)

HRQoL domains	Items	Mean	±SD	Observed Range	Cronbach's alpha (α)
Physical functioning	10	72.52	±28.04	0-100	0.909
Role limitation due to physical health	4	53.00	±41.23	0-100	0.840
Role limitation due to emotional problems	3	35.33	±41.18	0-100	0.813
Energy/ Fatigue	4	55.00	±19.32	20-100	0.623
Emotional well-being	5	61.44	±18.93	28-100	0.716
Social functioning	2	66.25	±32.26	0-100	0.845
Pain	2	65.10	±27.67	0-100	0.742
General health	5	52.60	±19.90	20-95	0.548

that the difference is meaningful (*d*=0.857). Likewise, the Emotional well-being score was greater in males (mean=74.80, SD=13.20) than in females (mean=58.10, SD=18.78), and the mean difference was statistically significant (p=0.011). The effect size was also large (*d*=1.028), which reflects the practical significance of the reported difference. The Physical functioning domain mean score was statistically significantly higher in unmarried patients (mean=79.37, SD=22.92) than in married (mean=60.34, SD=32.60); (p=0.037), and the effect size of the difference was medium (*d*=0.675).

There were significant variations in two HRQoL domains: Physical functioning and Energy/Fatigue among the three income groups, as indicated by Welch's' ANOVA test (p=0.030). Tamhane post hoc test results revealed that, the group who reported an income of 1000 LD or less has a significantly lower Physical functioning score (mean=68.32, SD=30.10) compared to the group whose income was between 1000 to 1500 LD (mean=89.37, SD=10.50), (p= 0.005), with a large Omega-squared effect size (ω^2=0.152). A significant difference in mean Energy/ Fatigue score between the three income groups was indicated by ANOVA test (p=0.031). Tukey better in patients who have no comorbidities (mean=78.75, SD= 28.41) than in those who have comorbidities (mean=57.91, SD=32.41); (p=0.024), with a medium effect size (d=0.683). The Pain domain mean score was also significantly better in SLE patients who reported HSD post hoc test results revealed that the group who reported an income of 1000 LD and less has a significantly lower Energy/ Fatigue score (mean=51.05, SD=18.85) compared to the group whose income was 1000 to 1500 LD (mean=68.75, SD=14.57), (p= 0.043), with a large Cohen's *f* effect size (*f*= 0.138).

Table 5 displayed the reported relationship between selected clinical variables (disease duration, comorbidity, adherence to medications and to follow-up) and HRQoL among SLE patients. No statistically significant difference in any of the HRQoL scores was found between patients with different disease duration length. Having other chronic comorbidities along with SLE found to adversely impact several HRQoL dimensions. The mean Role limitation due to emotional problems score was significantly lower in SLE patients who reported having other chronic diseases (mean=25.55, SD=38.83) than in those who have no other morbidities (mean=50.00, SD=41.18), and the mean difference was statistically significant (p=0.038), with a medium magnitude (*d*=0.610) Likewise, the Energy/ Fatigue score was significantly lower in those who have other morbidities (mean=49.83, SD=19.54) than that in patients who have no comorbidities (mean=62.75, SD=16.58); (p=0.019), and the effect size of the difference was medium (*d*=0.712). Social functioning was significantly no comorbidity (mean=77.25, SD=28.83) than the other group (mean=57.00, SD=24.07); (p=0.010), and effect size of the mean score difference was medium (d=0.762). General health mean score was significantly lower in patients who have comorbidity (mean=47.33,

SD=20.45) compared to that in those who have no other morbidities (mean=60.50, SD=16.53); (p=0.020), and the size of the effect of this difference was again medium (d=0.707). Poor medication adherence found to adversely impact the Role limitation due to emotional problems, as its mean score was significantly lower in patients who reported inadequate adherence (mean=0.00, SD=0.00) than in those who reported adequate adherence (mean=40.15, SD=41.65) (p=0.000), with a very large effect size (d=1.363). However, no significant mean differences in any of the eight HRQoL domains was found between patients who keep up with their follow-up appointments and those who were not on regular follow-up.

The corresponding 95% confidence intervals of the mean differences in all of the above reported significant findings did not embrace the value of no difference, however, the intervals were broad, which should be considered in the interpretation of the findings.

4. Discussion:

In the present study, the most affected domain of HRQoL among SLE patients was the Role limitation due to emotional problems and the least impacted domains were Physical and Social functioning. The last was in contrast with the results of other studies, which reported a lower Physical functioning [19, 20] and a poor Social functioning [20, 21].

The reported Role limitation due to emotional problems in this study was significant. This could be attributed to other coincident latent factors than the SLE. The Energy/Fatigue domain showed a nearly statistically significant negative and weak correlation with age. Age does not show a relationship with any of the HRQoL domains, which is contrary to several previous studies [20, 22- 25]. However, the low statistical power of the sample may have reduced the chance to detect significant relationships between age and the eight domains.

Of the eight HRQoL domains, Energy/ Fatigue and Emotional well-being domains were significantly higher in males than in females in agreement with other published studies [20, 26, 27]. This may be explained by that, most of females are housewives, who usually perform the living daily activities alongside with housing activities with the continuous effect of SLE during performing these activities.

Unsurprisingly, the Physical functioning domain mean score was statistically significantly higher in unmarried than in married patients, and the effect size of the difference was medium. Moreover, significant differences in Physical functioning and Energy/ Fatigue domains, were found across the three income groups.

In the present study, no statistically significant difference in any of the HRQoL scores was found between patients with different disease duration length. This was in agreement with some studies [20, 23, 28], and in contradiction with others [24, 29]. Having other comorbidities along with SLE in the current study found to adversely impact several HRQoL dimensions, this was compatible with another study [24]. The mean scores of Role limitation due to emotional problems, Energy/ Fatigue and General health domains were significantly lower in SLE patients who reported having comorbidities than in those who have no other comorbidities. Likewise, Social functioning and Pain domains mean scores were significantly better in patients who have no comorbidities than in those who have comorbidities. Poor medication adherence was found to adversely impact the Role limitation due to emotional problems. However, the cross sectional design of this study cannot establish a cause-effect relationship. No significant mean differences in any of the eight HRQoL domains was found between patients who keep up with their follow-up appointments and those who was not on regular follow-up.

Table 4: Relationship between HRQoL domains and selected socio-demographic characteristics (n=50)

Factors	RAND 36 Subscales															
	PF		RF		RE		VT		MH		SF		BP		GH	
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD
Age	-.195 [a]		-0.113 [a]		0.174 [a]		-0.279 [a]		0.005 [a]		0.056 [a]		-0.265 [a]		-0.173 [a]	
P value	0.179		0.441		0.232		0.052		0.972		0.702		0.066		0.234	
Sex																
Males	80.50	±30.50	52.50	±36.22	40.00	±40.97	67.50	±17.83	74.80	±13.20	71.25	±33.87	70.75	±34.66	56.50	±23.69
Female	70.53	±27.44	53.12	±42.81	34.16	±41.67	51.87	±18.59	58.10	±18.78	65.00	±32.17	63.68	±25.97	51.62	±19.06
P value	0.320		0.966		0.693		0.021*		0.011*		0.589		0.476		0.558	
Effect size	—		—		—		0.857[†]		1.028[†]		—		—		—	
Marital status																
Unmarried	79.37	±22.92	53.90	±40.71	29.16	±36.66	56.25	±21.44	60.00	±19.16	69.14	±33.44	69.29	±26.92	55.46	±19.56
Married	60.34	±32.60	51.38	±43.27	46.29	±47.33	52.7	±15.1	64.00	±18.76	61.1	±30.2	57.63	±28.17	47.50	±20.01
P value	0.037*		0.838		0.195		0.547		0.479		0.404		0.155		0.177	
Effect size	0.675[†]		—		—		—		—		—		—		—	
Income (LD)																
≤ 1000	68.32	±30.10	48.68	±41.48	28.07	±39.91	51.05	±18.85	58.52	±19.38	64.47	±33.45	62.56	±28.47	49.34	±20.07
>1000-1500	89.37	±10.50	65.62	±37.64	58.33	±34.50	68.75	±14.57	68.00	±14.34	68.7	±29.8	71.87	±23.25	63.75	±14.07
>1500	78.75	±19.31	68.75	±47.32	58.33	±50.00	65.00	±19.57	76.00	±15.31	78.1	±29.5	75.62	±29.88	61.25	±21.74
P value	0.030* [b]		0.425		0.083		0.031* [c]		0.120 [b]		0.711 [b]		0.512 [b]		0.116 [b]	
Effect size	0.152[‡]		—		—		0.138[§]		—		—		—		—	

* P<0.05, [a] Pearson's correlation (r), [b] based on Welch's ANOVA, [c] based on One-Way ANOVA, [†] Cohen's *d* effect size, [‡] Omega- squared (ω^2), [§]Cohen's *f* effect size,
PF=Physical functioning , RF=Role limitation due to physical health, RE=Role limitation due to emotional problems, VT=Energy/ Fatigue, MH=Emotional well-being, SF=Social functioning, BP=Pain and GH=General health.

