ISSN (Online) 3008-1467
ISSN (Print) 3008-1459

Libyan Journal of Public Health Practices

Volume 1 Number 2 (December) 2024

LJPHP

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

Editorial Board Team

Advisory Board

INFORMATION FOR AUTHORS

The Editors of the Libyan Journal of Public Health Practices (LJPHP) welcome contributions from our readers. The journal will consider manuscripts from anywhere in the world for publication, but particularly those that would interest readers in Libya and the Arab world. LJPHP is published in two volumes per year and is available in electronic format. It accepts contributions in the form of original articles, case studies, and review articles. All submissions are subject to review by the editorial board and referees in appropriate specialties.

SUBMISSION OF MANUSCRIPTS

The submission of a manuscript indicates that it is original work, has not been previously published (in print or online), and is not currently under consideration by another publication.

MANUSCRIPT PREPARATION

The researcher should format the manuscript according to the journal template available on the website and properly format and tailor it according to the specified publication requirements outlined below:

- The researcher should submit the formatted research in a Microsoft Word document (.doc or .docx).

- If this is the first time you are submitting research to the journal, you must register first, followed by uploading the research.

- The research must be written in the correct language, with attention to formatting, graphics, and tables numbered as shown in the journal template.

- A title should accurately describe the content of the paper with the fewest possible words (centered, bold, 14 pt), the academic title, and the researcher's name, affiliation, and email address (font size and type specified in the publication template).

- The abstract should be 200 to 250 words in length (12 pt).

- The research text body should be written using Times New Roman font at a size of 12 points.

- The research should be written with 1.0 spacing, with a minimum of ten pages and a maximum of thirty pages.

- Fonts should be bold for the main title and subheadings. The subheading should be written on a separate line (12 pt, italic) and numbered as shown in the publication template.

- The font color should be black automatically for all paragraphs.

Researchers must acknowledge the funding institution funding the research, if any, and the grant number or code. They must also acknowledge the individuals who assisted with the research.

References: Authors must list all references used inside the paper text. The style of the references follows the American Medical Association (AMA). In-text citations should be done by the number listed in the references section. Example: According to [3]. According to [3], [2], and [24].

RESPONSIBILITIES OF AUTHORS

Authors are responsible for all data accuracy (including dosages), references, and permissions for any previously published material. They should disclose any financial interests, direct or indirect, as well as personal relationships with individuals or organizations that may potentially exert undue influence or bias on their work. This encompasses relevant commercial funding sources, other forms of funding for the individual author(s), associated department(s), or organization(s), personal relationships, and direct academic competition.

INFORMED CONSENT

Every research endeavor involving human subjects, human materials, or human data necessitates prior approval from the relevant ethical committee. For manuscripts reporting such research, it is imperative to include a statement acknowledging this approval, along with the name of the ethics commission and, if applicable, the reference number. Additionally, the manuscript should provide comprehensive details regarding any exemptions obtained from ethics approval for the study, explicitly specifying the ethics committee that granted the exemption. The editor must be granted access to supplementary data and supporting documentation upon request. If the editor determines that the research was not conducted within an appropriate ethical framework, the manuscript may face rejection**.**

Message from Editor-In-Chief

The second issue of the Libyan Journal of Public Health practices is available online. We are delighted to offer this resource to researchers and those interested in public health research and hope it proves beneficial in their academic and professional endeavors.

LJPHP publishes original scientific research across various public health specialties and related fields. All published work adheres to rigorous scientific methodology and standards of presentation and investigation.

We are proud to collaborate with a distinguished panel of researchers from Libyan universities and higher institutes. Furthermore, a select group of leading professors from across Libya provide expert peer review, ensuring the quality and rigor of published articles. Their contributions are invaluable in identifying areas for improvement and guiding authors through necessary revisions.

We trust that this journal will meet our readers' expectations and contribute significantly to advancing knowledge and research in Libya.

Thank you for your continued support.

Editor-In-Chief

Table of Contents

Libyan Journal of Public Health Practices (LJPHP)

Journal homepage: https://journals.uob.edu.ly/LJPHP
ISSN (Online) 3008-1467

Research article

Comparison of Integrated Pest Management Knowledge, Attitude, and Practice among staff members of Four Major Hospitals in Benghazi

Fawzeia H. Elmhalli[1], Samira S. Garboui*[1], Naser Al.Hadaar[2],Rania N. Ali[3], Faiza A. Awad[3], Yasmine A. Ibrahim[3]

[1]Department of Infectious Disease, Public Health Faculty, University of Benghazi, Libya
[2] Department of Nutrition, Public Health Faculty, University of Benghazi, Libya
[3]Department of Environmental Health, Public Health Faculty, University of Benghazi, Libya

ARTICLE INFO

Article history:
Received 10/8/2024
Revised 20/10/2024
Accepted 26/10/2024
Available online xxxx

Keywords:
IPM
Knowledge
Practice
Attitude
Hospitals

ABSTRACT

Pests in the hospital environment pose a significant risk to the safety of patients and staff. While pesticides are commonly used to control pests, they can lead to additional problems. Therefore, alternative procedures such as Integrated Pest Management (IPM) have gained attention. This study aimed to assess hospital staff knowledge, practice, and attitudes regarding IPM in four major hospitals in Benghazi. A cross-sectional study used a questionnaire and checklist to collect the data from the participants. The results indicated that all hospitals showed low IPM knowledge and practiced widespread pesticide use. The Surgical and Emergency Hospital (SEH) demonstrated significantly higher IPM knowledge, practice, and attitude scores than the other three hospitals ($p = 0.000$), with a mean of 4.56, 2.61, and 10.94, respectively. All studied hospitals experienced pest infestations such as houseflies and roaches. These hospitals rely mainly on chemical control, employing 14 types of pesticides, including five restricted-use pesticides and seven that are banned. In addition, these chemicals can be used without proper supervision and by uncertified users with limited knowledge. .

*Corresponding author.
E-mail address: Samira.Garboui@uob.edu.ly

1. Introduction

Healthcare facilities, including hospitals, face many difficulties in maintaining the highest standard of sanitation while providing for vulnerable people. One of these difficulties is making sure the facility does not become infested with pests, which may pose a range of health risks by spreading disease and contaminating surfaces, medical supplies, and equipment [1]. The risk factors for insect infestations increase with the size of a facility, the movement of staff, the entry of objects from outside, and sometimes the accumulation of garbage and the lack of sanitation [2]. There are too many types of pests in hospitals including rodents, cockroaches, spiders, mosquitoes, fleas, lice, mites, ants, flies, and bed bugs. These pests spread diseases and contaminate surfaces, equipment, and supplies [1]. Many studies and survive shown that many hospitals suffer from infested pests and there are a lot of insect species associated with the hospital's environment, which causes a huge health concern. A study was done between 2015-2016 at Al-Jala Hospital, in Benghazi, showing that the most common types of pests found in the hospital were the cockroach, it was followed by bugs, flies, and rodents [3]. In the same year at the same hospital, a study showed that the building was struggling with certain insects such as cockroaches, followed by bugs, flies, and rodents [4]. The Medical Entomology Department, an arthropod reference laboratory in New South Wales, has over the years investigated numerous instances of pest infestations within the confines of hospitals and associated healthcare facilities [5], particularly vector-borne and food-poisoning diseases. There are many theories confirming the role of insects in the transmission of nosocomial infections [6]. As a result, we often depend heavily on chemicals to treat the symptoms of our pest issues, rather than resolving the underlying problem that led to the pest presence. This short-sighted approach results in pests being often not managed safely, effectively, or economically [7]. In the process of eliminating pests, healthcare facilities that use pesticides risk exposing patients, staff, and visitors to hazardous substances through Inhalation, ingestion, and absorption of pesticide residues [8].

The best way to manage pests is to create a sterile environment by denying them access to food, water, and shelter. Integrated pest management in general is a science-based decision-making framework that emphasizes pest prevention and least-toxic control measures"[9] also, "integrated pest management in health care facilities is an effective and environmentally sensitive approach to pest management" [10]. One of the earliest studies about IPM was in 1995, in New York surveyed hospitals through questionnaires. Out of the 64% response rate, three hospitals reported not using pesticides, while others mentioned the use of pyrethroids, boric acid, and pyrethrin [11].

The findings highlighted varying approaches to pest management in hospitals, with some adopting non-chemical methods and others relying on specific pesticides. Many natural substances have a relatively low mammalian toxicity and degrade rapidly in the environment, properties that make them attractive alternatives to many synthetic pesticides currently in use [12-13-14]. A study done in Saudi Arabia by Noureldin et al [15] indicates that the IPM used against the German cockroach in Jeddah is a successful program and should always be used to control cockroach infestations in the residences in Jeddah. This study aims to assess knowledge, practice, attitude, and influencing factors related to Integrated Pest Management (IPM) adoption

and pesticide use in four hospitals in Benghazi. Including identifying the types of pests present, determining the IPM strategies employed, evaluating the effectiveness of pest control programs, and examining pesticide application records. This research will involve direct examinations, questionnaires, and a comparison of results with previous studies.

2. Methodology

2.1.Study area and Study design

The study was conducted in four major hospitals in Benghazi city, including the Surgical and Emergency Hospital (SEH) , Benghazi Medical Centre (BMC), Nephrology, Dialysis Centre (NDC), and Benghazi Cardiac Centre (BCC), over three months from March 1st to June 15th, 2023. A cross-sectional descriptive research approach was employed to describe the knowledge, attitude, and practice regarding IPM of the population under investigation. The sample size was determined using a formula ($N = [Z^2 \times P (1 - P) / e^2] / [1 + (Z^2 \times P (1 - P) / e^2])$, [16-17], that took into account the total population of 1423 from the four hospitals, with a desired confidence interval of 90% and a standard deviation of 0.5. Based on this calculation, a sample size of 400 participants was deemed sufficient to detect variations between hospitals, and questionnaires were administered to 400 ± 1 individuals accordingly.

2.2. Data Collection Tools

Two data collection tools were developed for the study. Part 1, is a structured online questionnaire designed to evaluate the use of the Integrated Pest Management (IPM) program. This questionnaire was formulated by a published study in which the validity and reliability were tested. The questionnaire included socio-demographic information such as gender, age, education, workplace, and years of experience, along with assessments of knowledge, practices, and attitudes regarding IPM and pesticide control in hospitals [18]. It encompassed 54 domains related to IPM knowledge and was administered to infection control specialists, cleaning staff, nurses, kitchen staff, and doctors via Google Sheets through personal interviews. Part 2, an observational checklist was utilized to monitor and inspect the types of pests and the pesticides/IPM methods employed for their control. This checklist was sourced from the Integrated Pest Management Toolkit [19].

2.3.Statistical analysis

The study's data were analysed using version 25 of the Statistical Package for the Social Sciences (SPSS) software. Normality tests were conducted, and the analysis included descriptive statistics, cross-tabulations, and one-way ANOVA. Results were deemed statistically significant when the P-value was less than 0.05.

3.Results and discussion

3.1. *A structured online questionnaire result*

a- Demographic characteristics of participants

The distribution of participants in each hospital based on their job description is showed in Table 1. The data reveals that the BMC had the highest percentage of participants (39.85%) among the four hospitals, as it is the largest facility. Conversely, the BCC had the lowest percentage of participants (16.79%) as it is the smallest hospital. Furthermore, nurses

accounted for the highest number of participants (53.38%) across all four hospitals, based on their respective job roles. The respondent demographics show a majority of females across all four hospitals, reflecting the higher participation of female nurses at 63%. The age group of 31–40 years was the most prevalent, comprising 41.9% of respondents, while those aged above 51 represented only 0.4% of the total. Additionally, the institute category was the most common educational background among participants, constituting 43.8% in Figure 1.

b- Assessments of knowledge, practices, and attitudes results regarding IPM and pesticide control in hospitals

Table 2 shows the level of knowledge regarding IPM among hospital participants. SEH demonstrated the highest average IPM knowledge score (4.56 out of 6), significantly surpassing other hospitals ($p = 0.000$). This good score is attributed to its skilled infection control staff, while BCC exhibited the lowest mean score at 3.73. In terms of participant attitudes (with a maximum score of 4). SEH had the highest mean score (2.61), indicating a positive attitude towards IPM, significantly higher than the other hospitals ($p = 0.008$). Conversely, NDC had the lowest mean score (2.19) (Table 2). Regarding IPM Practices, the highest score recorded was 14, with SEH obtaining the highest score, with a mean of 10.94, indicating an acceptable level of IPM practice (Table 2). In contrast, BCC had the lowest practice score at 9.22, reflecting a notably substandard level of IPM adherence.

Table 1: The percentage of participants in the hospitals according to their job description

Hospital	Job description					Total (%)
	N (%)	IC (%)	CS (%)	KS (%)	Other (%)	
SEH	27 (35.50)	16 (21.05)	7 (9.21)	13 (17.10)	13 (17.1)	76 (19.04)
BMC	75 (47.17)	51 (32.07)	4 (2.51)	27 (16.98)	2 (1.26)	159 (39.85)
BCC	50 (74.63)	9 (13.43)	5 (7.46)	0 (0)	3 (4.48)	67 (16.79)
NDC	61 (62.89)	28 (28.87)	3 (3.09)	0 (0)	5 (5.15)	97 (24.31)
Total	213 (53.38)	104 (26.06)	19 (4.76)	40 (10.03)	23 (5.76)	399

SHE =Surgical and Emergency Hospital, BMC = Benghazi Medical Centre, NDC =Nephrology, Dialysis Centre and, BCC =Benghazi Cardiac Centre
N =Nurse, IC =Infection control, CS= Cleaning Staff, KS =Kitchen Staff

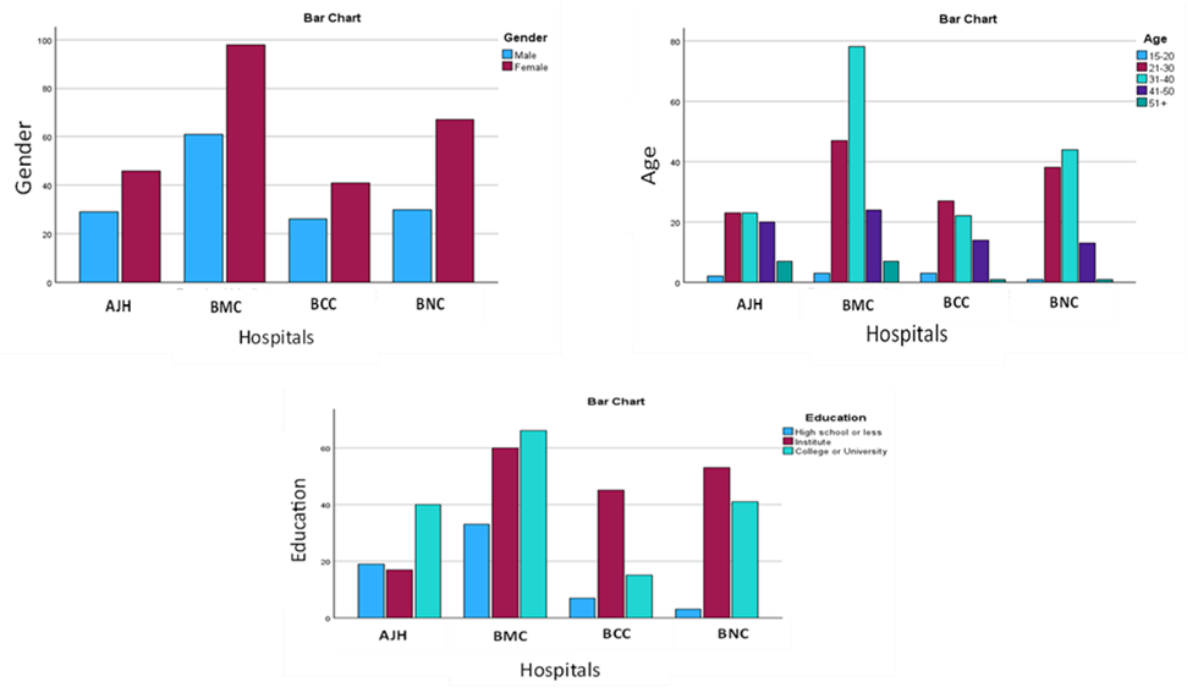

Figure 1. Socio-Demographic characteristics of respondents, A= The gender percentage, B= The ages and, C= The education level, of the participants in in the four hospitals

Notably, the staff at BMC showed a lack of awareness regarding IPM practices, resulting in the responsibility of this task falling on the cleaning company staff. At NDC, where nurses comprised the majority of participants, their level of practice was comparatively lower than that of SEH . Additionally, they exhibited a lack of knowledge on how to prevent insect or rodent infestations. Overall, the findings indicate variations in IPM practice scores among the hospitals, with SEH demonstrating the highest level of practice, while BCC had the lowest, and BMC and NDC faced specific challenges in terms of awareness and implementation of IPM practices.