Table 5: Relationship between HRQoL domains and selected clinical factors(n=50)

Factors	RAND 36 Subscales															
	PF		RF		RE		VT		MH		SF		BP		GH	
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD
Disease duration																
> 1 year	82.50	±18.92	62.50	±47.87	41.66	±31.91	55.00	±17.79	64.00	±21.41	68.75	±21.65	75.62	±28.75	58.75	±22.86
2-5 years	68.88	±29.23	44.44	±46.39	29.62	±42.30	56.11	±21.03	58.22	±17.90	72.22	±35.23	68.61	±29.42	54.44	±14.24
≥ 6 years	73.64	±28.18	54.86	±40.45	36. 11	±43.18	55.27	±19.56	62.44	±19.39	65.97	±32.26	63.33	±27.95	52.36	±20.68
P value	0.719[a]		0.728[a]		0.877[a]		0.993 [a]		0.819[a]		0.870 [a]		0.662 [a]		0.815 [c]	
Co-morbidity																
No	77.75	±26.38	65.00	±39.23	50.00	±41.1	62.75	±16.58	65.60	±19.86	78.75	±28.41	77.2	±28.8	60.50	±16.53
Yes	69.04	±29.00	45.0	±41.2	25.55	±38.8	49.83	±19.54	58.66	±18.08	57.91	±32.41	57.0	±24.0	47.33	±20.45
P value	0.287		.093		0.038*		0.019*		0.208		0.024*		0.010*		0.020*	
Effect size	—		—		0.610[†]		0.712[†]		—		0.683[†]		0.762[†]		0.707[†]	
Medications Adherence																
Inadequate	54.16	±32.15	29.16	±45.87	0.00	±0.00	42.50	±17.81	48.66	±17.60	47.91	±28.95	50.00	±25.69	42.50	±18.64
Adequate	75.02	±26.87	56.25	±40.03	40.15	±41.65	56.70	±19.07	63.18	±18.61	68.75	±32.18	67.15	±27.56	53.97	±19.87
P value	0.087		0.133		0.000*		0.091		0.078		0.140		0.156		0.188	
Effect size	—		—		1.363[†]		—		—		—		—		—	
Follow-up																
Inadequate	69.23	±26.68	44.23	±41.02	25.64	±33.75	48.46	±17.48	58.15	±16.38	64.42	±32.21	63.46	±29.44	47.69	±21.17
Adequate	73.68	±28.77	56.08	±41.41	38.73	±43.39	57.29	±19.63	62.59	±19.82	66.89	±32.70	65.67	±27.42	54.32	±19.44
P value	0.627		0.378		0.276		0.158		0.473		0.815		0.807		0.306	

* P<0.05 , [a] based on One-Way ANOVA, [†] Cohen's *d* effect size, PF=Physical functioning , RF=Role limitation due to physical health, RE=Role limitation due to emotional problems, VT=Energy/ Fatigue, MH=Emotional well-being, SF=Social functioning, BP=Pain and GH=General health.

The study had some limitations that should be considered in the interpretation of its findings, and in further research. Self-reporting of some variables is liable to response bias, like over reporting of medication adherence. The small sample size lowers the statistical power, this might have led to failure in detecting other significant relationships between the HRQoL domains and the studied characteristics. Also, the reported confidence intervals of all significant mean score differences in HRQoL domains in this study were broad, and this can be associated with some uncertainty of the estimates, and should be considered in the interpretation of the findings. However, broad confidence interval is expected with small sample sizes. The study strength of this study was that, the reported effect sizes with all statistically significant findings ranged from medium to large, which supports their practical significance. Besides communicating the practical importance of the significant findings, the presentation of the effect size indices in this study make it easier to compare its findings with other similar studies that report the same effect sizes indexes.

5. Conclusions

Among this sample of SLE patients in Libyan healthcare settings, the least impacted HRQoL domains were physical and Social functioning. While the most affected domain was the Role limitation due to emotional problems. The main factors associated with lower HRQoL domains scores were, female sex, marriage, low monthly income, and presence of comorbidities.

This study recommends a conduction of another research with a larger sample size to identify the predictive sociodemographic and clinical factors of poor HRQoL among SLE patients. Furthermore, a provision of psychological and social support to SLE patients may reduce their Role limitation due to emotional problems and can also provide a safe atmosphere for patients to share their apprehension and experiences.

References

1. Mikdashi J. Measuring and monitoring health-related quality of life responsiveness in systemic lupus erythematosus patients: current perspectives. Patient Related Outcome Meas. 2018 Oct 4;9:339-343. doi: 10.2147/PROM.S109479. PMID: 30323697; PMCID: PMC6178935.
2. Phuti A, Schneider M, Tikly M, Hodkinson B. Living with systemic lupus erythematosus in the developing world. Rheumatology Int. 2018;38(9):1601–13.
3. Yue Shi, Mucong Li, Lingshan Liu, Ziqian Wang, Yanhong Wang, Jiuliang Zhao, Qian Wang, Xinping Tian, Mengtao Li, Xiaofeng Zeng. Relationship between disease activity, organ damage and health-related quality of life in patients with systemic lupus erythematosus: A systemic review and meta-analysis, Autoimmunity Reviews, Volume 20, Issue 1, 2021.
4. Louthrenoo, W., Kasitanon, N., Morand, E. et al. Comparison of performance of specific (SLEQOL) and generic (SF36) health-related quality of life questionnaires and their associations with disease status of systemic lupus erythematosus: a longitudinal study. Arthritis Res Ther **22**, 8 (2020). https://doi.org/10.1186/s13075-020-2095-4
5. Strand V, Gladman D, Isenberg D, Petri M, Smolen J, Tugwell P. Endpoints: consensus recommendations from OMERACT IV. Outcome Measures in Rheumatology Lupus. 2000;9(5):322–7.
6. Nahla M. Gaballah, Amany R. El-Najjar, Clinical characteristics and health related quality of life (HRQoL) in Egyptian patients with systemic lupus erythematosus. The Egyptian Rheumatologist; Volume 41, Issue 2, 2019, Pages 117-121. https://doi.org/10.1016/j.ejr.2018.07.003.
7. Castellano-Rioja E, Giménez-Espert MD, Soto-Rubio A. Lupus erythematosus quality of life questionnaire (LEQoL): development and psychometric properties. International Journal of Environmental Research and Public Health. 2020 Nov;17(22):8642.
8. Krasselt, M.; Baerwald, C. Sex, Symptom Severity, and Quality of Life in Rheumatology. Clin. Rev. Allergy Immunol. 2019, 56, 346–361.
9. Hays RD, Sherbourne CD, Mazel RM. The RAND 36 Item Health survey 1.0. RAND, Santa Moniza, CA USA. Health Econ. 1993: 2 (3):217-227.
10. Nortvedt MW, Riise T, Mythr KM, Nyland HI. Performance of the SF-36, SF-12, and RAND-36 Summary Scales in a Multiple Sclerosis Population. Medical Care 2000, 38 (10): 1022-1028
11. Taft C, Karlsson J, Sullivan M. Do SF-36 summary domain scores accurately summarize subscale scores? Qual Life Res. 2001;10 (5): 395-404
12. Ware JE, Kosinski M. Interpreting SF-36 Summary Health Measures: A response. Qual Life Res. 2001; 10(5):405-420
13. Hagell P, Westergren A, Arestedt K. Beware of the origin of numbers: Standard scoring of the SF-12 an SF-36 summary measures distorts measurement and score interpretations. Research in Nursing and Health. 2017; 40(4): 378-386

14. Lins L, Carvalho FM. SF-36 Total score as a single measure of health-related quality of life: Scoping review. SAGE Open Med. 2016; 4
15. Nunnally, J.C. 1978. Psychometric theory. 2nd ed. New York: McGraw-Hill.
16. Nunnally, J.C. & Bernstein, I.H. 1994. Psychometric theory. 3rd ed. New York: McGraw-Hill.
17. Nunnally, J. C. 1967. Psychometric theory. New York: McGraw-Hill.
18. Briggs and Cheek (1986). The role of factor analysis in the development and evaluation of personality scales. *Journal of Personality*, *54* (1), 106 – 148.
19. K Eriksson, E Svenungsson, H Karreskog, I Gunnar sson, J Gustafsson, S Möller, S Pettersson & C Bost röm (2012) Physical activity in patients with systemic lupus erythematosus and matched controls, Scandinavian Journal of Rheumatology, 41:4, 290-297, DOI: 10.3109/03009742.2011.624117
20. Elmaghraby HA, El-Din SM, Yakout RA, Habiba AI. Quality of Life of Patients with Systemic Lupus Erythematosus.
21. Kamel F, El-Mokadem N, Abd El Latif O, Abo AL Soud A. (2018). Effectiveness of Exercises on Quality of Life in Patients with Systemic Lupus Erythematosus. IOSR Journal of Nursing and Health Science (IOSR-JNHS), 7(4), 59-66.
22. Mizukami, A., Trinh, M.T., Hoang, T.P. et al. Determinants of health-related quality of life among patients with systemic lupus erythematosus in Hanoi, Vietnam. BMC Rheumatol 7, 16 (2023). https://doi.org/10.1186/s41927-023-00339-6
23. Doria A, Rinaldi S, Ermani M, Salaffi F, Iaccarino L, Ghirardello A, Zampieri S, Della Libera S, Perini G, Todesco S. Health-related quality of life in Italian patients with systemic lupus erythematosus. II. Role of clinical, immunological and psychological determinants. Rheumatology (Oxford). 2004 Dec;43(12):1580-6. doi: 10.1093/rheumatology/keh392. Epub 2004 Sep 14. PMID: 15367746.
24. Hashemi S, Farahbakhsh S, Aghakhani Z, MomayezanMarnani A, Hemati N, Health-related quality of life and its related factors in patients with systemic lupus erythematosus in southwest Iran: a cross-sectional study. BMC Psychol. 2023 Sep 1;11(1):259. doi: 10.1186/s40359-023-01300-5. PMID: 37658385; PMCID: PMC10472603.
25. Plantinga L, Lim SS, Bowling CB, Drenkard C. Association of age with health-related quality of life in a cohort of patients with systemic lupus erythematosus: the Georgians Organized Against Lupus study. Lupus Sci Med. 2016 Jul 19;3(1):e000161. doi: 10.1136/lupus-2016-000161. PMID: 27547440; PMCID: PMC4964216.
26. Aly S, Mohammed F, Abd-Almageed A, Ahmed G. (2018). Comparative Study for Pattern of Social Support among Systemic Lupus Erythematosus Patients' at Out-patient Clinics, Assiut University Hospital. American Journal of Nursing Research, 6(6), 500- 6.
27. Yazdany J, Yelin E. (2010). Health-Related Quality of Life and Employment Among Persons with Systemic Lupus Erythematosus. Rheum Dis Clin North Am, 36(1), 15–32.
28. Chalhoub NE, Luggen ME. Depression-, Pain-, and Health-Related Quality of Life in Patients with Systemic Lupus Erythematosus. Int J Rheumatol. 2022 May 5;2022:6290736. doi: 10.1155/2022/6290736. PMID: 35572065; PMCID: PMC9098355.
29. Wang C, Mayo NE, Fortin PR. The relationship between health related quality of life and disease activity and damage in systemic lupus erythematosus. J Rheumatol. 2001 Mar;28(3):525-32. PMID: 11296953.

Libyan Journal of Public Health Practices (LJPHP)

Journal homepage:

https://journals.uob.edu.ly/LJPHP/index

Changes in Lifestyle and Eating Habits of the Libyan Population During the COVID-19 Pandemic

Souad F. El-Mani[1], Ashmisa Eltuhami[1], Reima M. Mansour[1], Laila Elabbar[2], Noha Bosrewill[2], Shams Burwag[2], Malak Alfadil[2], Wafa Elabbar[2]

[1] Department of Nutrition, Faculty of Public Health, University of Benghazi, Benghazi, Libya

[2] Department of Nutrition, Faculty of Public Health, University of Benghazi, Benghazi, Libya

ARTICLE INFO

Article history:
Received 1/6/2024
Revised 10/6/2024
Accepted 24/6/2024

Keywords:
COVID-19
Eating habits
Physical activity
Meal consumption
Life style changes

ABSTRACT

The corona virus pandemic has had a massive impact on people globally. Due to national lockdowns and social distancing people all over the world have developed irregular lifestyles. The current study aimed to assess the lifestyle and eating habit changes of population during the COVID-19 pandemic. A cross-sectional study was conducted by random sampling (N =940) on the general population of the Libyan population during the period from February 9th, 2021 until March 15th, 2021. A questionnaire was used to assess the changes of lifestyle and eating habits during COVID-19, which later identified by analysis using the SPSS program. The majority of the respondents 81% were not infected with the corona virus, and less than half of them, 39% followed all the recommended procedures. To lower the risk of being infected there was an increase in supplement use among female participants in comparison to male participants (85% of female vs. 15%, male p.value =0.000). This study also indicated that most of participants had a sedentary life style and changes in eating habits. These changes were seen more among participants infected with corona virus than others who were not infected (51% vs. 45%, p=0.000). The current study concluded that there were changes in participants' life style during the COVID-19 pandemic; the majority of the participants had a sedentary lifestyle, and increase in their body weight and in meal consumption- especially during the evening Education programs should be conducted to promote healthy lifestyle and healthy eating to combat infections such as COVID-19.

Corresponding author: Souad F. El-Mani
E-mail address:souad.elmani@uob.edu.ly

1. Introduction

The coronavirus disease of 2019 is referred to as COVID-19, or Corona Virus. (1) The corona virus was first identified in Wuhan, China in December 2019, and due to its high contagiousness, it rapidly spread around the globe. (2) On January 31, 2020, the World Health Organization (WHO) designated COVID-19 as a public health emergency of global concern. A day later, on March 11, 2020, the WHO classified this epidemiological occurrence as a pandemic. (3,4) The WHO released a situation report on July 29, 2022, stating that there have been more over 579 million confirmed cases worldwide, with roughly 505,450 of those cases occurring in Libya. (5)

Although these limitations were implemented to decrease the spread of the COVID-19 virus, they also had a negative impact on mental and physical health in many nations and were found to have changed people's behavior, especially with regard to food habits. (10–13) Many studies have shown that when in stressful situations people tend to binge- resorting to unhealthy foods also known as "comfort food" - which are highly processed, sugar filled items that can have a deteriorating effect on health in the long term. (14, 15) In addition, due to the closure of gyms and the implementation of curfew, most people were forced to decrease their physical activity and have sedentary life style. (13–15) The impaired nutritional habits combined with decline levels of physical activity- could lead to a positive energy balance that may lead to weight gain and obesity. (16-19) Number previous studies reported that participants saw an increase in their meal number and frequency during lockdown. (20-22) In a study based in the Middle East and North Africa a total of 2970 participants were questioned. The percentage of participants consuming five or more meals per day increased from (2.2%) before the pandemic to (6.2%) during the pandemic. Moreover, the percentage of participants skipping meals decreased from (64.4%) before the pandemic to (45.1%) during the pandemic. When asked why they skipped meals, (60.8%) stated that not having enough time was the main reason before the pandemic and (37.9%) stated that loss of appetite was the main reason for skipping meals during the pandemic Although the results showed an increase in meal frequency, (74.0%) of participants reported not meeting the recommended water intake; drinking less than eight cups of water per day during the pandemic (12).

Due to the effect of the restriction on eating habits and behavior, the World Health Organization (WHO) released a list of nutritional recommendations that may enhance human immunity and decrease the complication of the disease. These recommendation suggested people should be follow a healthy diet that includes a variety of foods from each food group to ensure they are getting enough vitamins, minerals, dietary fiber, and protein, it also suggested people should limit sugar, fat, and salt intake. (23–29) Although these may not prevent people from getting COVID, they do help build a stronger immune system and lower the risk of chronic illness and severe complications.

There are limited studies that investigate the eating habits of people during the COVID-19 pandemic in Libya, and no study that has been undertaken in Benghazi, Libya, which explores the impact of COVID-19 on people's lifestyle and dietary patterns. Therefore, it has been suggested that the increase in home confinement and the psychological effect of the pandemic have induced changes in the lifestyle and eating patterns of individuals in Libya. The main aims of this study were to investigate the lifestyle and eating habit changes of participants during the COVID-19 pandemic and to determine the demographic variation in eating habits and lifestyle among the participants in Libya.

2. Methodology

2.1. Study population: A cross-sectional study was conducted by random sampling (N =940) on the general population of the Libyan population during the period from February 9th, 2021 until March 15th, 2021. The respondents were recruited to take part in this study either by filling a questionnaire using Google form via

online platform, or by the distribution of hard copies of the questionnaires to people in public spaces that include malls and schools with restricted by the safety procedures. The total number of participants who agreed to complete the questionnaire was N=940 (N=850 completed electronic questionnaire, and N=90 completed the hard copy.

2.2. Questionnaire: The study's questionnaire consisted of 38 questions separated into five sections. The first section covered demographics and personal information about the participants, such as city of residence, age, gender, educational level, occupation, income, and the number of family members. The second section of the questionnaire inquired about the medical history of the participants. The third section asked question about the changes in people's lifestyles during the COVID-19 pandemic. The fourth section asked questions regarding the changes in eating habits that occurred during COVID-19. The last section contained food frequency questionnaire. To reach the largest number of participants the questionnaire was distributed by two methods, in person and online through social media platforms such as twitter and facebook.

2.3. Statistical Analysis*:* The data was analyzed using SPSS version 21.0, the Statistical Package for the Social Sciences. In order to compare data, descriptive statistical tests such as frequencies, correlation tests, and Chi square tests with 95% confidence intervals were performed. Chi square analysis was employed to examine the relationship between different sociodemographic. variables and the percentage of individuals who took supplements and/or herbs on a daily basis. In addition, the association between changes of life style, eating habits among participants and socio-demographic factors were tested using Chi square analysis. Correlation test was used to compare usual weight and current weight of participants. All p values <0.05 were considered statistically significant.

2.4. Ethical Statement: This study was approved by the University of Benghazi. All surveys were anonymous and unidentifiable to maintain the confidentiality of the data collected.

3. Results

3.1Demographical characteristics of participants:

The questionnaire was completed by 940 participants; the majority of them 676(72%) were form Benghazi and (28%) from outside Benghazi including (Tripoli n=173, Misruta n=19, Albayda n=15, Almarj n=6, Sirt n=7, Kufrah n=11, Tobruk n=10, Zawra n=9, Hon n=10, Ajdabia =4). The majority of the surveyed individuals were female (78%) and the most distributed age was 20-35 (62%). Around half of the participants were single (56%), and the majority of them (85%) had university degree or higher level of education. There was a variation in jobs of the participants, (28%), (17%), and (12%) of them were students, teacher, and doctor respectively, while (10%) of participants were housewife and (6%) did not have any job. More than half of the respondents stated that their income was very good, and they had more than five members in their family, (58%) and (57%) respectively **(Table1).**

Table 2 shows that the majority of participants (81%) were not infected by corona, while (19%) of them were infected by the corona virus. More than half of the participants (66%) had a family member infected by the corona virus. Most of the surveyed individuals (78%) reported following safety measurements during the COVID-19 pandemic. The majority of the respondents did not have any other disease and only small percentage of them reported having hearth problems those include (7%) hypertension (2%) heart disease (5%) diabetes and (8%) respiratory diseases. The majority of respondents (61%) reported using supplements during the pandemic, and half of the respondents (50%) reported using herbs during the pandemic. Female and participants of high level of education consumed more supplements than males and participants with low education levels (15% males vs. 85% females, p=0.000; 12% primary and secondary level vs. 88% university and above level, respectively)