3.2. Observational Checklist results

The checklist presents the pests mostly found in the hospitals, the commonly used pesticides, and the evaluation of the IPM practice in the hospitals. Type of pests in hospitals are shown in Table 3. The result revealed that the flies was the most common insect found among the hospitals, which was found approximately in all hospital places, infestation was observed visually and by the personal interviews with the staff of the hospitals. Many studies found that house flies were proven to carry over 130 pathogens, multi-drug resistant pathogens, which are opportunistic to humans and to be a cause of nosocomial infections [20] [21].

These results highlight the importance of house flies as a vector in sensitive places such as hospitals. Followed by cockroaches, studies confirmed that the most prevalent pest species found in hospitals is the cockroach [3-4],

Both studies conducted in the same hospital yielded consistent results. Based on our observations, the abundance of cockroaches in the hospital may be attributed to the poor condition of the building infrastructure. Multidrug resistant Gram-negative bacteria including E. coli and K pneumoniae, are resistant to multiple antibiotics [22-23-24].

At BMC, kitchen staff reported notable cockroach infestations, exacerbated by cracks and open manholes nearby. Infection control staff also emphasized their ongoing battle against these pests within the hospital. Mosquitoes were spotted at SEH hospital, especially near windows and water accumulation from air conditioners, with

Table 2: The average knowledge, attitude, and practice of the participants in the four hospitals

The average knowledge scores of the participants

Hospital	Mean	N	Std. Deviation	Std. Error of Mean	Sum	Minim	Maxum	Harmonic Mean
SEH	4.5658	76	1.14700	.13157	347.00	2.00	6.00	4.2066
BMC	4.1761	159	1.17750	.09338	664.00	1.00	6.00	3.7767
BCC	3.7313	67	.80870	.09880	250.00	2.00	6.00	3.5481
NDC	3.7423	97	1.05355	.10697	363.00	1.00	6.00	3.2697
Total	4.0702	399	1.12758	.05645	1624.00	1.00	6.00	3.6701

The average attitude scores of the participants

Hospital	Mean	N	Std. Deviation	Std. Error of Mean	Sum	Min	Max	Harmonic Mean
SEH	2.6184	76	.99287	.11389	199.00	.00	4.00	-
BMC	2.4214	159	.78259	.06206	385.00	1.00	4.00	2.1271
BCC	2.3731	67	.67050	.08191	159.00	1.00	4.00	2.1848
NDC	2.1959	97	.74497	.07564	213.00	.00	4.00	-
Total	2.3960	399	.81047	.04057	956.00	.00	4.00	-

The average practice scores of the participants

Hospital	Mean	N	Std. Deviation	Std. Error of Mean	Sum	Min	Max	Harmonic Mean
SEH	10.9474	76	2.52927	.29013	832.00	4.00	14.00	10.2094
BMC	9.7987	159	2.24392	.17795	1558.00	4.00	14.00	9.2499
BCC	9.2239	67	2.43597	.29760	618.00	4.00	14.00	8.5215
NDC	9.5464	97	2.33640	.23723	926.00	3.00	14.00	8.6754
Total	9.8596	399	2.41339	.12082	3934.00	3.00	14.00	9.1352

SHE =Surgical and Emergency Hospital, BMC = Benghazi Medical Centre, NDC =Nephrology, Dialysis Centre and, BCC =Benghazi Cardiac Centre

Table 3. The most common types of pests found in the hospitals studied

PEST	SEH	BMC	NDC	BCC
Cockroaches	All hospital places	Kitchen Bathrooms	Around the hospital	Bathrooms, Storage room, and outside area
Flies	In and around the hospital	Around the hospital	Around the hospital	Around the hospital
Rodents	Medical supplies storage room, bathrooms, outside area	0	Outside area	Outside area
Bed Bug	Doctor's room	Patient's rooms	0	0
Flea	0	Patient's rooms	0	0
Ants	outside area, front of the doors	outside area	outside area	outside area
Mosquito	outside area	0	outside area	0

SHE =Surgical and Emergency Hospital, BMC = Benghazi Medical Centre, NDC =Nephrology, Dialysis Centre and, BCC =Benghazi Cardiac Centre

reports of widespread presence from nurses at NDC. At BMC, kitchen staff reported notable cockroach infestations, exacerbated by cracks and open manholes nearby. Infection control staff also emphasized their ongoing battle against these pests within the hospital. Mosquitoes were spotted at SEH hospital, especially near windows and water accumulation from air conditioners, with reports of widespread presence from nurses at NDC. Knowledge about their impact on humans is limited. Rodents were often seen at SEH , attributed to an opening beneath the medical supplies storage door, despite a prior study showing low infestation rates [3].. Bed bugs were reported in doctors' rooms and the surgery section at BMC, with immediate management actions taken, though details were unclear. A study highlighted the need for IPM in hospitals due to these infestations [3].

Bed bugs are not known to transmit infectious agents to humans, though evidence is lacking [25]. A flea infestation occurred at BMC when a patient brought in infested clothing, leading to the spread of fleas throughout the facility. No infestations were reported in the other three hospitals. Ants were found in all hospitals, and a study in 2018-2019 at BMC indicated that ants may could act as mechanical vectors for pathogenic bacteria, potentially spreading them directly to people or indirectly via medical equipment [26]. Further research is needed to confirm the association between bacteria carried by ants and those present on surfaces in the same environment. Table 4 shows the most commonly used pesticides in the hospitals, revealing a total of 14 different types. Alarmingly, 7 of these have been banned by the World Health Organization [27], while only 4 are approved for use. The study also found that 3 pesticides had unknown sources, raising safety and effectiveness concerns. The educational level of those responsible for pesticide application was crucial, as many lacked knowledge [3-4]. Additionally, Boric

Acid, which has long been banned, was still being used in SEH 's kitchen as of 2023. In BMC, sticky traps were employed in the kitchen, while SEH utilized fly sticky traps throughout the facility, except in the kitchen where electric fly traps were used. The use of baits indicates a positive approach towards integrated pest control, which emphasizes the

Table 4: Types of Pesticides Used in Hospitals, Their Composition, And Product Status

Pesticides	Chemical Ingredient	Product Status*	Restricted Use*	Hospitals
Delta-Vam 5 Sc	Deltamethrin 5%	Approved	Yes	BMC
Top Bait Gold	Fipronil 0.5g/Kg, *Hydramethylnon, Imidacloprid, Indoxcrab*	Banned	No	BMC, SEH . NDC & BCC
Cyper X	*10% Cypermethrin, 2% Tetramethrin*	Banned	No	BMC
Rek Rok	*47% Boric Acid*	Banned	No	BMC & SEH
Fly Giue Traps	*Imidacloprid*	Approved	Yes	BMC, SEH , NDC &BCC
Cemort	*Cyfluthrin*	Banned	No	SEH
Maxifly	*10% Cyphenothrin*	Banned	No	BMC
Tornado-Forte	*Lambda-Cyhalothrin 10%, Tetramethrin 5%, Piperonyl Butoxide 5%.*	Banned 5%	No	SEH
Mr. Fly Granular Bait	*Imidacid 2%*	Unknown	No	SEH
Arisban Ariashimi	*Chlorpyrifos Ethyl 2.5%*	Banned 2020	No	SEH
Duracid	*Permethrina Pura 6g, Tetrametrina Pura 3g, Piperonilbutossido 6g, Coformulanti 100g*	Approved	Yes	NDC
Cockroac-Killing Bait	*1% Grenil*	Unknown	Unknown	NDC
Rat & Mouse Killer	*Brodifacoum, Coumarin.*	Approved	Yes	NDC
Attracide Df	*Phenoxybenzyl, Cyclopropanecarboxylate, Phenothrin, Butoxyethoxy, Piperonyl Butoxide*	Unknown	Yes	NDC

SHE =Surgical and Emergency Hospital, BMC = Benghazi Medical Centre, NDC =Nephrology, Dialysis Centre and, BCC =Benghazi Cardiac Centre

integrated pest control, which emphasizes the use of localized and less toxic pesticides. This approach aims to minimize the widespread application of pesticides and instead focuses on targeted solutions like baits. Regarding the pyrethroid group of pesticides, the study found the usage of deltamethrin 5%, cypermethrin 2%, tetramethrin, cyfluthrin, and cyphenothrin in hospitals. This is consistent with the study demonstrated that cypermethrin, deltamethrin, and cyfluthrin were used in six hospitals in Benghazi [4]. Pyrethroids have been widely used as insecticides in agriculture and household applications. Studies indicates that pyrethroids can easily cross the blood-brain barrier, directly impacting the central nervous system [28]. They can damage mitochondrial function, and cause neurotoxicity [29]. Furthermore, exposure to pyrethroids has been associated with haematological cancers, reproductive developmental toxicity, and immune disorder [30].

4. Conclusion

The study found that SEH exhibited higher knowledge levels compared to the other hospitals, possibly attributed to the qualifications of their infection control specialists. Despite this, the implementation of IPM strategies in these hospitals still falls within the lower range, indicating the necessity for further enhancements and improvements. Nevertheless, all hospitals had pest infestations and improper pesticide use by unqualified personnel. Further improvements are needed across all hospitals, including enhanced IPM practices and mandatory training programs for all staff. Additionally, maintaining hospital structures is crucial to effective pest control. Further research exploring the influencing factors on IPM adoption and the effectiveness of different IPM strategies would be beneficial.

Acknowledgment

The authors would like to express their greatest appreciation to the health workers who participated in the study conducted in the four hospitals and the infection control officers for their invaluable assistance.

Conflict of Interest and Financial Disclosure

The authors have not declared any conflicts of interest and confirm that they do not receive any financial support for this research.

References

1- Skadedyr Norge org (2022). How to Control Pests in Hospitals and Health Care Facilities. https://skadedyrnorge.no/how-to-control-pests-in-hospitals-and-health-care-facilities/
2- Potter, M. F., Fredericks, J., & Henriksen, M. (2015). The 2013 bugs without borders survey: bed bug infestations increasing across America. National Pest Management Association, Fairfax, VA. Available via http://npmapestworld. org/releases/bedbug survey. cfm. Cited, 23.
3- Garboui, S. El-Daly M., El-Montaser M., El-Megreisi A., El-Raeid A., and Saad A., (2016). Investigating Barriers to Adoption of Integrated Pest Management in AL Jallaa Hospital, The Fourth Scientific Conference of Environment and Sustainable Development in the Arid and Semi-Arid Regions.
4- Garboui, S., & Elbagrmi, T. (2017). Pest management and pesticide used in some hospitals of Benghazi. Libyan Journal of Science & its applications 5:2. 110-113.
5- Merilyn J. Geary, & Stephen L. Doggett. (2019). Pest Infestations in Hospitals Pose Health Risks to Patients and Staff. Arthropod Infestations in Hospitals. /Resources/FM, Files/Magazines/201910/FAOP.
6- Boiocchi, F., Davies, M. P., & Hilton, A. C. (2019). An examination of flying insects in seven hospitals in the United Kingdom and carriage of bacteria by true flies (Diptera: Calliphoridae, Dolichopodidae, Fanniidae, Muscidae, Phoridae, Psychodidae, Sphaeroceridae). Journal of medical entomology, 56(6), 1684-1697.
7- Rajmohan, K. S., Chandrasekaran, R., & Varjani, S. (2020). A review on occurrence of pesticides in environment and current technologies for their remediation and management. Indian journal of microbiology, 60, 125-138.
8- Rani, L., Thapa, K., Kanojia, N., Sharma, N., Singh, S., Grewal, A. S., ... & Kaushal, J. (2021). An extensive review on the consequences of chemical pesticides on human

health and environment. Journal of cleaner production, 283, 124657.

9- Dan Hounsell (2021). EPA Webinar Targets IPM in Healthcare Facilities. Healthcare facilities today. IPM-in-Healthcare-Facilities—26692

10- Anderson, M., & Enache, A. (2014). Pest Control Practices and Integrated Pest Management in Childcare Centres Initiative: 2010 Staten Island Pilot Project; USEPA. The Effectiveness of Venue Strategies for Environmental Communication in Non-Agricultural, School Integrated Pest Management Campaigns, 137.

11- Vacco, D. (1995). Pest Management in New York State Hospitals: Risk Reduction and Health Promotion. Attorney General of New York State. New York State Department of Law.

12- Silva-Aguayo G (2004) Pesticides: chemistries/pesticide resistance. Botanical insecticides. In: Ware GW, Whitacre DM (eds) An introduction to insecticides, 4th ed, Rad c life's IPM World Textbook, Willoughby, OH.

13- Elmhalli, F., Pålsson, K., Örberg, J., & Grandi, G. (2018). Acaricidal properties of ylang-ylang oil and star anise oil against nymphs of Ixodes ricinus (Acari: Ixodidae). Experimental and Applied Acarology, 76, 209-220.

14- Elmhalli, F., Garboui, S. S., Karlson, A. K. B., Mozūraitis, R., Baldauf, S. L., & Grandi, G. (2021). Acaricidal activity against Ixodes ricinus nymphs of essential oils from the Libyan plants Artemisia herba alba, Origanum majorana and Juniperus phoenicea. Veterinary Parasitology: Regional Studies and Reports, 24, 100575.

15- Noureldin, E. M. (2016). Integrated pest management (IPM) for the German cockroach (Blattella germanica L.) in Jeddah province, Saudi Arabia. Biosciences Biotechnology Research Asia, 7(2), 657-665.

16- Burmeister, E., & Aitken, L. M. (2012). Sample size: How many is enough? Australian Critical Care, 25(4), 271-274.

17- Mou, K., Li, Z., & Ma, C. (2023). Asymptotic Sample Size for Common Test of Relative Risk Ratios in Stratified Bilateral Data. Mathematics, 11(19), 4198.

18- Owens, K. (2004, November). Healthy hospitals: Controlling pests without harmful pesticides. In The 132nd Annual Meeting.