Table 1: The Distribution of Demographical Characteristics of Participants

Characteristics	Frequency	Percentage
Gender		
Female	738	**78%**
Male	202	22%
Age		
<20	73	8%
20-35	584	**62%**
36-50	204	22%
51-65	63	7%
>65	12	1%
Location		
Benghazi	680	**72%**
Outside of Benghazi	260	28%
Education level		
Primary level	23	3%
	113	12%
Secondary level	795	**85%**
University and above		
Social Status		
Single	529	**56%**
Married	370	40%
Divorced	24	3%
Widowed	12	1%
Occupation		
Student	267	**28%**
Teacher	169	**17%**
Doctor	108	12%
Engineer	65	7%
Housewife	90	10%
Government	78	8%
Employed	117	12%
Other	55	6%
Don't have		
Income		
Good	240	27%
Very good	519	**58%**
Excellent	133	15%
Number of Family Members		
≤5	396	43%
>5	518	57%

3.2Medical history of participants

Table 2: Medical history of participants:

Medical History	N	%
Corona infection:		
Yes	197	19%
No	753	**81%**
Family corona infection:		
Yes	317	**66%**
No	611	34%
Following safety procedures:	727	**78%**
Yes	205	22%
No		
Hypertension		
Yes	65	7%
No	814	**93%**
Heart disease		
Yes	17	2%
No	847	**98%**
Diabetes		
Yes	43	5%
No	829	**95%**
Respiratory disease		
Yes	69	8%
No	809	**92%**
Supplements intake:		
Yes	552	**61%**
No	359	39%
Herbs use:		
Yes	454	**50%**
No	454	50%

3.3Participants' Life style changes during corona:

When are asked the participants to describe the changes in their lifestyles during corona, approximately half of respondents 49% reported that they did not change in lifestyle and only 36% of them followed healthy life style. Nearly half of participants (43%) also state that they had changes in their health status and (58%) of them did not change the exercise level and only 16% had an increase exercise. Nearly half of the participants (47%) reported an increase in sleeping hours, and the majority sleeping hours were from 6-8 hours daily (49%). The same percentage of the surveyed individuals (54%) spent more than four hours on the television, and they reported an increase in their weight during the pandemic (54%). **In table 3** there was

significant relation between the changes of sleeping hours and participants who are infected with corona. Patients with Covid 19 had changes in their health status and increase sleeping hours. (57% vs 40%, p=0.000 and 61% vs 43% p=0.000) than uninfected participants.

Table 3: participants' life style changes during the pandemic of corona

	N	%
life style changes:		
Yes, became healthy	325	**36%**
Yes, became unhealthy	131	15%
Did not change	443	**49%**
Health status changes:		
Yes	388	43%
No	508	**57%**
Exercise changes:		
Yes, increase exercise	128	**16%**
Yes, decrease exercise	210	26%
Did not change	477	**58%**
sleeping hours changes:		
Yes, increase in sleeping hours	425	**47%**
Yes, decrease in sleeping hours	131	14%
Did not change	357	39%
Hours of sleeping		
Less than 6 hours	119	13%
6-8 Hours	442	**49%**
More than 8 Hours	348	38%
Hours of watching TV:		
0-2	173	19%
2-4	243	27%
>4	494	**54%**
Weight changes		
Increase in weight	493	**54%**
Decrease in weight	134	15%
Weight stayed the same	284	31%

3.4Food habits and food consumption among participants during the pandemic of corona virus:

Table 4 shows that around half of participants (46%) reported an increase in meal consumptions, 62% of them consumed less than three meals per day and 40 % of them consumed two snacks per day. The most meal neglected among participants was breakfast (44%), and the most type of snack consumption were chocolate and pastries, 50% and 24%. More than half of respondents state that their meal consumption was increased at night and in the evening, 52% 54%, respectively.

Table 4: Food habits and food consumption among participants during corona pandemic

	N	%
Meal consumption changes:	423	**46%**
Increase	135	15%
Decrease	358	39%
Did not change		
Number of meal consumption		
1-3	569	**62%**
3-6	334	36%
More than 6	16	2%
Number of snack consumption		
One snack	310	34%
Two snacks	363	**40%**
Three snacks	166	18%
More than three snacks	69	8%
Type of snack consumption		
Sweets	78	9%
Chocolate	424	**50%**
Pasta	204	**24%**
Nuts	97	12%
Others	43	5%
Neglected meals		
Breakfast	401	**44%**
Lunch	72	8%
Dinner	188	21%
Snacks	176	19%
Did not skip any meal	75	8%
Consumption increased:		
In the morning		
Yes	116	17%
No	551	**83%**
In the afternoon		
Yes	171	26%
No	492	**74%**
In the evening		
Yes	410	**54%**
No	350	46%
At night		
Yes	396	**52%**
No	364	48%

During the pandemic, there was variation in types of food consumption. Approximately near to half of participant had an increase consumption of fruit and vegetable, tea and coffee and starchy food, 46%, 42% and 32% respectively. Whereas 30% of the participants had decease fast food consumption and 67%, 70% of them reported that they did not change meat and restaurants food consumption **Table 5.**

4. Discussion:

This study indicates that there were no changes in participants' lifestyle during the pandemic of COVID-19. That means the level of physical activity was already low before the pandemic, therefore the pandemic had no effect on their sedentary life style. The present study's results are inconsistent with the findings from previous studies, which found that working from home, limitations on exercising, and gym closures during the COVID-19 pandemic were the main causes of the decline in physical activity levels (12, 30- 32).

The findings of this study revealed that more than half of the participants spent more than four hours watching television, similar to previous studies (31-36) which reported an increase of screen times in all age groups. This might be because participants were spending more time at home or the feeling of emptiness

Table 5- Changes in type of food consumption during COVID-19

	N	%
Change in Meat Consumption		
Increase consumption	145	17
Decrease consumption	144	16
Did not change consumption	587	**67**
Change in Fruit and Vegetable consumption		
Increase in consumption	406	**46**
Decrease in consumption	88	10
No change in consumption	357	44
Change in Tea and Coffee Consumption		
Increase in consumption	373	**42**
Decrease in consumption	119	14
No change in consumption	389	44
Changes in Fast Food Consumption		
Increase in consumption	246	29
Decrease in consumption	262	**30**
No change in consumption	357	41
Change in Starchy Food Consumption		
Increase in consumption	281	**32**
Decrease in consumption	154	18
No change in consumption	429	50
Increase in Consumption of Restaurant Food		
Increase in consumption	267	30
No change in consumption	639	**70**

that occurred during the corona pandemic- which lead to people trying to find comfort through television. Other studies indicated that the sleep quality decreased and the participants were suffering from insomnia during the pandemic. (37,38) In the previous study nearly half of participants showed an increase in sleeping hours (6-8 hours daily).(37) The findings of this study are similar with previous data obtained from China which confirmed total sleep time increased but sleep efficiency decreased. (34) Although the quality of sleep is not examined in this study, data from another Libyan study found that one-third of the Libyan population was suffering from clinical insomnia

during the pandemic, and there were changes in time and pattern of sleeping. (39)

Table 5: The association between changes in sleeping hours , meal consumption and socio-demographicalf

Variables	Changes in sleeping hours	p.value	Changes meal consumption	p. value
Sex: # **Male** **Female**	77(18%) **346(82%)**	P=0.020#	71(17%) **350(83%)**	P=0.006#
Age: # **<20** **20-35** **36-50** **> 50**	44(10%) **305(72%)** 57(13%) 19(5%)	P=0.000#	35 (8%) 298(71%) 71(17%) 18(4%)	P=0.000#
Education level: **Primary and Secondary** **University and above**	10 (2%) 414 (98%)	P=0.98	9 (2%) 410 (98%)	P=0.52
Social status: # **Single** **Married** **Divorced** **Widowed**	**289(68.4%)** 129(30.4%) 3(0.7%) 2(0.5%)	P=0.000#	**261(62%)** 150(36%) 7(1.3%) 3(0.7%)	P=0.014#
Income: **Good** **Very good** **Excellent**	111(28%) 230(58%) 57(14%)	P=0.94	113(28%) 229(57%) 57(14%)	P=0.913

significant association p. value <0.05 by chi-square test

This study results found that an approximately half of the participants reported an increase in meal consumptions similar to previous studies which showed an increase in meal number and frequency. (18, 33). This could be due to sitting at home, feeling afraid and stressed which could lead participant to overeat. Data from different international countries concluded that home confinement due to COVID-19 pandemic lead to an adverse effect on mental well-being and emotional state. These effects were associated with unhealthy lifestyle behaviours including unhealthy eating habits (18).

Regarding eating habit, this study indicates that most of the participants had unhealthy eating habits which included an increase in consumption of meals in the evening and at night. These results were confirmed by earlier worldwide studies (18,30,40-42) that demonstrated an increase in meal consumption and overeating among participants due to restrictions and stressful feelings. Although there is an increase in consumption of meals, this study found that most participants neglected breakfast. This could be due to disturbed quality of sleep and loss of appetite- this was confirmed by outcomes in a previous study (17). This study also found most

participants consumed unhealthy snacks such as chocolate and pasta. Similar results came from other studies that indicated psychological distress due to the pandemic of COVID-19 was associated with emotional eating and a higher consumption of unhealthy snacks that include beverages, sweets, high-sugar foods, and salty foods (12,43). In contrast, a Turkish study found a decrease in consumption of some foods such as chips, biscuits, chocolates, and frozen foods (44).

5. **Conclusion:**

The current study concluded that there were changes in participants' life style during the COVID-19 pandemic; the majority of the participants had a sedentary lifestyle. More than fifty percent of the participants did not participate in any physical activity, and reported an increase in sleeping hours. The major change among participants was an increase in body weight and an increase in meal consumption-especially during the evening. These changes were seen more among participants who were infected with the corona virus. In addition, there was an increase in consumption of supplementation and herbs; females consumed more supplements and herbs when compared to males.

Recommendations

1. Further longitudinal studies should be conducted to address these changes.
2. Establishing awareness programs aimed to promote healthy eating and ways to boost immunity to combat infections such as COVID-19.
3. Education programs should be carried out to educate people on supplements intakes and the benefits of them reducing the severity of COVID-19.

Acknowledgments:

We gratefully acknowledged all volunteers who participated in this study, as well as my colleagues for assistance in completing this study.

Conflict of interest:

Authors have declared that no conflict of interest

References:

1- Vergnaud S. What does COVID-19 stand for?. Cited at: https://www. goodrx. com/blog/what-does-covid-19-mean-who-named-it/. Retrieved on: 26th May. 2020
2- de Lemos JA, McGuire DK, Drazner MH. B-type natriuretic peptide in cardiovascular disease. The Lancet. 2003 Jul 26;362(9380):316-22.
3- World Health Organization. COVID 19 Public Health Emergency of International Concern (PHEIC). Global research and innovation forum: towards a research roadmap.2020.
4- Watson OJ, Barnsley G, Toor J, Hogan AB, Winskill P, Ghani AC. Global impact of the first year of COVID-19 vaccination: a mathematical modelling study. The Lancet infectious diseases. 2022 Sep 1;22(9):1293-302
5- World Health Organization. Libya /statistical [Internet]. [cited 2021 Apr 19]. Available from: https://www.who.int/countries/lby/
6- Certain Medical Conditions and Risk for Severe COVID-19 Illness | CDC [Internet]. [cited 2021 Apr 18]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/need-extra- precautions/people-with-medical-conditions.html
7- Muniyappa R, Gubbi S. COVID-19 pandemic, coronaviruses, and diabetes mellitus. American Journal of Physiology-Endocrinology and Metabolism. 2020 May 1;318(5):E736-41.
8- Petrakis D, Margină D, Tsarouhas K, Tekos F, Stan M, Nikitovic D, Kouretas D, Spandidos DA, Tsatsakis A. Obesity-a risk factor for increased COVID-19 prevalence, severity and lethality. Molecular medicine reports. 2020 Jul 1;22(1):9-19.
9- Mueller AL, McNamara MS, Sinclair DA. Why does COVID-19 disproportionately affect older people?. Aging (albany NY). 2020 May 5;12(10):9959.
10- Eating well during Coronavirus / COVID-19 [Internet]. [cited 2021 Apr 18]. Available from: https://www.bda.uk.com/resource/eating-well-during-coronavirus-covid-19.html
11- Balanzá–Martínez V, Atienza–Carbonell B, Kapczinski F, De Boni RB. Lifestyle behaviours during the COVID-19–time to connect. Acta Psychiatrica Scandinavica. 2020 May;141(5):399.
12- Ismail LC, Osaili TM, Mohamad MN, Al Marzouqi A, Jarrar AH, Zampelas A, Habib-Mourad C, Jamous DO, Ali HI, Al Sabbah H, Hasan H. Assessment of eating habits and lifestyle during the coronavirus 2019 pandemic in the Middle East and North Africa region: a cross-sectional study. British Journal of Nutrition. 2021 Sep;126(5):757-66.
13- Di Renzo L, Gualtieri P, Cinelli G, Bigioni G, Soldati L, Attinà A, Bianco FF, Caparello G, Camodeca V, Carrano E, Ferraro S. Psychological aspects and eating habits during COVID-19 home confinement: results of EHLC-COVID-19 Italian online survey. Nutrients. 2020 Jul 19;12(7):2152.
14- Razzoli M, Pearson C, Crow S, Bartolomucci A. Stress, overeating, and obesity: Insights from human studies and preclinical models. Neuroscience & Biobehavioral Reviews. 2017 May 1;76:154-62.

15- Munsch S, Meyer AH, Quartier V, Wilhelm FH. Binge eating in binge eating disorder: a breakdown of emotion regulatory process?. Psychiatry research. 2012 Feb 28;195(3):118-24.
16- Górnicka M, Drywień ME, Zielinska MA, Hamułka J. Dietary and lifestyle changes during COVID-19 and the subsequent lockdowns among Polish adults: a cross-sectional online survey PLifeCOVID-19 study. Nutrients. 2020 Aug 3;12(8):2324.
17- Husain W, Ashkanani F. Does COVID-19 change dietary habits and lifestyle behaviours in Kuwait: a community-based cross-sectional study. Environmental health and preventive medicine. 2020 Dec;25(1):1-3.
18- Ammar A, Brach M, Trabelsi K, Chtourou H, Boukhris O, Masmoudi L, Bouaziz B, Bentlage E, How D, Ahmed M, Müller P. Effects of COVID-19 home confinement on eating behaviour and physical activity: results of the ECLB-COVID19 international online survey. Nutrients. 2020 May 28;12(6):1583.
19- Hill JO, Wyatt HR, Peters JC. Energy balance and obesity. Circulation. 2012 Jul 3;126(1):126-32.
20- Di Renzo L, Gualtieri P, Pivari F, Soldati L, Attinà A, Cinelli G, Leggeri C, Caparello G, Barrea L, Scerbo F, Esposito E. Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. Journal of translational medicine. 2020 Dec;18(1):1-5.
21- Sidor A, Rzymski P. Dietary choices and habits during COVID-19 lockdown: experience from Poland. Nutrients. 2020 Jun 3;12(6):1657.
22- Phillipou A, Meyer D, Neill E, Tan EJ, Toh WL, Van Rheenen TE, Rossell SL. Eating and exercise behaviors in eating disorders and the general population during the COVID-19 pandemic in Australia: Initial results from the COLLATE project. International Journal of Eating Disorders. 2020 Jul;53(7):1158-65.
23- Davanzo R, Moro G, Sandri F, Agosti M, Moretti C, Mosca F. Breastfeeding and coronavirusdisease-2019: Adinterim indications of the Italian Society of Neonatology endorsed by the Union of European Neonatal & Perinatal Societies. Maternal & Child Nutrition. 2020 Jul;16(3):e13010.
24- Carver PE, Phillips J. Novel coronavirus (COVID-19): what you need to know. Workplace health & safety. 2020 May;68(5):250-.
25- Dietitians of Canada - Advice for the general public about COVID-19 [Internet]. [cited 2021 Jun 10]. Available from: https://www.dietitians.ca/News/2020/Advice-for-the- general-public-about-COVID-19 .
26- World Health Organization. coronavirus disease (COVID-19): Pregnancy and childbirth [Internet]. [cited 2021 Jun 10]. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus- 2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19-pregnancy-and- childbirth
27- UNICEF. Easy, affordable and healthy eating tips during COVID-19 | UNICEF [Internet]. [cited 2021 Jun 10]. Available from: https://www.unicef.org/coronavirus/easy-affordable-and- healthy-eating-tips-during-coronavirus-disease-covid-19-outbreak.
28- CDC. Coronavirus Disease (COVID-19) and Breastfeeding | Breastfeeding | CDC [Internet]. [cited 2021 Jun 10]. Available from: https://www.cdc.gov/breastfeeding/breastfeeding- special-circumstances/maternal-or-infant-illnesses/covid-19-and-breastfeeding.html
29- de Faria Coelho-Ravagnani C, Corgosinho FC, Sanches FL, Prado CM, Laviano A, Mota JF. Dietary recommendations during the COVID-19 pandemic. Nutrition reviews. 2021 Apr;79(4):382-93.
30- Phillipou A, Meyer D, Neill E, Tan EJ, Toh WL, Van Rheenen TE, Rossell SL. Eating and exercise behaviors in eating disorders and the general population during the COVID-19 pandemic in Australia: Initial results from the COLLATE project. International Journal of Eating Disorders. 2020 Jul;53(7):1158-65.
31- Matsungo TM, Chopera P. Effect of the COVID-19-induced lockdown on nutrition, health and lifestyle patterns among adults in Zimbabwe. BMJ Nutrition, Prevention & Health. 2020 Dec;3(2):205.
32- Deschasaux-Tanguy M, Druesne-Pecollo N, Esseddik Y, De Edelenyi FS, Allès B, Andreeva VA, Baudry J, Charreire H, Deschamps V, Egnell M, Fezeu LK. Diet and physical activity during the coronavirus disease 2019 (COVID-19) lockdown (March–May 2020): Results from the French NutriNet-Santé cohort study. The American journal of clinical nutrition. 2021 Apr;113(4):924-38.
33- Górnicka M, Drywień ME, Zielinska MA, Hamułka J. Dietary and lifestyle changes during COVID-19 and the subsequent lockdowns among Polish adults: a cross-sectional online survey PLifeCOVID-19 study. Nutrients. 2020 Aug 3;12(8):2324
34- Li Y, Qin Q, Sun Q, Sanford LD, Vgontzas AN, Tang X. Insomnia and psychological reactions during the COVID-19 outbreak in China. Journal of Clinical Sleep Medicine. 2020 Aug 15;16(8):1417-8.
35- Wang X, Li Y, Fan H. The associations between screen time-based sedentary behavior and depression: a systematic review and meta-

analysis. BMC public health. 2019 Dec;19(1):1-9.

36- Carroll N, Sadowski A, Laila A, Hruska V, Nixon M, Ma DW, Haines J, Guelph Family Health Study. The impact of COVID-19 on health behavior, stress, financial and food security among middle to high income Canadian families with young children. Nutrients. 2020 Aug 7;12(8):2352.

37- Casagrande M, Favieri F, Tambelli R, Forte G. The enemy who sealed the world: effects quarantine due to the COVID-19 on sleep quality, anxiety, and psychological distress in the Italian population. Sleep medicine. 2020 Nov 1;75:12-20.

38- Cellini N, Canale N, Mioni G, Costa S. Changes in sleep pattern, sense of time and digital media use during COVID-19 lockdown in Italy. Journal of sleep research. 2020 Aug;29(4):e13074.

39- Elhadi M, Alsoufi A, Msherghi A, Alshareea E, Ashini A, Nagib T, Abuzid N, Abodabos S, Alrifai H, Gresea E, Yahya W. Psychological health, sleep quality, behavior, and internet use among people during the COVID-19 pandemic: a cross-sectional study. Frontiers in psychiatry. 2021 Mar 31;12:632496.