19- UCSF (2011). California Childcare Health Program, University of California, San Francisco School of Nursing • www.ucsfchildcarehealth.org,

20- Khamesipour, F., Lankarani, K. B., Honarvar, B., & Kwenti, T. E. (2018). A systematic review of human pathogens carried by the housefly (Musca domestica L.). BMC public health, 18, 1-15.

21- Garboui, S. S., Abdeldaim, G. M. K., Elsherif A. A., El- Zwe A. S., El bargathe, A. S., El mabsout K. A. and EL drase S. A. (2019). Multidrug Resistant Gram-Negative Bacteria Isolated from housefly (Musca Domestica) in Al-Jallaa Hospital, Benghazi. TUJMS Vol 2:39-44

22- Popoola O., D., Efuntoye, M., O., Agu. G., C., B., Thomas, T., (2022). Pulse-Field Analysis Diversity of Extended Spectrum Beta Lactamases Producing Gram Negative Bacteria Isolated from Periplaneta americana (Cockroaches). Tanzania Journal of Science, doi: 10.4314/tjs. v48i3.10

23- Sarrah, Landolsi., Rachid, Selmi., Linda, Hadjadj., Asma, Ben, Haj, Yahia., Kaouther, Ben, Romdhane., Lilia, Messadi., Jean-Marc, Rolain. (2022). First Report of Extended-Spectrum β-Lactamase (blaCTX-M1) and Colistin Resistance Gene mcr-1 in E. coli of Lineage ST648 from Cockroaches in Tunisia. Microbiology spectrum, doi: 10.1128/spectrum.00036-21

24- Fithamlak, Solomon., Gebre, Kibru., Solomon, Ali. (2018). Multidrug-resistant pattern of food borne illness associated bacteria isolated from cockroaches in meal serving facilities, Jimma, Ethiopia. African Health Sciences, doi: 10.4314/AHS.V18I1.6

25- Jacques, Sevestre., Mohamed, Aly, Lemrabott., Jean-Michel, Berenger., Adama, Zan, Diarra., Ali, Ould, Mohamed, Salem, Boukhary., Philippe, Parola. (2023). Detection of Arthropod-Borne Bacteria and Assessment of MALDI-TOF MS for the Identification of Field-Collected Immature Bed Bugs from Mauritania. Insects, doi: 10.3390/insects14010069

26- Garboui S. S., Al. Subaihi, A. K., El shaari, R. M., Almanafee,N., Alfarisi, A.A. (2022). Ants as carriers of pathogenic bacteria in the Benghazi Medical Centre (BMC). Libyan Journal of Medical Research (LJMR), Volume 16 Issue 2A, ISSN 2413 – 6096. http://www.ljmr.com.ly/

27- World Health Organisation. (2020). List of Banned Pesticides According to World Health Organization. WB ADMI Project Supported by World Bank. Pp.2.

28- Ye, Bu., Yuan, Wang. (2023). Effects of pyrethroids on the cerebellum and related mechanisms: a narrative review. Critical Reviews in Toxicology, doi: 10.1080/10408444.2023.2229384

29- Zisis, Rah., Bayu, Rustika. (2022). Toxicity and Health Hazards of Pyrethroid Pesticides. Science insights, doi: 10.15354/si.22.re096

30- Jyothi, Puvula., Narendra, Maddu., Nagajothi, Gutam., Asha, Parimal., Pongali, B., Raghavendra. (2022). The role of pyrethroid derivatives in autophagy and apoptosis
31- crosstalk signaling and potential risk for malignancies. Oncotarget, doi: 10.18632/oncotarget.28328

Libyan Journal of Public Health Practices (LJPHP)

Journal homepage: https://journals.uob.edu.ly/LJPHP
ISSN (Online) 3008-1467

Research article

Stress, Anxiety, And Depression Among Dentists Three Years into The Pandemic

Sumeia Werfalli [1 *], Ghada Gehani[1] and Sanosi Taher[2]

[1] Department of Oral Medicine, Oral Pathology and Oral Radiology, School of Dentistry, University of Benghazi, Benghazi, Libya
[2] Department of Oral Medicine, School of Dentistry, Libyan International Medical University, Benghazi, Libya.

ARTICLE INFO

Article history:
Received 28/6/2024
Revised 4/9/2024
Accepted 30/10/2024
Available online xxxx

Keywords:
Depression
Anxiety
Stress
COVID
Dentists

ABSTRACT

The COVID-19 pandemic had a significant impact on healthcare workers globally, including the psychological wellbeing of dentists. To evaluate the effect of the early phase of the pandemic on the long-term psychological well-being of dentists, this study assessed dentists' mental health outcomes at two time points, at fall 2020 (six months into the pandemic), and at winter 2023 (three years into the pandemic). Specifically measuring the prevalence of symptoms of depression, anxiety, stress, and potential associated risk factors. The study surveyed dentists in Libya who responded to the study questionnaire Specifically measuring the prevalence of symptoms of depression, anxiety, stress, and potential associated risk factors. The study surveyed dentists in Libya who responded the study questionnaire in fall 2020 (n = 67) and winter 2023 (n = 38). The survey included self-report measures assessing four mental health outcomes: depression, anxiety, and stress. The chi-square test was used to compare mental health outcome measures between fall and winter. The prevalence of self-reported depression, anxiety, and stress decreased between fall 2020 and winter 2023 (40% vs. 37%, p =0.27; 55% vs. 42%, p = 0.37; 97% vs. 71%, p = 0.11 respectively). These estimates were particularly higher among those with a history of psychiatric disorder. Three years into the coronavirus disease 2019 pandemic, poor mental health outcomes were highly prevalent among dentists. Further research is needed to assess contributing factors in this specific population. Dental syndicates should promote targeted programs and services aimed at improving dentists' well-being.

* Corresponding author
E-mail address: sumeia.werfalli@gmail.com

1. Introduction

The dental profession is highly stressful. Influenced by various factors including challenging nature of dental clinical work, adverse working conditions, stressors related to the dentist-patient relationship, and time pressure. Additionally, dentists face occupational hazards such as biological, chemical, and radiation risks [1]. These stressors contribute to a high risk of professional burnout, workplace and poor mental health outcomes, including anxiety and depression. The repercussions of depression and anxiety extend beyond the individual, affecting families and communities by interfering with work and productivity. Fortunately, both conditions are reliably diagnosed and treated in primary care settings [2]. Before the COVID-19 pandemic, depression and serious depression occurred among dentists, and much of it was untreated. The rate of depression among dentists was prevalent with a reported rate of 9% [3]. A study conducted in Egypt highlighted that 98.5% of healthcare workers including dentists experienced moderate to severe stress during the pandemic, with 90.5% reporting anxiety and 18.5% facing depression [4]. The pandemic has exacerbated the well-being of healthcare professionals globally, as inadequate preparation and organizational support have intensified the mental burden on these workers. Elevated levels of stress, anxiety, and depressive symptoms may have long-term psychological implications, particularly for dentists. Most research on the impact of stress, psychological distress, and burnout has primarily focused on physicians and nurses [5]. A systematic review has confirmed the significant psychological impact of the COVID-19 pandemic on the dentists' mental health worldwide; however, few studies have conducted follow-up analyses to assess changes in mental health parameters over the period of the COVID pandemic among dentists. Dentists reported that direct contact with patients during this period heightened their fear of infection and potential transmission to families, staff, and patients. Many viewed the pandemic as a dangerous experience, leading to feelings of insecurity regarding infection control protocols [5].

To date, no studies have specifically examined the mental health status of dentists in Libya during the COVID-19 pandemic. This study's main aim was to compare dentists' mental well-being between two time points, i.e. fall 2020 (6 months from the start of the pandemic) and winter 2023 (three years into the pandemic), focusing on the prevalence of symptoms related to depression, anxiety, and stress, as well as potential associated risk factors.

The findings of this study will contribute valuable longitudinal data on dentists' wellness throughout the COVID-19 pandemic. Additionally, the results can inform Libyan dental syndicate administrators in developing interventions aimed at improving the well-being of dentists in Libya.

2. Methodology

2.1.Study design:

Ethical approval for this study was obtained from the ethical committee of the Libyan International Medical University (LIMU). This study utilized cross-sectional data collected through two administrations of an unidentified survey collected using an internet-based Form. Participation in this study was entirely voluntary and uncompensated. All dentists in Libyan academic institutions and dental clinics were invited to participate via email (with two follow-up reminders).

The initial survey was administered from September 3, 2020, to October 28, 2020, and the follow-up survey was conducted from February 12, 2023, to February 25, 2023.

2.2. Survey measures

The survey included questions addressing depression, anxiety, and stress. It comprised previously validated scales and additional questions about demographics, psychiatric history, and pandemic-related data. The first survey included 28 items, while the second one contained 32 items; both were identical except that the 2023 survey included four newly added

items related to COVID-19 inquiring about vaccination status.

2.3.Demographics

Demographic data (age, gender, specialty, marital status, and city of residence) were self-reported by participants. The type of clinical practice was also documented.

2.4. Psychiatric and pandemic- related data

Questions related to the pandemic included susceptibility to serious COVID-19 outcomes, a personal and/or family history of psychiatric disorders, and current treatment for a psychiatric disorder. In addition to the current activity status of the dental practice where they worked.

2.5. Mental health data

To investigate our main study aim, we examined four outcomes related to mental health: depression, anxiety, and perceived stress. The depression levels of participants were measured using the 9-item Patient Health Questionnaire (PHQ-9). This standardized tool is constructed directly on the diagnostic criteria for major depressive disorder and is both highly valid and reliable in screening and assessing the degree of depression [6]. Each item was given a score ranging from 0 to a score of 3, then item scores were added to calculate the total score. Utilizing the typical threshold decided by the scale authors, a PHQ-9 overall score of 10 or higher has a sensitivity of 88% and a specificity of 88% for major depression. Scores were interpreted as follows: 5 = mild, 10 = moderate, 15 = moderately severe, and 20 = severe depression. Anxiety was assessed with the 7-item Generalized Anxiety Disorder scale, which is based directly on the diagnostic criteria for generalized anxiety disorder and is a widely used screening tool that assesses the severity of generalized anxiety disorder with high validity and reliability [7]. Each item was given a score ranging from 0 to a score of 3, then we added item scores to find the total score. Using the average cutoff of a total score of 10 or higher to categorize participants as probably fulfilling the criteria for generalized anxiety disorder (a scale of normal (0-4), mild (5-9), moderate (10-14), and severe (15-21) anxiety) (8). Perceived stress: The PSS-10 is a self-reported scale to measure the global level of perceived stress. This scale includes two factors: Factor 1 (perceived helplessness) has consisted of negatively phrased items (i.e., items 1, 2, 3, 6, 9, and 10; e.g., “In the last month, how often have you felt nervous and stressed”); and Factor 2 (perceived self-efficacy) which is made of positively phrased items (i.e., items 4, 5, 7, and 8; e.g., “In the last month, how often have you felt that things were going your way”) [9].

2.6. Data analysis

All data were analyzed by using the Statistical Package for the Social Sciences (SPSS), version 24. Descriptive statistics, including percentages for categorical and means/standard deviations for continuous variables, were calculated. Differences in continuous variables were analyzed using independent samples t-tests, while differences in categorical variables (demographic characteristics, psychiatric history, and pandemic-related experiences) were analyzed using the chi-square tests. In addition, we examined if the prevalence of each of the mental health outcomes assessed differed significantly between fall 2020 and winter 2023 using the chi-square test. Significance was assessed at the $P < 0.05$ level. To identify potential predictors (gender, marital status, employment status), vaccination status, history of psychiatric disorder, currently being treated for psychiatric disorder, and conditions that predispose to serious COVID-19 outcomes. When all the parameters were entered simultaneously, full models were used to evaluate these variables' relative contributions to our main mental health outcomes at both baseline and follow-up.

3-Results and discussion

3.1 Demographics

A total of 67 dentists finished the first survey in fall 2020 and 38 dentists completed the second survey in winter 2023. At both baseline and follow up, the majority were women and living in Benghazi. We found no significant

differences in demographic data between the two questionnaire administrations except for the dental specialty and whether the dentist worked in a private clinic (Table 1).

3.2 Psychiatric and Pandemic-related data

Psychiatric and Pandemic-related data

The psychiatric related history was not statistically different between the two administrations. The status of the dental practice activity differed significantly between the two groups ($p<0.001$). In the first survey the majority answered that their dental practice was open but have a lower patient volume than usual. However in the second survey the majority reported that their practices were open and conducting business as usual (Table 2). Twenty-eight (74%) participants reported receiving COVID vaccination, nineteen (32%) received two doses, nine (32%) AstraZeneca, eight (29%) Pfizer, and ten (36%) Sinovac.

3.3 Mental health data

This study found no significant differences in the prevalence of likely depression, anxiety, or perceived stress in fall 2020 compared to winter 2023 (40% in fall vs. 37% in winter, $p = 0.27$; 55% in fall vs. 42% in winter, $p = 0.37$; 97% in fall vs. 71% in winter, $p = 0.11$, respectively) (Table 3). The median PHQ-9 scores at both baseline and follow-up were higher among people with psychiatric disorders compared to those without psychiatric disorder diagnosis at baseline ($p =0.62$), follow-up ($p < 0.001$). The median GAD scores at both baseline and follow-up were higher among people with psychiatric disorders compared to those without psychiatric disorder diagnosis ($p = 0.03$). Similarly, there were no significant differences in responses to the PSS-10 between our subgroups except for the median PSS scores at both baseline and follow-up were higher among people with psychiatric disorders compared to those without psychiatric disorder diagnosis ($p = 0.05$).

At baseline, The combination of predictors were significantly related to anxiety, $F(13,46) = 2.06$, $p = 0.03$, adjusted $R^2 = 0.36$. PHQ score and marital status were significantly related to this outcome. The combination of predictors were not significantly related to depression diagnosis, $F (12,47) = 1.82$, $p = 0.07$, adjusted $R^2 = 0.31$. The depression score, psychiatric history, employment status, and GAD score predicted having depression. The combination of predictors were not significantly related to perceived stress and none of the parameters were significantly related to perceived stress.

At follow up, the combination of predictors were significantly related to anxiety diagnosis, $F (8,29) = 4.44$, $p = 0.001$, adjusted $R^2 = 0.42$. The depression score, psychiatric history, and current psychiatric problem significantly predicted having anxiety at follow-up. The combination of predictors were significantly related to depression diagnosis, $F(10,27) = 2.29$, $p = 0.04$, adjusted $R^2 = 0.45$. The psychiatric history, GAD score, and marital status significantly predicted having anxiety at follow up. The combination of predictors were also significantly related to severity of perceived stress, ($F(10,27)=3,00$, $p=0.011$, adjusted $R^2 = 0.52$). at follow -up.

The study surveyed dentists in Libya to assess changes in mental health outcomes during the COVID-19 pandemic. While the prevalence of likely depression, anxiety, and stress decreased from the initial to follow-up surveys, the levels remained high, particularly among individuals with a history of psychiatric disorders. Approximately 40% met criteria for depression, and about half exhibited symptoms of generalized anxiety disorder. These figures highlight substantial emotional distress among dentists, emphasizing the importance of addressing mental health issues in this population. Despite efforts by the World Health Organization to improve mental health services in Libya, these services remain underdeveloped, and patients often present at late stages of mental illness. Stigma surrounding mental health leads families to manage these issues without seeking help, underscoring the need for increased awareness and psycho-education [10].