40- Moynihan AB, Tilburg WA, Igou ER, Wisman A, Donnelly AE, Mulcaire JB. Eaten up by boredom: consuming food to escape awareness of the bored self. Frontiers in psychology. 2015 Apr 1;6:369.

41- Di Renzo L, Gualtieri P, Pivari F, Soldati L, Attinà A, Cinelli G, Leggeri C, Caparello G, Barrea L, Scerbo F, Esposito E. Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. Journal of translational medicine. 2020 Dec;18(1):1-5.

42- Sidor A, Rzymski P. Dietary choices and habits during COVID-19 lockdown: experience from Poland. Nutrients. 2020 Jun 3;12(6):1657.

43- Bemanian M, Mæland S, Blomhoff R, Rabben ÅK, Arnesen EK, Skogen JC, Fadnes LT. Emotional eating in relation to worries and psychological distress amid the COVID-19 pandemic: a population-based survey on adults in Norway. International journal of environmental research and public health. 2021 Jan;18(1):130.

44- Özlem A, Mehmet N. COVİD-19 Pandemi Kilitlenmesi Sürecinde Yeme Alışkanlıklarındaki Değişiklikler. ESTÜDAM Halk Sağlığı Dergisi. 2020;5:188-96.

Libyan Journal of Public Health Practices (LJPHP)

Journal homepage:

https://journals.uob.edu.ly/LJPHP/index

Knowledge and Attitudes of Protein Supplements Used Among Benghazi Gym Trainers

Hameida Elfarssi*[1], Nagwa Ali[1] Tofaha Eltegani[1], Murouj Othman[1], Amani Alobyde[1], Afiyah Salheen[1]

[1]Department of Nutrition, Faculty of Public Health University of Benghazi, Libya

ARTICLE INFO

Article history:
Received 2/6/2024
Revised 9/6/2024
Accepted 24/6 /2024

Keywords:
Usage of protein supplements
Knowledge
Attitudes
Athletes
Sport

ABSTRACT

Protein supplements are commonly utilized by everyone, from casual exercisers to highly skilled athletes, to enhance health and athletic performance. This study aimed to investigate the use of protein supplements among Benghazi gym users and examine their knowledge and attitudes toward protein supplement use. A cross-sectional study was conducted in a period between March and June 2023 at users of gyms in Benghazi, Libya. 240 participants in all, including 162 were males and 78 were females, were selected randomly from eight different gyms. A self-administered, validated, and pretested questionnaire was used. It contained items connected to personal information, the incidence, knowledge, attitudes, and practice of protein supplementation. The results showed that 68 % of respondents who took protein supplement were males and 32 % were females. They consumed between a scoop or two of supplements daily by 44.2% and 41% of participants took protein to maintain a good body shape. Coaches encouraged over 47.5% of the participants to use supplements containing protein. 68% of participants showed good knowledge and attitudes about protein supplement use and 77% of them were males and 23% were females. 50.4% of participants at fitness centers used the gym three times per week. Conclusions: in this research, individuals who used gyms showed positive attitudes and good understanding regarding taking protein supplements. There was also a significant correlation found between participants' daily protein calculations and their educational level.

* Corresponding author. Hameida Elfarssi
E-mail address: hameida.elfarssi@uob.edu.ly

1. Introduction

Dietary supplements (DS) are products with dietary components such as vitamins, minerals, amino acids, botanicals or herbs, and other substances, and they add additional nutritional value to the diet (1). The usage of DS has been increasing since the 1970s (2), and there is a wealth of information on its widespread usage in many different nations (2,3). However, there is a consensus dearth regarding the security and effectiveness of DS therapy, prevention, or management in populations that are nutrient-replete (4). In addition, dietary supplements play a vital role in preserving health as a diet delivers essential nutrients, while supplements complement the diet as they allow replacement of any deficiencies the diet lacks (5). There has been an increasing use of nutritional supplements by people who participate in physical activities (6). Supplement use among athletes is well documented. It was estimated to range from 40 to as high as 88% (7,8). According to earlier research, proteins are the most commonly consumed supplements among physically active individuals. A previous study carried out in Baghdad city reported that the most common supplements used were mass protein (35.9%), followed by whey protein (29.3%), and creatinine (15.1%) (9). Another study carried out in Lebanon found that about 80% of the dietary supplement users reported consuming whey protein as a protein supplement, with a higher prevalence among men than women (10), Moreover, previous study carried out in Saudi Arabia have reported that nearly 50% of the participants consumed protein supplements (1). There are several places to obtain information regarding supplement use; yet, depending on the study results conducted in Lebanon, the primary source of information is coaches for users (11). Numerous studies have indicated that coaches are the primary individuals who advise users to utilize protein supplements (12,13). There are several studies assessing knowledge and attitudes of protein supplements used by gym trainers. Eelier study conducted in Saudi Arabia reported that the participants appeared to be knowledgeable about protein supplements (1). Other study carried out in United Arab Emirates found that public need to educate of responsible use of dietary supplements (14). Another previous study has shown that less than 40% of athletes had the knowledge about the proper and intended use of protein, creatine, amino acids, beta alanine and glutamine (15). Moreover, study carried out in Tehran, Iran According to the results, the adolescent athletes aged 15 -18 years in Tehran did not have sufficient sports nutrition knowledge and attitude (16).

In Libya, DS are commonly available in the market with poor guidance and regulations. However, there is insufficient data on DS consumption in Libya (17). Our study is the first to investigate the use of protein supplements among Benghazi gym users and examine their knowledge and attitudes toward protein supplement use.

2. Methodology

2.1 Design of the Study and Selection of Participants

The cross-sectional investigation was carried out in Benghazi, Libya over 3 months from March to June 2023 on users of gyms. In total participants who were selected from gyms were 240, including 162 were males and 78 were females. They were randomly selected from eight gyms (Fitness, Red gym, Oxygen gym, Daughter of Libya Center for Fitness and Beauty, Sultan gym, Omar gym, Saad gym, and Makhlouf gym) after obtaining permission from the center for sports management to distribute questionnaires to the athletes and coaches. Collecting participants' data and assessing their attitudes, knowledge and consuming supplements of protein were by using paper or electronic questionnaires.

2.2. Assessing of knowledge, Attitudes, and Protein Supplements Usage.

The present study used a self-administered, validated and pretested questionnaire to gather data on adult Libyans' knowledge, attitudes, and use supplements of protein (20). The questionnaire was classified into two sections:

the first part consisted of 29 questions connected to personal data, such as (age; gender; height, weight, education level, job, frequency of visits to the gym; protein utilization, comprising the quantity of protein eaten and required; the kind of protein; the timing and purpose of the protein consumption) participants' knowledge regarding the using supplements containing proteins, analysis before consuming protein; positive changes and side effects after consuming protein. Also, the information's source, those that influence protein supplement ingesting, and symptoms related to protein consumption were all covered in the questionnaire. In the second part, six statements regarding protein supplements were presented to respondents, who were requested to select their responses on a four-point Likert scale (strongly agree, agree, disagree, strongly disagree).

2.3 Statistical Analysis

Coded data were analyzed using Statistical Package for the Social Sciences (SPSS) version 22, and descriptive data were used to summarize the social demographic characteristics of gym users. Statistical analysis of knowledge and attitudes to protein supplement uses were conducted by using the chi-square test or Fisher`s test. The general satisfaction and the various features related to the educational level of participants and calculation of protein and knowledge and attitude regarding the usage of supplemental protein were examined by using Spearman correlation to indicate statistical significance. The level of significance was set at a value of ≤ 0.05.

2.4 Ethical Considerations

Permission to collect the primary data was obtained from the Department of Nutrition at the University of Benghazi. Research Ethics Committee approved the study at the Faculty of Public Health, University of Benghazi**.** Respect or the participants (autonomy) was kept. The purpose of the research and the expected duration for the participants to complete the interview were communicated. This study kept the confidentiality of the participants and their names were not written on any results.

3. Results

Table 1 summarizes the basic demographical characteristics of respondents. Out of the 240 participants, 68% were men and 32 % were females. 47% of the sample was 26- to 35-year-olds. Seventy one percent (71%) of participants were single and over 61% were holders of a university degree. Around 35% of participants were businessmen and 5% of them were teachers. Most participants (68 %) were with income less than 1000 dinar. The majority of respondents (89 %) had no illnesses. 53.3% of respondents did not do any blood tests before starting protein supplements while 40% of them did liver and kidney function tests before starting protein supplements as in Figure1.

The types, amount, and timing consumption of protein supplements linked to gender are displayed in Table 2, more than half (64.6%) of participants used both powder protein and protein-fortified food. Approximately 44.2% of the respondents consumed between a scoop or two of protein supplements daily. Of the most males 72% consumed 1- 2 scoops. Whereas, 28% of females consumed the same amounts. 61% of participants took protein supplements immediately after exercising and 41% of participants used whey protein.

Table 3 shows the participants' answers to the reasons for the consumption of protein and the positive change and adverse effects of taking a protein supplement by gender. Maintaining a good body shape was the main reason for consuming the supplements by 41%, 83% of them were males and 17% were females.