Table 1: Demographic data of the sample of Libyan dentists in fall 2020 and winter 2023

Variable	Baseline (%) or M±SD N=67	Follow-up N=38	p-value
Age (years)	37.94 ± 6.19	37.0 ± 11.8	0.96
Gender			
Female	38 (57%)	37 (97%)	0.09
Male	29 (43%)	1 (3%)	
Marital status			
Married	51 (76.11)	29 (76%)	
Single	12 (17.91)	6 (16%)	0.77
Divorced	4 (5.97)	3 (8%)	
City of residence			
Benghazi	44 (66%)	37 (97%)	0.86
Other	20 (30%)	1 (3%)	
Dental specialty			
General Practice	19 (28%)	10 (26%)	
Prosthodontics	11 (16%)	7 (18%)	
Oral pathology	6 (9%)	8 (21%)	
Public health	6 (9%)	2 (5%)	
Orthodontics	5 (7%)	1 (3%)	0.01
Pediatric dentistry	4 (6%)	2 (5%)	
Periodontics	2 (3%)	2 (5%)	
Endodontics	2 (3%)	3 (8%)	
Oral biology	1 (1%)	2 (5%)	
Other	8 (12%)	1(3%)	
Do you work in a private dental practice?			
Yes	43 (64%)	15 (39%)	0.02
No	24 (36%)	23 (61%)	
Do you currently use tobacco products?			
Yes	9 (13%)	1 (3%)	<0.001
No	58 (87%)	36 (97%)	

Table 2. Comparison of psychiatric and pandemic related data of the study population of Libyan dentists in fall 2020 and winter 2023

	2020	2023	P-value
PHQ-9	40%	37%	0.27
GAD-7	55%	42%	0.37
PSS*	97%	71%	0.11

* moderate or severe stress %

Before the pandemic, dentists reported high levels of stress and burnout and low well-being [11]. Unfortunately, we do not have data about pre-pandemic depression, anxiety, and stress estimates among Libyan dentists which would provide a better picture of the contribution of the pandemic to changes in these parameters. To improve mental health care for dentists after the pandemic, it is essential to understand their mental health status and psychosocial problems. Care should be directed towards identifying and managing preexisting mental health issues among dentists. Dental clinics/institutions should build a strong sense of belonging for their dentists to improve dentists' wellness. The main strength of our study is the repeated collection of cross-sectional data which allows us to compare samples over time. In addition, we used validated tool to assess mental health parameters which can effectively screen for these disorders. To the best of our knowledge, this is the first study to examine the psychological impact of COVID-19 on dentists in Libya. In terms of study limitations, first, due to the relatively low response rate to our survey, we cannot generalize our results to this population. Second, due to the anonymous nature of our survey, we did not obtain

Table 3. Comparison of proportion of Libyan dentists who met criteria for depression, anxiety, and stress between fall 2020 and winter 2023

Variable	Baseline % N=67	Follow up % N= 38	p-value
Are you currently being treated for, or have been told by a doctor that you have, a condition that may make you more susceptible to serious COVID outcomes?			
Yes	9 (13%)	3 (8%)	
No	54 (81%)	33 (87%)	0.86
Don't know	4 (6%)	2 (5%)	
Do you have a history of psychiatric disorders?			
Yes	2 (3%)	2 (5%)	0.82
No	65 (97%)	36 (95%)	
Do you have a family history of psychiatric disorders?			
Yes	0	4 (8%)	0.82
No	67 (100%)	34 (92%)	
What is the current status of the dental practice where you work?			
• *Open but have a lower patient volume than usual*	35 (52%)	14 (37%)	
• *Closed and not seeing any patients.*	11 (16%)	2 (5%)	<0.001
• *Closed and seeing emergency patients only.*	7 (10%)	2 (5%)	
• *Open and conducting business as usual.*	12 (18%)	19 (50%)	
Are you currently being treated for a psychiatric disorder?			
Yes	1 (1%)	2 (5%)	0.81
No	66 (99%)	36 (95%)	

participants' identifiers which prevented us from being able to compare each participant's data between both survey administrations and obtain data about intra-individual variability.

4. Conclusions

The mental wellness of dentists is crucial for the sustainability of dental services during challenging times like the COVID-19 pandemic. Although the prevalence of depression, anxiety, and stress decreased by nearly 15% between fall 2020 and winter 2023, these levels remained high, indicating on going poor mental health among dentists in Libya. Further studies should explore the risk factors contributing to these elevated levels. These findings can guide dental syndicates in directing efforts to improve dentists' wellness and alleviate the remaining mental health effects of the COVID-19 pandemic.

Acknowledgment

The authors would like to thank Dr. Lisa Heaton (Care Quest Institute for Oral Health, University of Washington) for providing advice on earlier drafts of this manuscript.

Conflict of Interest and Financial Disclosure

The authors declare no conflict of interest or funding.

References:

1- Myers, H. L.; Myers, L. B. 'It's difficult being a dentist': stress and health in the general dental practitioner. Br Dent J 2004, 197 (2), 89-93; discussion 83; quiz 100-101. DOI: 10.1038/sj.bdj.4811476.
2- Mujić Jahić, I.; Bukejlović, J.; Alić-Drina, S.; Nakaš, E. Assessment of Stress among Doctors of Dental Medicine. Acta Stomatol Croat 2019, 53 (4), 354-362. DOI: 10.15644/asc53/4/6.
3- Mathias, S.; Koerber, A.; Fadavi, S.; Punwani, I. Specialty and sex as predictors of depression in dentists. J Am Dent Assoc 2005, 136 (10), 1388-1395. DOI: 10.14219/jada.archive.2005.0052.
4- Aly, H. M.; Nemr, N. A.; Kishk, R. M.; Elsaid, N. M. A. B. Stress, anxiety and depression among healthcare workers facing COVID-19 pandemic in Egypt: a cross-sectional online-based study. BMJ Open 2021, 11 (4), e045281. DOI: 10.1136/bmjopen-2020-045281.
5- Lefkowitz, B.; Houdmont, J.; Knight, A. A systematic review of dentists' psychological wellbeing during the COVID-19 pandemic. Br Dent J 2023. DOI: 10.1038/s41415-023-6232-8.
6- Kroenke, K.; Spitzer, R. L.; Williams, J. B. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med 2001, 16 (9), 606-613. DOI: 10.1046/j.1525-1497.2001.016009606.x.
7- Spitzer, R. L.; Kroenke, K.; Williams, J. B.; Löwe, B. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med 2006, 166 (10), 1092-1097. DOI: 10.1001/archinte.166.10.1092.
8- Spitzer, R. L.; Kroenke, K.; Williams, J. B.; Lowe, B. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med 2006, 166 (10), 1092-1097. DOI: 10.1001/archinte.166.10.1092.
9- Chiu, Y. H.; Lu, F. J.; Lin, J. H.; Nien, C. L.; Hsu, Y. W.; Liu, H. Y. Psychometric properties of the Perceived Stress Scale (PSS): measurement invariance between athletes and non-athletes and construct validity. PeerJ 2016, 4, e2790. DOI: 10.7717/peerj.2790.
10- Rhouma, A. H.; Husain, N.; Gire, N.; Chaudhry, I. B. Mental health services in Libya. BJPsych Int 2016, 13 (3), 70-71. DOI: 10.1192/s2056474000001288.
11- Collin, V.; Toon, M.; O'Selmo, E.; Reynolds, L.; Whitehead, P. A survey of stress, burnout and well-being in UK dentists. Br Dent J 2019, 226 (1), 40-49. DOI: 10.1038/sj.bdj.2019.6.

Libyan Journal of Public Health Practices (LJPHP)

Journal homepage: https://journals.uob.edu.ly/LJPHP
ISSN (Online) 3008-1467

Research article

Junk Food Consumption and Obesity Risk Among Students at Benghazi University: A Cross-Sectional Study

Salima Saad*, Sara Ahmed Elsherif, Aya Eltabouni, Buthina Edbaish, Nosiba Alkwafi And Nour Elzway

Department of Nutrition, Faculty of Public Health, University of Benghazi, Benghazi, Libya.

ARTICLE INFO

Article history:
Received xxxx
Revised 17/10/2024,
Accepted 26/10/2024,
Available online xxxx

Keywords:
Junk food
Obesity
University students

ABSTRACT

Consumption of junk food is an environmental factor linked to obesity and may heighten the risk of obesity-related diseases, representing a significant public health issue. The study aim is to clarify the association between junk food consumption and obesity among students at Benghazi University and will also examine students' knowledge of the adverse effects of junk food consumption. A cross-sectional study was conducted among students in the medical colleges of the University of Benghazi from January 2024. A self-administered questionnaire was utilized, including socio-demographic data, patterns of junk food consumption, knowledge about Junk food, and weight and height measurements. A total of 354 students participated in the study, with 67.5% female and 32.5% male. The majority (84.4%) were less than 25 years old. Notably, 98.9% of students consume junk food. 39.5% of students reported consuming junk food once or twice a week. Knowledge assessment revealed that 47.7% had good knowledge, 26.3% had fair knowledge, and 26% had poor knowledge regarding junk food. Based on the Body Mass Index (BMI) classification, 52.8% of participants had a normal BMI, 26.3% were overweight, 13.6% were obese, and 7.3% were underweight. Increased weekly junk food consumption was observed, alongside a high prevalence of overweight and obesity among students, despite a majority having normal BMI. No significant association between junk food consumption and BMI was found. Students acknowledged junk food's negative effects but continued consumption due to emotional factors and taste preference.

*Corresponding author:
E-mail: salima.saad@uob.edu.ly

1. Introduction:

The global prevalence of overweight and obesity has risen sharply, impacting individuals of all ages, genders, and ethnicities. The prevalence of obesity is considered a significant public health crisis [1] Obesity is a major contributor to non-communicable diseases, such as type 2 diabetes, cardiovascular diseases, certain cancers, and musculoskeletal disorders, as well as other health issues like arthritis, gallbladder disease, and respiratory problems [2; 3]. Environmental factors play a crucial role in this epidemic, and dietary habits have emerged as one of the most influential. The increased consumption of junk food, specifically high-calorie, low-nutrient foods that are readily available, affordable, and convenient, is particularly concerning for its role in obesity [4; 5]. Junk food, including items like chips, sugary drinks, fast food, and other highly processed options, is typically high in calories, fats, sugars, and sodium while offering minimal nutritional value [6]. Often popularized for convenience, flavor, and low cost, these foods are especially appealing to young adults, including university students, who are particularly vulnerable to poor dietary choices due to their unique lifestyle challenges [7] Research shows that students frequently consume fast food and sugary beverages due to time constraints, social influences, and financial limitations, leading to an increase in daily caloric intake [8] For instance a study found that approximately 30% of university students consumed fast food at least once daily, a pattern that significantly raises their energy intake and increases the likelihood of weight gain [9] One factor linking junk food consumption to obesity is its high energy density. Foods like fried snacks and sugary sodas contain more calories per gram than less processed options, contributing to passive overconsumption and promoting weight gain, [10]. Combined with the sedentary behaviors often seen among university students, high-calorie diets create a significant risk for obesity and other metabolic issues [11]. Stress and psychological factors also influence university students' dietary habits. Academic demands, social pressures, and financial concerns contribute to stress, which is associated with an increase in high-calorie, low-nutrient food consumption—a behavior known as "emotional eating" [12]. Wardle et al. found that stress led to increased consumption of calorie-dense and sugary foods among students during high-stress periods, contributing to weight gain [13]. Additionally, social factors such as peer influence and exposure to junk-food advertising play a significant role in dietary choices. In a study, over 50% of university students reported that fast-food restaurants were a regular part of their social activities, further increasing their junk food intake and risk of obesity [14]. The availability and affordability of junk food make it a common choice for students on a budget, exacerbating the problem [15] Physical inactivity among university students adds to the effect of junk food consumption on obesity. Studies show that the combination of frequent junk food intake and low physical activity levels leads to increases in BMI over time [16]. The prevalence of obesity and junk food consumption among students at Benghazi University, along with the limited understanding of the associated health risks, necessitates a comprehensive study to investigate these factors within the Libyan context.

This study aims to investigate the consumption of junk food among Benghazi University students, assessing its association with obesity. It will also examine students' knowledge of the adverse effects of junk food consumption, the frequency of consumption, and the underlying reasons for their choices.

2. Methodology:

2.1 Study setting and Study Populations:

A cross-sectional study involving students from five colleges within Benghazi University's medical schools was undertaken in January 2024, (Medicine, Public health, Pharmacy, Dental and Oral Surgery, and Biomedical Sciences).

Sample size determined using Solvins Formula Calculator.[17] within margin of error 5% with 95% confidence interval.
From the total students population (n=11,414). The students number in each collage was: 5321 students in Medicine, 2362 in Dental and Oral surgery,1275 students in Pharmacy, 1320 in Public Health, and 1136 in Biomedical sciences. According to the calculated sample size 386 students were selected to participate in the study. However 32 students reject to participate in the study, so the real number of participant was 354. A Convenience sampling method was used, because access was easy and all individuals were encouraged to participate.
Response rate: College that have facilitated approval procedure and cooperate with us. Every student who accepted to complete the questionnaire was enrolled in the research.
Excluded criteria: The students outside the specified colleges.

2.2 Measures:

A self-administrated questionnaire was used. A pre designed structural questionnaire that translated in Arabic version have been used in the study. A Pilot study was under taken before starting the main data collection of the study (Number=21). The questionnaire consists of 4 parts:

2.2.1 The first part contained a 11 questions on Socio demographics data: college name, sex , age, educational and occupational level of parents , marital status and economic status. doing exercise and family history of chronic disease and obesity.

2.2.2 The second part contained a 10 questions about junk food consumption: reasons for choosing to eat at fast food, fast food consumption per week, what fast food do they prefer, when do they eat fast food.

2.2.3 The third part contained a 10 questions about junk food knowledge; the questions were categorized as having low, fair, or good knowledge (Knowledge about adverse effects of junk food) to determine the participants' level of expertise. A score of one was assigned to the right response, and a score of zero was assigned to the wrong one. The maximum score was ten, and the minimum was zero. Using Bloom's cut-off categories for the total knowledge score. The level with (80-100%) categories as good knowledge, From (60-79%) categories as fair knowledge, and less than 60% categories as poor knowledge [18].

2.2.4 The fourth part section**:** by measuring weight and height. The weight was determined by Lica Italy personal scale (Home scale).Height was determined using Tape measurement. BMI determined according to WHO, BMI classified as below 18.5 is under Wight, from 18.5-24.9 is a Normal weight, from 25-29.9 is a Pre-obese, From 30-34.9 is an Obesity class I, from 35-39.9 obesity class II, and above 40 is an obesity class III [19].

2.3 Statistical analysis:

Descriptive statistics were used to calculate frequency and percentage of variables. Pearson's chi-square test of independence was used. A p - value of less than 0.05 was considered statistically significant. Data was first entered into a Google form, then inserted into a Microsoft Excel spread sheet, coded, and transferred into SPSS. The statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS) for Windows version 16.

2.4 Ethical Consideration:

Before an asking participants, an official letter was issued from the Nutrition department to the colleges administrators' to inform them about the aim of the study and to ask for cooperation to take data from students at every college. A consent form was read to all participants to be signed by students approved to enroll in the research.
The consent form includes:
1 - A briefing about the study to inform them the aim of this research.
2 - No names were used on the survey and the data were secure, collected data saved completely anonymous.
Weight and height are measured in private place.

3. Results:

3.1 Background characteristics among students in University of Benghazi:

354 students from 5 colleges shared in the study 47.5% of the students were from Medicine collage, 20.3% Dental and Oral surgery, 10.2% from Pharmacy, 12.7% from Public Health and 9.3% from Biomedical Science. The study comprised 67.5% female and 32.5% male students. 84.4% of students less than 25 years of age.

The majority of parents had university degrees 70.9% for mothers and 64.1% for fathers. most of mothers 61.1% were housewives and 68.9% of fathers employed. Additionally, 91.8% of the students were single, 87.6% had middle-class incomes. Regarding to family history disease most of participants had a family history of diabetes 42.3%. and 54.2% of the participants doing an exercise (Table 1).

Table 1: Demographic characteristics of students in Benghazi University (n=354):

Qualitative Variable		Number (%)
College	Medicine Dental and Oral Surgery Pharmacy Public health Biomedical science	168 (47.5) 72 (20.3) 36 (10.2) 45 (12.7) 33 (9.3)
Sex	Male Female	115 (32.5) 239 (67.5)
Age Group	18-24 years old ≥ 25 years	299 (84.4) 55 (15.5)
Mother's education level:	Less than University level University level None	95 (26.9) 251 (70.9) 8 (2.3)
Father's education level	Less than University level University level None	113 (31.9) 227 (64.1) 14 (4)
Mother's Occupation	Housewife Employee	161(45.5) 193 (54.5)
Father's Occupation:	Self-employed Employee	110 (31.1) 244 (68.9)
Marital status	Married Single Others	20 (5.6) 325 (91.8) 9 (2.5)
Economic status of the family	Low Middle High No answer	3 (8) 310 (87.6) 28 (7.9) 13 (3.7)
Family history diseases	Diabetes Hypertension Cardiovascular disease Obesity and overweight Not available	150 (42.3) 104 (29.4) 26 (7.3) 12 (3.4) 131 (37.0)
Doing exercise	**Yes** **No**	192 (54.2) 162 (45.8)

3.2 Junk food consumption among the participant: Table (2) demonstrate 98.9% of students consume junk food. 39.5% consume junk food once or twice a week; 51% of students eat junk food for lunch; 46.6% of students choose to eat junk food because they like the taste; 46.3% reveal that choosing a junk food option is influenced by branding; and 48.9% of students eat junk food based on their emotional state. 4% of students were vegetarians.

Table 2 : Junk Food consumption among participant

Junk Food consumption	Number (%)
Number of times you consume the junk food:	
0 times (don't eat junk food)	4 (1.1)
1-2 times a week	140 (39.5)
3-4 times a week	43 (12.1)
> 4 times a week	28 (8)
1-2 times a month	139 (39.3)
Time of junk food consumption:	
Breakfast	17 (4.8)
Lunch	180 (51)
Dinner	121 (34.1)
Snack	29 (8.2)
No specific time	3 (0.8)
No junk food consumption	4 (1.1)
Reasons for choosing to eat at junk food :	
Advertisement	9 (2.5)
Enjoy the taste	156 (46.6)
limited time	111 (31.3)
Variety of menu	42 (11.8)
Eat with friend / family	58 (16.8)
No junk food consumption	4 (1.1)
Usual junk food meal: Burger	90 (25.4)
Fries	98 (28)
Pizza	102 (28.8)
Fried chicken	60 (16.9)
Sandwich	181 (51.1)
Soda	48 (13.5)
Grilled meat	6 (2)
No junk food consumption	4 (1.1)
Does branding affect the chosen junk food ?	
Yes	164 (46.3)
No	86 (24.3)
Neutral	104 (29.4)
from Are food prices influencing the chosen junk food: Yes	115 (43.8)
No	89 (25.1)
Neutral	110 (31.1)
How does nutritional information influence your choice about junk food? Yes	146 (41.2)
No	117 (33.1)
Neutral	91 (25.7)
Taking junk food depends on the emotions: Yes	173 (48.9)
No	137 (38.7)
Neutral	44 (12.4)
Vegetarians: **Yes**	14 (4)
No	340 (96)

Table 3: knowledge regarding junk food consumption among the students

knowledge regarding junk consumption	Number (%)
1.Junk food is:	
Healthy	13 (3.7%)
Unhealthy	339 (95.8%)
I do not know	2 (0.6%)
2. Reasons why junk food is unhealthy	
High in fat	107 (30.2%)
High in energy	65 (18.3%)
High sodium chloride	12 (3.3%)
Low fiber	11 (3.1%)
All of the above	192 (54.2%)
None of the above	7 (2.0%)
I do not know	16 (4.5%)
3.Consumption junk food repeatedly increase the risk of cancer:	
Yes	167 (47.2%)
No	187 (52.8%)
4.Eating junk food frequently increase the risk of Hypertension:	
Yes	231 (65.3%)
No	123(34.7%)
5.Eating junk food regularly increase the risk of Cardiovascular diseases:	
Yes	293 (82.8%)
No	61 (17.2%)
6.Eating junk food frequently increase the risk of High cholesterol level:	
Yes	343 (96.9%)
No	11 (3.1%)
7.Eating junk food frequently increase the risk of diabetes:	
Yes	236 (66.7%)
No	118 (33.3%)
8.Are you aware of the nutritional information and ingredients found in all of the junk food you eat?	
Yes	147 (41.5%)
No	132 (37.3%)
I do not know	75 (21.2%)
9. food such as Burgers and Pizza contain a lot of fiber that is beneficial to the digestive system:	
Yes	35 (9.9%)
No	227 (64.1%)
I do not know	92 (26.0%)
10.Drinks that contain carbohydrates , such as coca cola , pepsi , and fanta contain high amounts of sugar , which may cause weight gain and obesity:	
Yes	332 (93.8%)
No	22 (6.2%)

3.3 knowledge regarding junk food consumption among the students:

Table 3 lists ten questions about the participants' knowledge of junk food consumption (354 in total). Most respondents, 95.8%, state that junk food is unhealthy. 47.2%, 82.8%, and 82.8% demonstrate that eating junk food frequently increases the risk of cancer, hypertension, and cardiovascular disease, respectively; 96.9% and 66.7% increase the risks of cholesterol levels and

diabetes mellitus. Of those who eat junk food, 41.5% were aware of the contents; 64.1% disagree that burgers and pizza include fiber; and 93.8% concur that sugar-filled drinks including Coca-Cola, Pepsi, and Fanta are high in sugar.

3.4 Level of knowledge among participants:

Table 4 displays the participants' knowledge about junk food: most of them had good knowledge (47.7%), while 26.3% of participants had fair knowledge, and 26% of them had poor knowledge.

Table 4: The level of knowledge among participants

Knowledge score	Frequency	Percent
good knowledge (80-100%)	169	47.7
Fair knowledge (60-79%)	93	26.3
Poor knowledge (less than 60%)	92	26.0
Total	354	100.0

3.5 BMI classification among participants:

According to the participants' body mass index, the majority of students (52.8%) had a normal BMI. While 26.3% of participants were overweight, 13.6% were obese, and only 7.3% were underweight. as shown in figure 1.

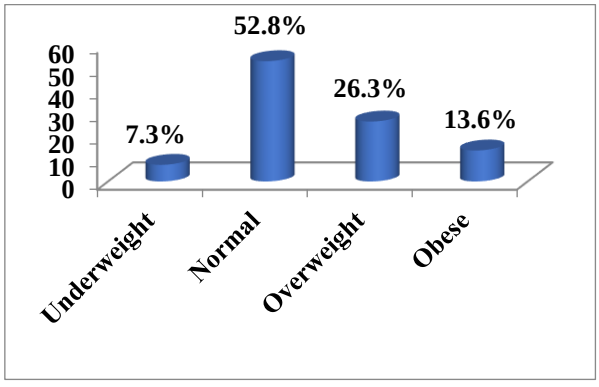

Figure 1: BMI classification among students

3.6 Association between junk food consumption and BMI among participants:

Table 5 shows that most 26.3% of participants were overweight. 7.5% of them eat junk food more than 4 times a week. 13.6% of students were obese. 6.2% of them eat junk food more than 4 times a week. There's no association between BMI level and fast food consumption with a p-value greater than 0.05.

4. Discussion:

…This study was conducted to determine the association between junk food consumption and obesity at the University of Benghazi. Among 354 students from five medical colleges in the University of Benghazi. The majority of data was provided by females, 67.5%. The majority (84.4%) were less than 25 years old. Furthermore, 87.6% of the students were middle-class income, and 91.8% of them were single. In terms of family medical history, 42.3% of participants had a family history of diabetes.

4.1 Junk food consumption:

Among 354 students in this study, most of them (98.9%) consume junk food. 39.5% of students in this study consume fast food 1-2 times per week, which is lower than the 74.5% of students who consume fast food 1-2 times per week in another study [20]. Most of the participants in the other study had fast food during lunchtime (43.7%), which is comparable to the 51% of participants in this study [21]. The primary reason students visit fast food restaurants is because they enjoy the taste, but in a different survey conducted by Al Otaibi et al., the percentage of students who enjoyed the taste was the lowest at 25.3% [22].

In this study, 48.9% of students reported that their consumption of fast food was significantly influenced by emotions like happiness, sadness, anger, and worry. In contrast, a study on medical students in India found that 55% of students approved of this statement and 23.3% were upset [23]. Exercise is important for maintaining health, reducing the risk of chronic illnesses, preventing rapid weight gain, and improving physical fitness [24]. In the current study, 54.2% of students reported exercising. While 76.7%

Table 5: Junk food consumption and BMI among participants:

Number of times you consume the junk food:	BMI descriptive Number (%)				Total	p- value
	Under-weight	Normal	Over-weight	Obese		
0 times	0 (0)	3 (1.6)	0 (0)	1(2.1)	4(1.1)	0.3*
1-2 times a month	14(53.8)	63(33.7)	44(47.3)	18(37.5)	139 (39.3)	
1-2 times a week	8 (30.8)	81(43.3)	33(35.5)	18(37.5)	140 (39.5)	
3-4 times a week	3(11.5)	23(12.3)	9(9.7)	8(16.7)	43 (12.1)	
>4 times a week	1(3.8)	17(9.1)	7(7.5)	3(6.2)	28(8)	
Total	26(7.3)	187(52.8)	93 (26.3)	48 (13.6)	354 (100.0)	

*p-value is not significance

of the sample in a different study did not play sports. [25]. 49.5% of medical students in Southern Thailand participated in physical exercise. [26] These findings emphasize that while junk food consumption is widespread, the factors influencing this behavior, such as taste, emotional states, and lifestyle practices, vary significantly. Recognizing these influences is essential in developing targeted interventions to address unhealthy eating patterns and promote healthier choices among university students.

4.2 knowledge regarding Junk food consumption among the participants:

In the study, 95.8% of participants acknowledged that fast food is unhealthy. This contrasts with findings from another study, which included undergraduates from medicine, engineering, and architecture programs. In that study, a significant portion of students knew that eating fast food had no negative health effects, with 40% of medical students, 26% of engineering students, and 57% of architecture students holding this view. [27] However, this study demonstrates that 18.3% of medical students recognize that consuming fast food increases the risk of high energy levels. Similar to Sudhanshu et al., they noted that fast food is high in calories. [27].

While only 19.6% of students in a different study read the nutritional information about fast food, 41.5% of participants in this study were aware of the ingredients and nutritional information about the fast food they eat. [22].

Among the participants of this study, 66.7 of them believe that eating fast food frequently raises the risk of developing diabetes. A study found that regions with a high concentration of junk food and few other dining options may be particularly harmful to the development of diabetes [28].

Knowledge of junk food's negative effects doesn't always translate into changed behavior. Sims et al. found only 25% of participants had good knowledge and 52% had poor knowledge [29], contrasting with another study reporting 47% good knowledge. Despite this awareness, fast food consumption remains high,

emphasizing the importance of practical application. This is supported by research on medical students' knowledge application [30]. While medical students are often aware of the health consequences associated with junk food, as supported by Habib et al., this awareness doesn't always lead to healthier dietary habits [31] The lack of correlation between knowledge and reduced consumption, found in this study as well, suggests that awareness alone may not be sufficient to curb junk food intake. Instead, integrating practical applications of this knowledge into students' lifestyles could be more effective, especially as many students continue to favor convenience and taste over nutritional value despite understanding the health risks.

4.3 Classification of BMI :

In this study, the participants' BMI levels were 7.3% underweight, 52.8% normal weight, 39.9% overweight, and obesity. In comparison, similar BMI values were discovered in another study by Shah et al., with 59.18% normal, 31.9% overweight, and obesity [32].Another study conducted in Syria discovered that the percentage of BMI among medical students was 82.5% obesity and overweight [25]. These studies illustrate a broader public health concern, as university environments seem to facilitate factors that contribute to increased BMI, potentially impacting young adults' long-term health.

4.4 Junk food consumption and BMI classification:

Various studies have demonstrated a positive correlation between the consumption of junk food and elevated BMI levels among students [33; 35]. A study demonstrated that there was a significant relationship between BMI and fast food consumption [32].

No significant association ($p > 0.05$) was found between BMI and junk food consumption, aligning with previous research [36; 20]. This lack of association highlights the likely influence of other factors—genetics, physical activity, and overall diet—on BMI. The results underscore the complex interplay between diet and weight, suggesting that while junk food may contribute to weight gain generally, individual factors can significantly modify this relationship.

5. Conclusions:

This study revealed a high prevalence of overweight and obesity among Benghazi University students, despite a significant students exhibiting normal BMI. While increased weekly junk food consumption was observed, no significant association was found between this consumption and BMI. This suggests that factors beyond junk food consumption, such as emotional eating and taste preferences, may significantly influence weight status in this population, despite students' awareness of the health risks associated with junk food.

Study limitations:

Limitations include convenience sampling, potentially biasing participant selection, and a short data collection period. Self-reported data may also introduce response bias, affecting the study's results.

Acknowledgment:

The authors would like to thank all students who participated in the research..

Conflict of Interest

No conflict of interest was declared by the authors.