Table 1: Demographical Characteristics of the Study Sample (N=240)

Variable	Frequency	%
Gender		
Male	162	**68%**
Female	78	32%
Marital status		
Single	170	**71%**
Married	70	29%
Age category		
16- 25	86	36%
26-35	113	**47%**
36-55	41	17%
Educational level		
Primary	14	6%
Secondary	80	33%
University	146	**61%**
Occupation		
Businessman	84	**35%**
Employee	63	26%
Student	39	16%
Doctor	16	7%
Engineer	16	7%
Coach	9	4%
Teacher	13	5%
Income		
Less than 1000	163	**68%**
More than 1000	77	32%
Do you suffer from any diseases?		
Yes	27	11%
No	213	**89%**
If yes, then what is the disease?		
Diabetic	8	3.3%
Hypertension	3	1.2%
Insulin resistance	2	0.8%
Rheumatoid	1	0.4%
Other	13	5.4%

Table2: The types, amount, and timing consumption of protein supplements linked to gender

Variable	All	Male	Female
What type of supplement protein do you take?			
Powder	29.6%	70.4%	29.6%
Protein-fortified food	5.8%	43%	57%
Both of them	**64.6%**	**68%**	**32%**
Number of scoops/days			
fewer than one scoop	6.7%	37.5%	62.5%
Only 1 scoop	21.7%	36.5%	63.5%
Scoop1_2	**44.2%**	**72%**	**28%**
Greater 2 scoops	27.4%	92.4%	7.6%
Timing of consumption			
Early morning	13%	58%	42%
Before exercising	14%	56%	44%
Immediately after Exercising	**61%**	**45.6%**	**54.4%**
Any other time	12%	86%	14%
What type of supplement protein do you utilize?			
Whey protein	**41%**	**58%**	**42%**
Isolate protein	18%	64%	36%
Mass protein	36%	86%	14%
Other	5%	23%	77%

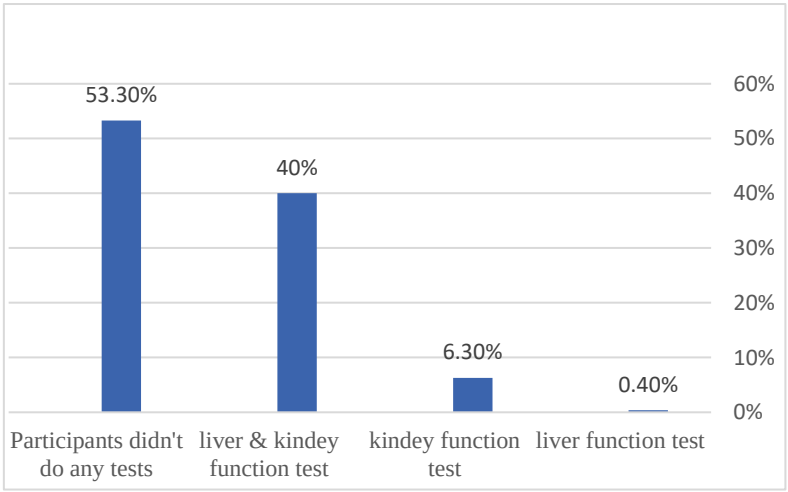

Figure 1: Laboratory tests done before participants started to take the supplement protein

Table 3: Reasons for consuming protein and the positive change and adverse effect of taking a protein supplement by gender (N (%).

Variables	All	Male	Female
Why do you consume a protein supplement?			
Maintain good body shape	**41%**	**83%**	**17%**
Gain muscle	35%	68%	32%
Weight loss	13%	29%	71%
Weight gain	11%	54%	46%
Who has recommended you to consume protein supplements?			
Coach	**47.5%**	**70%**	**30%**
Nutritionist	19.5%	72%	28%
social media	17.9%	58%	42%
Friends / relatives	5.8%	43%	57%
No one	9.1 %	77%	23%
Have you noticed any side effect after consuming these supplements?			
Yes	6.25%	67%	33%
No	**93.7%**	**68%**	**32%**
Have you noticed any positive changes after consuming these supplements?			
Yes	**92.5%**	**71%**	**30%**
No	7.5%	28%	72%

In table 4 displays that the majority of respondents agreed with the statement that stated that fitness centre attendees should take protein supplements, Consuming protein supplements reduce the build-up of undesirable body fat, most individuals my age do not take adequate protein in their diets, supplements of protein are preferable to diets rich in protein. for muscle building and supplements contain protein are energy source during workouts. However, participants

Table 4: knowledge and attitudes of respondents about supplements protein related to gender (N (%).

Variable	All	Male	Female
Should fitness centre attendees consume protein-supplements?			
strongly agree	15%	76%	24%
agree	**68%**	**77%**	**23%**
disagree	16%	23%	77%
strongly disagree	0.4%	0%	0.4%
Consuming protein supplements reduce the build-up of undesirable body fat			
strongly agree	16%	77%	23%
agree	**47%**	**73%**	**27%**
disagree	32%	54%	46%
strongly disagree	5%	75%	25%
Most individuals at my age do not take adequate protein in their diets			
strongly agree	19%	65%	35%
agree	**67%**	**68%**	**32%**
disagree	13%	65%	35%
strongly disagree	1.25%	1.25%	0%
Protein supplements are essential for building of muscle through weight lifting.?			
strongly agree	13%	68%	32%
agree	33%	81%	19%
disagree	**43%**	**56%**	**44%**
strongly disagree	12%	71%	29%
Protein supplements are preferable to diets high in protein for building of muscle			
strongly agree	25%	75%	25%
agree	**68%**	**66%**	**34%**
disagree	7%	56%	44%
strongly disagree	0.4%	0%	0.4%
Are protein supplements a good source of energy for exercises?			
strongly agree	26%	68%	32%
agree	**53%**	**67%**	**33%**
disagree	19%	65%	35%
strongly disagree	2.5%	2.5%	0%

could not agree on the statements that claimed that supplements are necessary for building of muscle through weight lifting.
Table 5 presents that half of participants visited gym three times a week. 63.6 % of them were men while 36% were women.

Table 5: Attendance of the participants relate to gender (N (%))

Variable	All	Male	Female
How often do you go to the gym?			
Daily	29%	70%	30%
3 times a week	**50.4%**	**63.6%**	**36.4%**
A few hours a week	5.4%	53.8%	46%
Other	15%	80.6%	19.4%

Table 6 represents the knowledge and attitude and protein daily protein of respondents connected to education level. There was a strong correlation between the statements that protein supplements are critical for muscle building through weight lifting and education level (p=*0.000). However, the rest of the items that showed knowledge and attitude were not related to education level. There was strong association between the statements that indicated the calculation of daily protein requirement and education level (p=*0.000).

4. Discussion

The main results of the current study show that 68 % of respondents who use protein supplements were males and 32 % were females which corroborates with the earlier studies that found males took more protein supplements than females (18,19,20). It could be explained by the fact that males were exercising more frequently than females as previously reported (19). In the current research, more than half of participants (60.8%) were holders of a university degree. These findings agree with a previous study reported that 67.9% of respondents had a history of tertiary education (21). Additionally, a previous study also highlighting that usage of supplements was higher in those having higher education (22). The finding of our study showed that the highest percentage of the participants was in the age group of 26- 35 years. This similar to findings published earlier (21,23). The results of the present study confirm that less than half of the participants did liver and kidney function tests before starting to protein supplements. These results are in line with earlier research that showed similar results (24,25).

According to the present findings, 41% of participants used whey protein and 58% of them were males, and 42% were females. These results are in line with earlier research which indicated that 54.5%, and 50 % of participants consumed whey protein respectively (9,18). Furthermore, a previous study has reported that gym visitors prefer whey protein supplements because they appear to be more successful in raising rates of muscle protein synthesis during exercise (11). The current results reveal that respondents used between a scoop or two of protein supplements daily and the most of them were males. This is in agreement with earlier study which showed similar result (1). Our result reports that the majority of gym attendees 1–3 times per week. These findings agreed with earlier study (26).

Additionally, the present results reveal that respondents were taking protein supplements immediately after exercising. These findings of the present research agreed with earlier studies carried out in Baghdad city and Saudi Arabia which found that participants taking protein after exercise by 45.5% and 45% respectively (1,9). The results of this study show that 41% of participants were taken protein for maintaining a good body shape. This is in agreement with previous study that showed same results (9,11 ,18). On the contrary, previous studies confirmed that the main typical cause cited by participants for taking supplements of protein were to enhance their food (27). The explanation of the difference between the results studies may be the majority of participants 83% were males and they appear to use protein for increasing strength, muscle

Table 6: knowledge and attitude and calculation of daily protein of participate related to educational level

Variable	All%	*P%	*S %	*U%	P-value
Should fitness centre attendees consume protein supplements	**(Question for attitude)**				
strongly agree	15	3	35	62	
agree	68	8	36	56	
disagree	16	0	21	79	
strongly disagree	0.4	0	0	0.4	0.121
Consuming protein-supplements reduces the build-up of undesirable body fat	**(Question for knowledge)**				
strongly agree	16	7.7	41	51.3	
agree	47	7	35	58	0.240
disagree	32	4	30	66	
strongly disagree	5	0	8	92	
Most individuals at my age do not take adequate protein in their diets	**(Question for knowledge)**				
strongly agree	19	2.2	34.8	63	
agree	67	5.6	32.5	61.9	0.188
disagree	13	8	34	58	
strongly disagree	1.25	33.3	66.7	0.0	
protein supplements are critical for building of muscle through weight lifting?	**(Question for knowledge)**				
strongly agree	13	0.0	58	42	
agree	33	13.9	49.4	36.7	0.000
disagree	43	2.9	20.6	76.5	*
strongly disagree	12	0	7	93	
Are foods high in protein better than protein supplements for building of muscle?	**(Question for knowledge)**				
strongly agree	25	5	30.5	64.5	
agree	68	6	37	57	0.541
disagree	7	6.3	12.5	81.2	
strongly disagree	0.4	0	0	100	
Protein supplements are source of energy for exercises?	**(Question for knowledge)**				
strongly agree	26	6.5	35.5	58	
agree	53	6	32	62	0.987
disagree	19	4.3	34.8	60.9	
strongly disagree	2.5	0	33.3	66.7	
Do you count how much protein you need each day	**(Question for knowledge)**				
Yes, I do	27.5	1.5	16.7	81.8	*0.00
No roughly	72.5	7.5	39.7	52.9	0