References:

1- Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: A systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2014;384(9945):766–81.
2- World Health Organization. Obesity and overweight [Internet]. Geneva: WHO; 2021 [accessed at 12/10/2024]. Available from:

https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
3- Pi-Sunyer FX. The medical risks of obesity. Obes Res. 2002;10(S2):97S-103S.
4- Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, Moodie ML, et al. The global obesity pandemic: Shaped by global drivers and local environments. Lancet. 2011;378(9793):804–14.
5- Malik VS, Willett WC, Hu FB. Global obesity: Trends, risk factors and policy implications. Nat Rev Endocrinol. 2013;9(1):13–27.
6- Lin BH, Guthrie J, Frazao E. Nutrient contribution of food away from home. In: America's eating habits: Changes and consequences. Washington: U.S. Department of Agriculture; 1999. p. 213–42.
7- Larson N, Story M. A review of environmental influences on food choices. Ann Behav Med. 2009;38(1):56–73.
8- Hill JO, Wyatt HR, Peters JC. Energy balance and obesity. Circulation. 2012;126(1):126–32.
9- Musaiger AO, et al. Socioeconomic and lifestyle factors associated with obesity among Bahraini adolescents. Appetite. 2012;56(3):931–5.
10- Duffey KJ, Gordon-Larsen P, Jacobs DR Jr, Williams OD, Popkin BM. Differential associations of fast food and restaurant food consumption with 3-y change in body mass index: The Coronary Artery Risk Development in Young Adults Study. Am J Clin Nutr. 2007;85(1):201–8.
11- Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: An overlooked age for weight-related behavior change. Obesity (Silver Spring). 2008;16(10):2205–11.
12- Torres SJ, Nowson CA. Relationship between stress, eating behavior, and obesity. Nutrition. 2007;23(11-12):887–94.
13- Wardle J, Steptoe A, Oliver G, Lipsey Z. Stress, dietary restraint, and food intake. J Psychosom Res. 2000;48(2):195–202.
14- Al-Rethaiaa AS, Fahmy AE, Al-Shwaiyat NM. Obesity and eating habits among college students in Saudi Arabia: A cross-sectional study. Nutr J. 2010;9:39.
15- French SA, Story M, Jeffery RW. Environmental influences on eating and physical activity. Annu Rev Public Health. 2001;22:309–35.
16- Adams T, Rini A. Predicting 1-year change in body mass index among college students. J Am Coll Health. 2007;55(6):361–5.
17- https://www.statology.org/slovins-formula-calculator/
18- Alzahrani MM, Alghamdi AA, Alghamdi SA, Alotaibi RK. Knowledge and attitude of dentists towards obstructive sleep apnea. international dental journal. 2022 Jun 1;72(3):315-21.
19- World Health Organization. A healthy lifestyle - WHO recommendations.
20- Alfawaz HA. The relationship between fast food consumption and BMI among university female students. Pakistan Journal of Nutrition. 2012 May 1;11(5):406.
21- Fryar CD, Hughes JP, Herrick KA, Ahluwalia N. Fast food consumption among adults in the United States, 2013–2016.
22- Al-Otaibi HH, Basuny AM. Fast food consumption associated with obesity/overweight risk among university female student in Saudi Arabia. Pakistan Journal of Nutrition. 2015 Aug 1;14(8):511.
23- Shree V, Prasad RR, Kumar S, Sinha S, Choudhary SK. Study on consumption of fast food among medical students of IGIMS, Patna. International Journal Of Community Medicine And Public Health. 2018 Jul;5(7):2750-4.
24- Mirmiran P, Noori N, Zavareh MB, Azizi F. Fruit and vegetable consumption and risk factors for cardiovascular disease. Metabolism. 2009 Apr 1;58(4):460.
25- Alhashemi M, Mayo W, Alshaghel MM, Alsaman MZ, Kassem LH. Prevalence of obesity and its association with fast-food consumption and physical activity: A cross-sectional study and review of medical students' obesity rate. Annals of medicine and surgery. 2022 Jul 1;79:104007.
26- Wattanapisit A, Fungthongcharoen K, Saengow U, Vijitpongjinda S. Physical activity among medical students in Southern Thailand: a mixed methods study. BMJ open. 2016 Sep 1;6(9):e013479.
27- Mahajan SA, Gothankar JS. Fast food consumption pattern amongst undergraduates of various disciplines of private colleges in Pune.
28- Polsky JY, Moineddin R, Glazier RH, Dunn JR, Booth GL. Relative and absolute availability of fast-food restaurants in relation to the development of diabetes: a population-based cohort study. Canadian journal of public health. 2016 Jan;107(Suppl 1):eS27-33.
29- Laohasiriwong W, Samphors S, Chamroen P, Dewey RS, Rachutorn T, Pisey V. Socio-demographic and lifestyle factors associated with understanding fast food consumption among adults in Cambodia. F1000Research. 2020 Sep 28;9(1121):1121.
30- El-Gilany AH, Abdel-Hady DM, El-Damanawy R. Consumption and knowledge of fast/junk foods among medical students, Mansoura University, Egypt.
31- Habib A, Al Alyani M, H ussain I. Prevalence, Determinants and Consequences of Fast-Food

Consumption among college students in Abha-Aseir.

32- Shah T, Purohit G, Nair SP, Patel B, Rawal Y, Shah RM. Assessment of obesity, overweight and its association with the fast food consumption in medical students. Journal of clinical and diagnostic research: JCDR. 2014 May;8(5):CC05.

33- Burgoine, T., Forouhi, N. G., Griffin, S. J., Wareham, N. J., & Monsivais, P. (2014). Associations between exposure to takeaway food outlets, takeaway food consumption, and body weight in Cambridgeshire, UK: population based, cross sectional study. Bmj, 348, g1464.

34- Bibeau, W. S., Saksvig, B. I., Gittelsohn, J., Williams, S., Jones, L., & Young, D. R. (2012). Perceptions of the food marketing environment among African American teen girls and adults. Appetite, 58(1), 396-399.

35- Kirkpatrick, S. I., Reedy, J., Kahle, L. L., Harris, J. L., Ohri-Vachaspati, P., & Krebs-Smith, S. M. (2014). Fast-food menu offerings vary in dietary quality, but are consistently poor. Public health nutrition, 17(4), 924-931

36- Mohammadbeigi A, Asgarian A, Moshir E, Heidari H, Afrashteh S, Khazaei S, Ansari H. Fast food consumption and overweight/obesity prevalence in students and its association with general and abdominal obesity. Journal of preventive medicine and hygiene. 2018 Sep;59(3):E236.

Libyan Journal of Public Health Practices (LJPHP)

Journal homepage: https://journals.uob.edu.ly/LJPHP
ISSN (Online) 3008-1467

Research article

Evaluation of the Association between Unhealthy Lifestyle and Colon Cancer among the Patients Treated in the Oncology Unit of Benghazi Medical Center

Heithum S. Baiu [*], Salha A. Bendardaf , Areej A. Abdel Salam [1,] Nafessa A. Elmogrbi, Anwaar S. Hefter, and Marwa S. E. Imbarak

Department of Health Education, Faculty of Public Health, University of Benghazi, Libya

ARTICLE INFO

Article history:
Received 2/9/2024
Revised 26/10/2024
Accepted 2/11/2024
Available online xxxx

Keywords:
Case Control Study
Lifestyle Variables
Colorectal Cancer
Binary Logistic Regression
Body Mass Index

ABSTRACT

Colorectal cancer is one of the most common types of cancer around the world and is related to an unhealthy lifestyle. A retrospective case-control study, of 95 colorectal cancer patients and 95 matched controls investigated the association between lifestyle factors and colorectal cancer at Benghazi Medical Centre from June to July 2024. Data were collected via interviews and questionnaires. A binary logistic regression test was used to evaluate the relationship between each lifestyle variable and colon cancer. BMI was statistically significantly related to colon cancer (P = 0.045; odd ratio = 0.927, 95% CI (0.861 to 0.998)). Several dietary factors showed significant associations with colon cancer risk. Healthy diets were inversely associated (OR 0.379, P = 0.045), while vegetable consumption was positively associated (OR 4.619, P = 0.001). Red meat consumption also showed a positive association (OR 2.479, P = 0.042), whereas increased sugar consumption was inversely associated (daily: OR 0.243, P = 0.007; >daily: OR 0.222, P = 0.004). Adoption of health education interventions by health educators in Libya to promote healthy lifestyles is recommended. Future studies will be needed for further evaluation of the relationship between lifestyle factors and colorectal cancer in Libya.

[*] Corresponding author. Heithum Saleh Baiu
E-mail address: heithum.baiu@uob.edu.ly

1. Introduction

Colorectal cancer is the cancer of the colon and rectum [1]. It is the third most common cancer in men after prostate cancer and lung cancer [1]. It is the second most common cancer in women (The first common cancer is breast cancer) [1]. Based on the World Health Organization, there are 1.9 million new cases diagnosed with colorectal cancer and almost 1 million deaths from colorectal cancer around the world in the year of 2020 [1]. Additionally, colorectal cancer is the second most common cancer in Libya [2]. Colorectal cancer was the most common GIT cancer in Libya with 1123 new cases and 701 deaths in 2020 [3]. Furthermore, the country with the highest rate of colorectal cancer across North Africa is Libya [2]. Moreover, colon cancer was the most common cancer in the eastern part of Libya based on the hospital-based registry of Benghazi Medical Center in the year of 2012 [4].

The risk factors of colon cancer can be modifiable risk factors or non-modifiable risk factors [1]. Non-modifiable risk factors include age, gender, and a family history of colon cancer [1]. People older than 50 years, male, and have a family history of colon cancer at a high risk of colon cancer [1].

The modifiable risk factors of colon cancer include unhealthy lifestyle factors like being overweight or obese, sedentary lifestyle, smoking, excessive drinking of alcohol, consumption of too much red meat, consumption of a low amount of vegetables and fruits, and consumption of sugars [1]. Moreover, people with inflammatory bowel disease are at a high risk of colon cancer [5]. The risk of colon cancer can be decreased by following a healthy lifestyle [1].

The symptoms of colon cancer include abdominal pain, change in bowel habits, weight loss, nausea, vomiting, malaise, abdominal distension, hematochezia, and anemia [1].

Since many patients with colon cancer are asymptomatic during the early stage of the disease, this cancer is considered a silent cancer. Thus, the screening test for colon cancer is recommended for people ages older than 50 years to detect colon cancer in the early stage [1].

Even though smoking was not statistically significantly related to the development of colorectal cancer as indicated by a previous study conducted in Oman, published in 2018 [6], other studies conducted in the United Kingdom, Egypt, and Poland, published in 2004, 2014, and 2022, respectively, have indicated that smoking increases the risk of colon cancer [7, 8, 9].Although physical activity was not statistically significantly related to the development of colorectal cancer based on previous studies conducted in Oman and the United Kingdom, published in 2018 and 2004 respectively [6, 7], other studies conducted in Egypt, Poland, and the United States of America, published in 2014, 2022, and 1999, respectively, have indicated that there is an inverse relationship between physical activity and colon cancer [8, 9, 10]. Although obesity was not statistically significantly related to the development of colorectal cancer according to a previous study conducted in the United Kingdom, published in 2004 [7], other studies conducted in Oman and Poland, published in 2018 and 2022, respectively, have indicated that overweight and obesity increase the risk of colon cancer [6, 9].Though the consumption of fruits and vegetables was not statistically significantly related to the development of colorectal cancer as indicated by a previous study conducted in the United Kingdom, published in 2004 [7], other studies conducted in Oman and Egypt, published in 2018 and 2014, respectively, have indicated that there is an inverse relationship between the consumption of fruits and vegetables and the development of colon cancer [6, 8].It has been shown that the consumption of red meat increases the risk of colorectal cancer based on previous studies conducted in Egypt. 2014 and Poland, 2022 [8, 9].

It has been shown that the consumption of carbohydrates increases the risk of colorectal cancer, as indicated by previous studies [7, 8, 11].The majority of previous studies in the literature review have indicated that there is a relationship between lifestyle factors like poor

diet, physical inactivity, being overweight or obese, and smoking increase the risk of colorectal cancer. Accordingly, these findings have been significant to the public health field in terms of how to prevent colorectal cancer in people. The Heath educators and primary healthcare providers across the world have adopted health education interventions in order to prevent colorectal cancer in people by encouraging them to change their unhealthy behavior to healthy behavior. Despite many studies around the world that have evaluated the relationship between unhealthy lifestyles and colon cancer, there are very few published studies in Libya to evaluate the relationship between unhealthy lifestyles and cancer of the colon.

Thus, the study aims to evaluate the relationship between unhealthy lifestyles and colon cancer in Benghazi.

2. Methodology

2.1 Study Design:

This quantitative, retrospective study was designed to address a specific research question. To ensure the validity and reliability of the findings, the study's questionnaire was developed based on a validated instrument used in previous studies [6, 7, 8 9, 10, 11].

2.2 Study Population:

The participants in the study were 95 cases and 95 controls. Selection of cases: inclusion criteria include the patients that were diagnosed with colon cancer and treated in the Oncology Unit of Benghazi Medical Centre from June to July of 2024, with either males or females of any age. Exclusion criteria include cases with a family history of colon cancer.

Selection of controls: inclusion criteria include people were recruited randomly from the University of Benghazi during June to July of 2024 who do not have colon cancer and matched with cases based on gender and age categories (frequency matching). Exclusion criteria include individuals or relatives who have a family history of colon cancer.

2.3 Data collection and management:

Interviews were conducted, and a written questionnaire was used to collect data from the participants in the study. Since the study is a case-control study, the data were collected retrospectively. The data were collected from the cases and controls during June to July of 2024. The controls were selected from the community and not from the hospitals to avoid control selection bias. The patients were instructed to answer a questionnaire for some time before the disease was diagnosed. The data collected include:

-Socio-demographic data: age, gender, educational level, and employment status.

-Colorectal cancer disease awareness and medical information data: disease awareness, periodic medical checkups, disease stage detection, and diseases other than colon cancer.

-Data about lifestyle factors: body mass index, smoking status, physical activity, and diet habit. To avoid the responder bias (recall bias) due to the self-reported height, weight, and BMI, the height and weight were collected (at the time of admission to the hospital) from the patient files in the hospital. The BMI was computed for each patient by the BMI calculator from the CDC [12]. Age and gender are potential confounding variables in the study based on previous studies [8, 11] and the biologically believable facts. Thus, the cases and controls were matched according to age and gender during data collection to remove the confounder effect and to ensure the accuracy of the results in the study. Additionally, the family history of colon cancer is a potential confounding variable based on a previous study [8] and the biologically believable facts. Thus, the participants in the study were restricted to participants with no family history of colon cancer during data collection to ensure the accuracy of the results in the study.

1.3 Data Analysis:

The SPSS software (statistical package for the social sciences) was used to analyze data in the study. First of all, the collected data were entered in the SPSS by creating the variables in

the variable view and entering data in the data view. Secondly, the data cleaning process was performed before data analysis on SPSS to ensure the findings of the study were accurate.
Finally, the data were analyzed by performing the descriptive analysis in SPSS to use the cross tabulation to calculate the counts and percentages. The graphical representation of data was performed by the clustered bar graphs. The assumptions for binary logistic regression were tested before using a binary logistic regression test for the inferential analysis in SPSS. The assumptions of a binary logistic regression test include the sample size, the normality of the distribution, and multi-collinearity. The data of the study met the assumptions for the binary logistic regression test. The binary logistic regression test was used and the polychotomous variables were recoded as dummy variables.
The statistically significant results were for p values less than 0.05. As a part of the binary logistic regression test, the odd ratio was calculated to evaluate if the relationship between each independent variable (lifestyle variables) and dependent variable (colon cancer) is a causative or a protective relationship. The 95% confidence interval of the odd ratio was calculated to evaluate if the relationship is statistically significant (if the range of the confidence interval passes through 1, it is not significant).

2.4 Ethical Considerations:

An approval was gotten from the oncology unit of the Benghazi medical Centre to collect data from the patients with colon cancer treated in the unit to make the collection process easier.
Additionally, the ethical considerations were obeyed in carrying out the study, which include voluntary participation of the participants, informed consent from the participants to participate in the study, anonymity (the identifiable information was not collected from the participants in the study), and confidentiality (the information was kept protected and secured).

2. Results and Discussion

According to the socio-demographic variables, 52.6% of the cases were male, 38.9% of the cases were for ages less than 55 years, 28.4% of the cases were university level of education, and the most of the colorectal cancer cases were worked (47.4%).

As stated by the educational level, 28.4% of the cases were university-level, while 60% of the controls were university-level. However, the inferential analysis for the study indicated that educational levels were not statistically significantly related to colon cancer (p-value is 0.388 for middle school level, 0.545 for high school level, and 0.189 for university level of education, all compared to primary school level of education). As indicated by the disease awareness, most of the colorectal cancer cases had low colorectal cancer disease awareness (81.1%), while the controls with good colorectal cancer disease awareness were 35.8%.Thus, the descriptive analysis of the study indicated that low disease awareness increases the risk of colorectal cancer. It is reasonable since people with good knowledge about the risk factors of the disease (colorectal cancer) are at a lower risk of the disease.
Based on the periodic medical checkup, the percentage of the colorectal cancer cases that did not adhere to the periodic medical checkup was 74.7%. On the other side, the percentage of the controls that did not adhere to the periodic medical checkup was 68.4%. Thus, these findings show the importance of the medical checkup for the screening of colorectal cancer in order to prevent the development of colorectal cancer.
However, there is not much difference between the percentages of exposure in the cases and controls. (74.7%, 68.4%).
According to the disease stage detection, the majority of the colorectal cancer cases were detected in the late stage of the disease (50.5%). The most cases did not adhere to the screening test for colorectal cancer since the most of them were detected in the late stage of the disease.

Table 1. Colorectal Cancer Cases and Controls according to the Sociodemographic Variables

Socio-demographic Variables		Colorectal Cancer Cases		Controls	
		N	%	N	%
Age Groups	Less than 55 years	37	38.9%	37	38.9%
	55 to 65 years	34	35.8%	34	35.8%
	Older than 65 years	24	25.3%	24	25.3%
Gender	Male	50	52.6%	50	52.6%
	Female	45	47.4%	45	47.4%
Educational Level	Primary School	21	22.1%	9	9.5%
	Middle School	25	26.3%	13	13.7%
	High School	22	23.2%	16	16.8%
	University	27	28.4%	57	60%
Employment Status	Work	45	47.4%	40	42.1%
	Retired	21	22.1%	21	22.1
	Does not work	29	30.5%	34	35.8%
Total		95	100%	95	100%

Table 2 Colorectal Cancer Cases and Controls based on Colorectal Cancer disease awareness and Medical Information

Awareness and Medical Information		Colorectal Cancer Cases		Controls	
		N	%	N	%
Disease Awareness	Good	12	12.6%	34	35.8%
	Medium	6	6.3%	24	25.3%
	Low	77	81.1%	37	38.9%
Medical Checkup	Yes	24	25.3%	30	31.6
	No	71	74.7%	65	68.4%
Disease Detection Stage	Early Stage	47	49.5%	0	0%
	Late Stage	48	50.5%	0	0%
	No Disease	0	0%	95	100%
Diseases other than colon cancer	Diabetes	8	8.4%	8	8..4%
	Hypertension	11	11.6%	8	8.4%
	Diabetes and Hypertension	10	10.5%	14	14.7%
	Other Diseases	7	7.4%	10	10.5%
	No Other Diseases	59	62.1%	55	57.9%
Total		95	100%	95	100%

Thus, this result shows the importance of the screening test for early detection of colorectal cancer.

In accordance with the cases that have diseases other than colorectal cancer and controls that have any disease, the majority of the colorectal cancer cases were hypertensive (11.6%) and diabetics (8.4%). The most of the controls had both diabetes and hypertension (14.7%). As indicated by these results, controlling blood pressure and blood glucose level might decrease the risk of colon cancer. Notwithstanding, most cases did not have diseases other than colorectal cancer and the most controls did not have any diseases.

As indicated by the BMI, the most cases were normal weight (35.8%) while the most controls were overweight (40%). Additionally, the inferential analysis for the study indicated that BMI was statistically significant related to colon cancer (P = 0.045; odd ratio is 0.927, 95% CI of odd ratio (0.861 to 0.998)). Thus, the study indicated that high BMI is protective against the development of colon cancer. However, these findings are in contrast with previous studies (6, 9) which showed that

obesity and overweight increase the risk of colon cancer.

As stated by the coffee and tea addiction, 61.1% of the colorectal cancer cases were not addicted to the coffee and tea, while 54.7% of the controls were not addicted to the coffee and tea. Notwithstanding, the inferential analysis of the study indicated that coffee and tea addiction was not statistically significant related to colon cancer (P = 0.681). This result is in contrast with a previous study which showed that caffeine consumption is inversely related to colon cancer [11].

Based on smoking status, the colorectal cancer cases and controls among non-smokers were 72.6% and 67.4% respectively. 11.6% of the colorectal cancer cases were smokers. 11.6% of the controls were ex-smokers. Additionally, the inferential analysis of the study indicated that smoking was not statistically significant related to colon cancer (P = 0.249 for ex-smokers, P = 0.108 for smokers all compared to non-smokers). Although these results are in agreement with a previous study [6], other studies indicated that smoking is associated with the development of colon cancer [7, 8, 9].

According to the physical activity, the colorectal cancer cases and controls that were physically inactive were 68.4% and 50.5% respectively. The colorectal cancer cases and controls that were physically active were 31.6% and 49.5% respectively. Nevertheless, the inferential analysis of the study indicated that physical activity was not statistically significant related to colon cancer (P = 0.062). Though this result is in agreement with previous studies [6, 7], other studies were indicated that physical activity is inversely related to colon cancer [8, 9, 10].

As indicated by the healthy diet plan, the colorectal cancer cases and controls that did not follow a healthy diet plan were 83.2% and 77.9% respectively. The colorectal cancer cases that followed a healthy diet plan were 16.8%. The controls that followed a healthy diet plan were 22.1%. Additionally, the inferential analysis of the study indicated that there is a statistically significant inverse relationship between the healthy diet plan and colon cancer (P = 0.045, odd ratio 0.379, 95% CI of odd ratio (0.147 to 0.977). Thus, the inferential analysis of the study indicated that the healthy diet plan is protective against colon cancer.

In accordance with the number of meals, the colorectal cancer cases that consumed more than two meals per day were 60%. The controls that consumed more than two meals per day were 75.8%. The colorectal cancer cases that consumed one meal per day were 3.2% while the controls that consumed one meal per day were 1.1%. However, the inferential analysis of the study indicated that the number of meals was not statistically significant related to colon cancer (P = 0.200 for two meals per day, 0.067 for more than two meals per day, all compared to one meal).

Based on carbohydrate consumption, the colorectal cancer cases and controls that consumed carbohydrates as one of the major content in the meals were 95.8% and 90.5%. Nevertheless, the inferential analysis in the study indicated that carbohydrate consumption was not statistically significant related to colon cancer (P = 0.442). This result is consistent with previous studies which indicated that the Consumption of carbohydrates increases the risk of the colorectal cancer [7, 8, 11].

As stated by vegetable consumption, the colorectal cancer cases and controls that consumed vegetables as one of the major content in the meals were 83.2% and 44.2%. Also, the inferential analysis in the study indicated that vegetables consumption was statistically significant related to colon cancer (P = 0.001; odd ratio is 4.619, 95% CI of odd ratio (1.912 to 11.161)). These findings indicated that the consumption of vegetables is a causative of colon cancer. Furthermore, these results are in contrast with previous studies which indicated that the consumption of fruits and vegetables decreases the risk of colon cancer (6, 8). According to red meat consumption, the colorectal cancer cases and controls that consumed red meat as one of the major contents in the meals were 76.8% and 54.7%. Moreover, the inferential analysis in the study indicated that there is statistical significant relationship between red meat consumption and colon cancer (P = 0.042; odd ratio is 2.479, 95% CI of odd ratio (1.035 to

5.933)). These findings indicated that the consumption of red meat is a causative of colon cancer which is in agreement with previous studies [8, 9].

As indicated by sugars consumption, the colorectal cancer cases that consumed sugars one time per day consumption were 37.9%. The controls that consumed sugars one time per day were 44.2%. The controls that consumed sugars for more than one time per day were 43.2%. Additionally, the inferential analysis in the study indicated that sugars consumption was statistically significant inversely related to colon cancer (P = 0.007; odd ratio is 0.243, 95% CI of odd ratio (0.087 to 0.676) for one time per day sugar consumption compared to no consumption) and (P = 0.004; odd ratio is 0.222, CI 95% of odd ratio (0.079 to 0.624) for more than one time per day sugar consumption compared to no consumption). These results indicated that the consumption of sugars is a protective against colon cancer which is in contrast with previous studies [8, 11].

The study indicated that the relationship between lifestyle factors like (BMI, vegetables consumption, sugars consumption, carbohydrates consumption, physical activity, and smoking status) and the development of colon cancer is not in agreement with the majority of previous studies in the literature review, the general knowledge about the topic, and the hypothesis of the study.

Thus, future studies will be needed for further evaluation of the relationship between lifestyle factors and colon cancer in Libya. It is recommended to find strategies to avoid self-report bias and to decrease recall bias to improve the accuracy of the findings when they evaluate the relationship between lifestyle factors and colon cancer.

Table 3. Binary logistic regression analysis for the educational levels

Educational level	P Value	Odds ratio (OR)	95% C.I for Odds ratio
Middle School Level	0.388	1.752	0.490 to 6.266
High School Level	0.545	1.476	0.418 to 5.209
University Level	0.189	0.473	0.155 to 1.445

Note: Primary School is the reference for other educational levels dummy variables in the Binary Logistic Regression.

Table 4. Binary logistic regression analysis of life style factors increase the risk of Colorectal Cancer

Variables	P Value	Odds ratio (OR)	95% C.I for Odds ratio
Vegetables Consumption	0.001	4.619	1.912 to 11.161
Red meat Consumption	0.042	2.479	1.035 to 5.933

Table 5. Binary logistic regression analysis of life style factors decrease the risk of Colorectal Cancer

Variables	P Value	Odds ratio (OR)	95% C.I for Odds ratio
BMI	0.045	0.927	0.861 to 0.998
Healthy Diet Plan	0.045	0.379	0.147 to 0.977
Sugars Consumption one time per day	0.007	0.243	0.087 to 0.676
Sugars Consumption more than one time per day	0.004	0.222	0.079 to 0.624

Note: No Sugars Consumption is the reference for Sugars Consumption one time per day dummy variable and Sugars Consumption more than one time per day dummy variable in the Binary Logistic Regression.

3. Conclusion and recommendations

As indicated by the results of the study, the hypothesis of the study is not supported except for the relationship between lifestyle factors (healthy diet plan, consumption of red meat) and colorectal cancer The study indicates that following a healthy diet plan, sugars consumption, and BMI are inversely related to colon cancer. On the other side, red meat consumption and vegetables consumption are causative of colon cancer. However, other independent variables are not related to colon cancer.

Table 6. Binary logistic regression analyses of life style factors

Variables	P Value	Odds ratio (OR)	95% C.I for Odds ratio
Coffee and Tea Addiction	0.681	0.845	0.380 to 1.882
Ex-smoker	0.249	0.532	0.182 to 1.555
Smoker	0.108	0.428	0.152 to 1.203
Physical Activity	0.062	0.484	0.226 to 1.037
Consumption of two meals per day	0.200	0.181	0.013 to 2.467
Consumption of more than two meals per day	0.067	0.089	0.007 to 1.187
Carbohydrates Consumption	0.442	1.812	0.398 to 8.254

Note: Non-smoker is the reference for Ex-smoker dummy variable and smoker dummy variable in the Binary Logistic Regression. Consumption of one meal per day is the reference for Consumption of two meals per day dummy variable and Consumption of more than two meals per day dummy variable in the Binary Logistic Regression.

Future studies will be needed of further evaluation for the relationship between lifestyle factors and colorectal cancer in Libya.

The health educators should be recommended to encourage people to adhere to the screening test for colorectal cancer after 50 years of age, to increase awareness about cancer colon disease among the public, to encourage people to decrease the consumption of red meats, and to encourage people to follow a healthy diet plan in order to decrease the risk of colon cancer.

Limitations of the study

Since the participants of the study were restricted to the participants with no family history of colon cancer, the findings of the study cannot be generalized to people with a family history of colon cancer.

Since the study design was a case control study, it could be difficult for the cases to recall information for the time period before the disease was diagnosed. Thus, the study could be subjected to recall bias.

Since the height and weight were collected from the controls through self-report, the study could be subjected to self-report bias.

Acknowledgement

We are very grateful to the management of the Benghazi Medical Center and the management of the faculty of Public Health at the University of Benghazi for their approval and aid during the research period.

Conflict of Interest

There is no conflict of interest was declared by the authors.

References

1. World Health Organization. (2023, July 11). Colorectal Cancer. https://www.who.int/news-room/fact-sheets/detail/colorectalcancer
2. I. Siala, A. Abushaala, M. Grain, N. Alzaroug, S. Abdulrahman, F. Abudeeb. P-236 Time Interval from Presentation to Treatment of Colorectal Cancer in Libya: A study of Cases Referred to Medical Oncology at Tripoli University Hospital, Tripoli, Libya in 2021. European Society for Medical Oncology. Elsevier Inc. 2022; 33(S4):S332. Available from DOI: https://doi.org/10.1016/j.annonc.2022.04.326
3. Alkuni S, Diekna W, Allafi M, Abdulhamid M, Torjman F. Prevalence of Gastrointestinal Tract Cancer in Western Part of Libya. Alg J. Med App Sci. 2023; 6(2):491-495. https://doi.org/10.5281/zenodo.8270621
4. Bodalal Z, Azzuz R, Bendardaf R. Cancers in Eastern Libya: First Results from Benghazi Medical Center. WJG. 2014; 20(20): 6293-6301. Available from DOI: https://doi.org/10.3748/wjg.v20.i20.6293
5. Laredo V, Garcia-Mateo S, Martinez-Dominguez S J, De La Cruz J L, Gargallo-Puyuelo C J, and Gomollon F. Risk of Cancer in Patients with Inflammatory Bowel Diseases and Keys for Patient Management. Cancers (Basel). 2023; 15(3): 871. Available from DOI: https://doi.org/10.3390/cancers15030871
6. Mafiana R N, Al Lawati A S, Waly M I, Al Farsi Y, Al Kindi M, Al Moundhri M. Association between Dietary and Lifestyle Indices and Colorectal Cancer in Oman: A Case-Control Study. APJCP. 2018; 19(11): 3117-3122. Available from DOI: https://doi.org/10.31557/APJCP.2018.19.11.3117
7. Sanjoaquin MA, Appleby PN, Thorogood M, Mann JI, Key TJ. Nutrition, Lifestyle and Colorectal Cancer Incidence: A Prospective Investigation of 10998 Vegetarians and Non-Vegetarians in the United Kingdom. BJC. 2004;

90(1): 118-121. Available from DOI: https://doi.org/10.1038/sj.bjc.6601441

8. Mahfouz E M, Sadek R R, Abdel-Latief W M, Mosallem F A, Hassan E E. The Role of Dietary and Lifestyle Factors in the Development of Colorectal cancer: Case Control Study in Minia, Egypt. CEJPH. 2014; 22(4): 215-22. Available from DOI: https://doi.org/10.21101/cejph.a3919
9. Lewandowska A, Rudzki G, Lewandowski T, Stryjkowska-Gora A, Rudzki S. Risk Factors for the Diagnosis of Colorectal Cancer. Cancer Control 2022; 29: 10732748211056692. Available from DOI: https://doi.org/10.1177/10732748211056692
10. Slattery M L, Edwards S L, Boucher K M, Anderson K, Caan B J. Lifestyle and Colon Cancer: An Assessment of Factors Associated with Risk. AJE. 1999; 150, (8):869-77. Available from DOI: https://doi.org/10.1093/oxfordjournals.aje.a010092
11. Theodoratou E, Farrington S M, Tenesa A, McNeill G, Cetnarskyj R, Korakakis E, Din F V N, Porteous M E, Dunlop M G, Campbell H. Association between Dietary and Lifestyle Risk Factors and Colorectal Cancer in the Scottish Population. European Journal of cancer prevention. 2014; 23(1): 8-17. Available from DOI: https://doi.org/10.1097/CEJ.0b013e3283639fb8
12. Charan J, Biswas T. How to calculate Sample Size for Different Study Designs in Medical Research? India J Psychol Med. 2013; 35(2): 121-126. Available from DOI: https://doi.org/10.4103/0253-7176.116232

Libyan Journal of Public Health Practices (LJPHP)

Journal homepage: https://journals.uob.edu.ly/LJPHP
ISSN: 3008-1467 (Online)

Case study

Corpus Callosum Hematoma in a 4-Year-Old Child Following Road Traffic Accident. A Case Report

Hind Gazeti[1], Zinab Elfituri[2*] and Sufwan Algrmi[3]

[1]Department of Diagnostic Radiology, Faculty of Medicine, University of Zawia, Zawia, Libya
[2]Department of Medical Physiology, Faculty of Medicine, University of Zawia, Zawia, Libya
[3]Department of Surgery, Faculty of Medicine, University of Zawia, Zawia, Libya

ARTICLE INFO

Article history:
Received 3/9/2024
Revised 26/10/2029,
Accepted 30/10/2024
Available online xxxx

Keywords:
Corpus callosum hematoma
Traumatic subarachnoid hemorrhage
Brain CT
Conservative therapy.