*Statistical differences *p*.value <0.05 by Chi. Square test
*P is for Primary * S is for Secondary * U is for University

mass and performance (28). As a result of the current investigation, coaches provided the respondents with the main information regarding supplements of protein. This in agreement with other previous research carried out in Saudi Arabia, demonstrated that the main people who advised users to consume supplements of protein were coaches (1). Nearly 30% of participants in Swiss study obtained their information on protein supplements from the coach or trainer (13). Moreover, male members from Riyadh gym got their information from non-health professionals (29). However, this is in contrast with earlier study showed that the majority (57%) of volunteers were consuming supplements based on a doctor's recommendation (5). The explanation for this might be because of the difference in collection data in Saudi study participants were not members of gyms from general public while in present study participates were gym users and they found coaches easier way to contact. The finding of the study shows that the majority of participants did not notice any side effects related to consume protein supplements. These results are in agreement with previous study (1). However, this in contrast with earlier studies carried out Saudi sport center users revealed that the majority of those who took powder of supplements protein experienced gastrointestinal problems, including indigestion, constipation diarrhea, stomach pain, nausea and decreased appetite (30). The explanation of the difference between the results studies was the types of protein use. In our study more than half of participants consumed protein-fortified food and powder. Current study finding shows good knowledge and attitudes about consuming protein supplements. The previous studies presented nearly the same percentage of awareness of volunteers (1,9).

According to the present study, there was a strong correlation between knowledge and level of education. This similar to previous results showed that most gym users were of similar educational level having university bachelor's degrees (11,19).

5. Conclusion

The present study revealed that over half of the participants who use protein supplements were males and they used more than one protein supplement. The most of gym attendees who used protein supplements one to three times were taken protein supplements immediately after exercising. Moreover, less than half of participants took protein to maintain a good body shape and less than half of participants used whey protein. It seems that coaches who encouraged participants to use protein supplements. Sport center visitors in this study showed good knowledge and attitudes about consuming protein supplements and there was a strong correlation between knowledge, and daily protein calculation of participants and level of education.

Study limitations

This study has some significant limitations; lack of cooperation of some private centers and allow taking information from gym users. Some gyms did not have members who take supplements protein.

Acknowledgements

The authors express their gratitude to thank all users of gyms who participated in this research and provided us with their time and attention.

Conflicts of Interest

Authors declare no conflicts of interest.

References

1- Alhakbany MA, Alzamil HA, Alnazzawi E, Alhenaki G, Alzahrani R, Almughaiseeb A, Al-Hazzaa HM. Knowledge, attitudes, and use of protein supplements among saudi adults: gender differences. *Healthcare* 2022;10(2): 394

2- Bailey RL, Gahche JJ, Lentino CV, Dwyer JT, Engel JS, Thomas PR, Betz JM, Sempos CT, Picciano MF. Dietary supplement use in the United States, 2003–2006. *The Journal of nutrition.* 2011 Feb 1;141(2):261-6.

3- Kourkouta L, Iliadis C, Frantzana E, Monios A, Dimitriadou A, Papathanassiou IV. Health and dietary supplements. *Int J Eng Appl Sci.* 2016

Sep;3(9):2394-3661

4- Elsahoryi NA, Odeh MM, Jadayil SA, McGrattan AM, Hammad FJ, Al-Maseimi OD, Alzoubi KH. Prevalence of dietary supplement use and knowledge, attitudes, practice (KAP) and associated factors in student population: A cross-sectional study. *Heliyon*. 2023; 9(4).

5- Algaeed HA, AlJaber MI, Alwehaibi AI, AlJaber LI, Arafah AM, Aloyayri MA, Binsebayel OA, Alotaiq SA, Alfozan MA, Ahmed IB. General public knowledge and use of dietary supplements in Riyadh, Saudi Arabia. *Journal of family medicine and primary care*. 2019;8(10):3147.

6- Calfee R, Fadale P. Popular ergogenic drugs and supplements in young athletes. *Pediatrics*. 2006 Mar 1;117(3):e577-89.

7- Sobal J, Marquart LF. Vitamin/mineral supplement use among athletes: a review of the literature. International Journal of Sport *Nutrition and Exercise Metabolism.* 1994 Dec 1;4(4):320-34.

8- Molinero O, Márquez S. Use of nutritional supplements in sports: risks, knowledge, and behavioural-related factors. *Nutricion hospitalaria.* 2009;24(2):128-34.

9- Ghazi HF, Abdalqader M, Hasan Tn. Kn owledge and Attitude of Young Athletes in Baghdad City/Iraq Toward the Use of Sports Supplements. Malaysian *Journal of Public Health Medicine*. 2022; 22(3):153-9.

10- Saleh KK, Julien SG. Protein Supplement Perceptions, Use, and Associated Performance in Young Lebanese Resistance-Training Athletes. *Journal of Nutrition and Metabolism*. 2022 18;2022.

11- El Khoury D, Antoine-Jonville S. Intake of nutritional supplements among people exercising in gyms in Beirut city. *Journal of nutrition and metabolism.* 2012; 2012.

12- Goston JL, Correia MI. Intake of nutritional supplements among people exercising in gyms and influencing factors. *Nutrition*. 2010; 26(6):604-11.

13- Mettler, S.; Bosshard, J.V.; Häring, D.; Morgan, G. High prevalence of supplement intake with a concomitant low information quality among Swiss fitness center users. *Nutrients.* 2020; 12, 2595.

14- Sharif SI, Mohammed A, Mohammed I, Sharif RS. Evaluation of knowledge, attitude and use of dietary supplements among people exercising in the gym in Sharjah-United Arab Emirates. *Phys. Med. Rehabil. Res.* 2018;3(5):1-5.

15- Jovanov P, Đorđić V, Obradović B, Barak O, Pezo L, Marić A, Sakač M. Prevalence, knowledge and attitudes towards using sports supplements among young athletes. *Journal of the International Society of Sports Nutrition*. 2019 Dec;16:1-9.

16- Ahmadi F, Ebrahimi M, Kashani V. Sports nutritional knowledge, attitude, and practice of adolescent athletes in Tehran, Iran. *Asian Journal of Sports Medicine.* 2022 Dec 31;13(4).

17- Kablan NM, Mansor EA, Denna I, Alabeade A, Alsahly F, Almagbry H, Elfergani H. The Prevalence of Dietary Supplements Use at University of Benghazi Medical Campus. 202; (11): 65-71.

18- Bianco, A., Mammina, C., Paoli, A., Bellafiore, M., Battaglia, G., Caramazza, G., & Jemni, M. Protein supplementation in strength and conditioning adepts: knowledge, dietary behavior and practice in Palermo, Italy. *Journal of the International Society of Sports Nutrition*, 2011; 8(25); 1-6.

19- Jawadi AH, Addar AM, Alazzam AS, Alrabieah FO, Al Alsheikh AS, Amer RR, Aldrees AA, Al Turki MA, Osman AK, Badri M. Prevalence of dietary supplements use among gymnasium users. Journal of nutrition and metabolism. 2017 ; 5;2017.

20- Scofield DE, Unruh S. Dietary supplement use among adolescent athletes in central Nebraska and their sources of information. *The Journal of Strength & Conditioning Research.* 2006: 20(2):452-5.

21- Braun M, Venter I. Use of dietary supplements, and awareness and knowledge of the recommended fruit and vegetable intakes and consumption of health food store customers in the Cape Town city bowl. *South African Journal of Clinical Nutrition.* 2008 ;21(4):323-30.

22- Alowais MA, Selim MA. Knowledge, attitude, and practices regarding dietary supplements in Saudi Arabia. *Journal of family medicine and primary care*. 2019;8(2):365..

23- Ishihara J, Sobue T, Yamamoto S, Sasaki S, Tsugane S. Demographics, lifestyles, health characteristics, and dietary intake among dietary supplement users in Japan. *International Journal of Epidemiology.* 2003;32(4):546-53.

24- Schlickmann DS, Molz P, Brand C, Dos Santos C, da Silva TG, Rieger A, Benito PJ, Reuter CP, Renner JD, Franke SI. Liver and kidney function markers among gym users: the role of dietary supplement usage. *British Journal of Nutrition.* 2022;128(4):704-11.

25- Galati, PC, Carreira, NP, Galvão, SR, et al. Nutritional and biochemical profile of young practitioners of physical activity in the use of nutritional supplementation. Braz *J Sports Nutr*. 2018; 11(68):1050-1060.

26- Hartmann C, Siegrist M. Benefit beliefs about protein supplements: A comparative study of users and non-users. *Appetite*. 2016; 103:229-35.

27- Froiland K, Koszewski W, Hingst J, Kopecky L. Nutritional supplement use among college athletes and their sources of information. *International journal of sport nutrition and exercise metabolism.* 2004; 14(1):104-20.

28- Morton, R.W.; Murphy, K.T.; McKellar, S.R.; Schoenfeld, B.J.; Henselmans, M.; Helms, E. A systematic review, meta-analysis and meta-regression of the effect of protein supplementation on resistance training-induced gains in muscle mass and strength in healthy adults. Br. *J. Sports Med*. 2018, 52, 376–384.

29- Alshammari, S.A.; AlShowair, M.A.; AlRuhaim, A. Use of hormones and nutritional supplements among

Gyms' attendees in Riyadh. J Fam. Community Med. 2017, 24, 6–12.

30- Alhekail, O.; Almeshari, A.; Alabdulkarim, B.; Alkhalifa, M.; Almarek, N.; Alzuman, O.; Abdo, A. Prevalence and patterns of the use of protein supplements among gym users in Riyadh, Saudi Arabia. *Int. J. Pharm. Res.* Allied Sci. 2018: 7:80–86.