ABSTRACT

A 4-year-old male child presented to the emergency department at Nawat Al Mustaqbal Hospital in Zawia City, following a head injury sustained in a road traffic accident (RTA). During the initial brain CT scan, a corpus callosum hematoma was detected in the interhemispheric fissure, initially thought to be a traumatic subarachnoid haemorrhage (tSAH). A follow-up brain CT conducted six hours later showed no additional abnormal findings. Subsequently, the patient was transferred to the surgical department for conservative treatment. Following a three-day improvement in his condition, he was discharged. Optimal management for corpus callosum hematoma includes good supportive care, careful clinical follow-up, and prompt recognition of delayed complications to achieve the best neurological outcome.

* Corresponding author.
E-mail address: z.elfituri@zu.edu.ly ORCID ID: 0000-0003-0808-490X

1. Introduction

The corpus callosum, a significant structure within the brain, serves as a bridge connecting the two cerebral hemispheres. It comprises approximately 190 million axons, facilitating interhemispheric communication and coordination [1]. Lesions of the corpus callosum are uncommon and can arise from various etiologies. They can be broadly classified into several categories based on their underlying pathophysiology. These include neoplasms, vascular issues, infections, demyelination conditions, leukodystrophy, congenital abnormalities, trauma, and others [2]. Corpus callosum hemorrhage, a rare and serious complication of head trauma, occurs when bleeding accumulates within the corpus callosum. Depending on the location and size of the bleeding, corpus callosum hematoma can cause various neurological squeals, including seizures, cognitive deficits, and motor impairments [3].

In children, head trauma is a leading cause of morbidity and mortality, and the involvement of the corpus callosum can have severe neurological consequences [4]. Corpus callosum hematoma should be quickly recognized as it is an emergent situation requiring immediate neurosurgical intervention to prevent adverse course and sequelae such as increased intracranial pressure, seizures, and long-term neurologic deficits [5]. Managing corpus callosum hematomas in children is difficult since small children may be unable to articulate their clinical symptoms, which could delay an accurate diagnosis. Hence, radiological tools such as computed tomography (CT), magnetic resonance imaging (MRI), and diffusion tensor imaging (DTI) play a considerable role in the detection of corpus callosum hematoma in the pediatric population with head trauma [6]. CT is frequently employed as the first imaging modality to examine head trauma in children because it is easily accessible, quick, and effective in identifying acute cerebral bleeding [7]. Hyperdense lesions inside the corpus callosum are typical CT findings of the corpus callosum hematoma, with or without extension into the surrounding white matter [8]. Because of its important position and the risk of fast neurological degeneration, corpus callosum hematoma must be treated as soon as possible. Depending on the severity of the bleeding and clinical presentation, medications such as diuretics to reduce edema and osmotic agents to lower intracranial pressure may be administered, as well as, anticonvulsants may be used if seizures develop [9]. However, in extreme situations with life-threatening bleeding or a considerable mass effect (compression of adjacent brain tissue), surgical evacuation of the hematoma may be required [10]. The prognosis for children with corpus callosum hematoma varies greatly according to the severity of the first presentation, the degree of bleeding, and the efficacy of therapy [5]. This case report describes the presentation, investigation, management, and challenges encountered in a child who developed a corpus callosum hematoma following head trauma.

2. Case Presentation

A 4-year-old male Libyan child presented to the emergency department at Nawat Al Mustaqbal Hospital in Zawia City, following a head injury sustained in a road traffic accident. The child was a passenger in a car involved in a collision. On arrival at the emergency department, upon evaluation, he was semiconscious with a Glasgow Coma Scale score of 12. He had no orientation, but his direct and indirect light reflexes were positive and his pupils were of equal size. He responded to painful stimuli and could localize the pain. Initial brain CT did not reveal any epidural, subdural, or parenchymal hematoma or midline shift. However, there was a presence of hematoma in the interhemispheric fissure, which was suspected to be a traumatic subarachnoid hemorrhage (Figure 1). He was admitted to the intensive care unit for supportive treatment, and a follow-up brain CT was performed 6 hours later, revealing no new radio pathological findings (figure 2). After 12 hours he became conscious, and oriented, and complained of intermittent headaches.

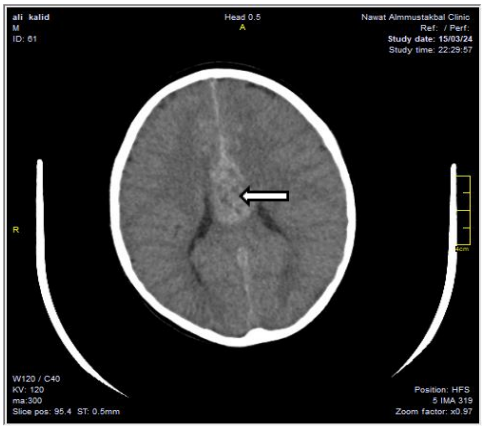

Figure 1. Initial brain CT showed no epidural or subdural hemorrhage, but a traumatic subarachnoid hemorrhage in the interhemispheric fissure with corpus callosum edema.

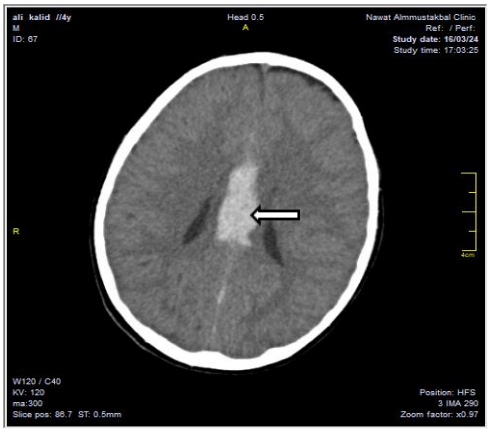

Figure 2. Brain CT showed a clear interhemispheric hematoma on the corpus callosum, causing neurological disorientation.

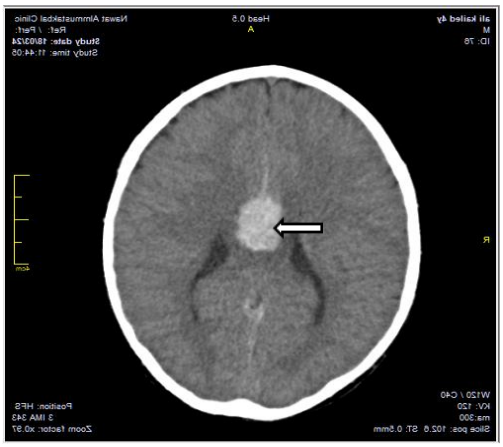

Figure 3. Brain CT showed a smaller hematoma on the corpus callosum, compared to the previous CT image

The patient was then admitted to the surgical department for conservative therapy before being discharged after three days of improvement in his health, (figure 3) shows the last CT on discharge day.

3. Discussion

This case report describes a 4-year-old child who presented with a suspected traumatic subarachnoid hemorrhage (tSAH) after suffering a head injury in a RTA. Although no major intracranial hematomas exist on initial CT scans, blood is identified in the interhemispheric fissure that may indicate a corpus callosum hemorrhage (tSAH).

The child initially presents semiconscious with a Glasgow Coma Scale (GCS) score of 12, indicating a moderate head injury. A responsive light reflex, reaction to pain localization, and improving consciousness within 12 hours were good prognostic signs. The presence of blood in the interhemispheric fissure (corpus callosum hematoma) on the initial CT scan, with no other significant findings, was a typical presentation of a tSAH. A follow-up CT scan with no new abnormalities further increases the suspicion of a tSAH. Routine intensive care unit (ICU) support was a reasonable first approach. Pain management and close observation as an outpatient was an adequate conservative treatment in this case.

The diagnosis of tSAH can be difficult, especially in children. Although CT scans were sensitive in identifying blood within the subarachnoid space, the diagnosis may sometimes need to be confirmed by lumbar puncture and cerebrospinal fluid (CSF) analysis. Lumbar puncture, however, is not routinely performed in all cases as there can be some risk involved with the procedure, particularly in suspected increased intracranial pressure cases.

Despite this child's clinical improvement, long-term follow-up is imperative. Children who have sustained a tSAH may be at higher risk for delayed complications, such as the development of hydrocephalus (fluid accumulation in the brain) or vasospasm (blood vessel narrowing). Imaging and clinical follow-up to detect these delayed complications is, therefore indicated.

Conclusion

This case illustrates the importance of maintaining a high index of suspicion for subarachnoid hemorrhage at corpus callosum in the setting of head trauma, even when initial CT findings are normal. Delayed presentations of traumatic subarachnoid hemorrhage have been reported in the literature, and clinical history and examination may lead to important clues. Optimal management includes good supportive care, careful clinical follow-up, and prompt recognition of delayed complications for the best neurologic outcome.

Conflict of Interest and Financial Disclosure

There are no financial, personal, or professional conflicts of interest to declare.

References

1- Aboitiz, F. (2017). A Brain for Speech. Springer. http://books.google.ie/books
2- Ayaz H, Baker WB, Blaney G, et al. Optical imaging and spectroscopy for the study of the human brain: status report. Neurophotonics. 2022;9(S2). doi:10.1117/1.nph.9.s2.s24001
3- Cassar-Pullicino V, Oswestry, Uk, Taylor S, Schmidt S. ECR 2014, Part A. Insights Into Imaging. 2014;5(S1):1-133. doi:10.1007/s13244-014-0316-6
4- Curvelo E, Viana L, De Jesus Santos L, et al. Communication Disorders Following Traumatic Brain Injury. In: InTech eBooks. ; 2014. doi:10.5772/57321
5- Hamad MK, Takruri DH, Patro SN, Habib MB, Verma V. Corpus callosum hematoma, as a rare complication of COVID-19. Clinical Case Reports. 2021;9(12). doi:10.1002/ccr3.5178
6- Mandine N, Tavernier E, Hülnhagen T, et al. Corpus callosum in children with neurodevelopmental delay: MRI standard qualitative assessment versus automatic quantitative analysis. European Radiology Experimental. 2023;7(1). doi:10.1186/s41747-023-00375-4
7- Galgano M, Toshkezi G, Qiu X, Russell T, Chin L, Zhao LR. Traumatic Brain Injury. Cell Transplantation. 2017;26(7):1118-1130. doi:10.1177/0963689717714102

8- Pascual JM. Progressive Brain Disorders in Childhood. Cambridge University Press; 2017. http://books.google.ie/books?id

9- Kadyrova A, Baudinov I, Alin G, Mamytova E , Antipina I , Kyrbasheva I , Toktogaziev B , Bazarbaeva A ,Tagaev T , Vityala Y. Roles of diagnostic imaging techniques in traumatic brain injury. Biomedicine. 2022;42(1):1-10. doi:10.51248/.v42i1.1117

10- Florian IA, Timis TL, Aldea CC, Florian IS. Preventing Rupture: Clipping of Unruptured Intracranial Aneurysms. In: IntechOpen eBooks. ; 2020. doi:10.5772/intechopen.88038

Libyan Journal of Public Health Practices

(LJPHP)

Journal homepage: https://journals.uob.edu.ly/LJPHP
ISSN (Online) 3008-1467

Case study

The Critical Role of Mixed Methods Research in Public Health: Insights from Real-World Case Studies

Abdelfattah Elbarsha*, Aiman Gannous and Ibrahim Elbakosh

Department of Health Informatics, University of Benghazi, Libya

ARTICLE INFO

Article history:
Received 2/10/2024
Revised 22/10/ 2024
Accepted 10/11/2024
Available online xxxx

Keywords:
Mixed methods research
public health
quantitative analysis
quantitative analysis
statistical rigor

ABSTRACT

Mixed methods that combine quantitative and qualitative elements of the approach afford a better capture of the intricacies of health-related issues than any single-method designs. In this review research, we explore the role and importance of mixed methods research in public health by examining how it has been applied in several real-world case studies. The review aims to demonstrate how the mixed methods approach provides an in-depth insight and understanding of public health interventions and their outcomes. Four public health case studies were analyzed to determine the value of mixed methods. The review also goes further to compare the mixed-methods approach with one that is solely quantitative or qualitative. Mixed methods created enormous advantages by putting together statistical rigor with rich contextual insights. Mixed-methods studies can provide a more comprehensive and nuanced view of public health issues than single-method approaches. Mixed methods offered the capacity for in-depth analysis of both measurable outcomes and contextual factors due to their integrative nature with quantitative and qualitative data; hence, we found that complex studies regarding public health could not have been possible without such a method. In addition, the application of mixed methods increased the robustness of public health research by combining empirical data with the community's experiences.

* Corresponding author.
E-mail address: Abdelfattah.elbarsha@uob.edu.ly

1. Introduction

Mixed-methods research is a methodology wherein quantitative and qualitative research strategies are conducted conjointly to provide a holistic approach to research questions. It encompasses collecting, analyzing, and interpreting numerical data or words/texts in a single study or multiple studies. This approach enables researchers to study complex phenomena by capitalizing on the strengths of both methods and, in that way, increases the level and breadth of understanding that might not be achieved by either method alone [1].

Mixed-methods research allows scope for the interplay between numeric data and social context, which is considered vital in understanding complex health issues. The approach also allows the study of quantitative issues, for example, the prevalence of a health condition, and then explores the qualitative dimensions, such as patient experiences, cultural beliefs, and social determinants of health. As an example, the integration of statistical analysis and in-depth qualitative insight has played a great role in the formulation of effective public health interventions, in developing those to suit community needs, and in assessing the outcomes of interventions developed [2].

While there has been a growing awareness of the complexities associated with health issues, traditional research methods often rely on purely quantitative or qualitative approaches, thus failing to fully reflect the multifaceted nature of health-related problems. The sole reliance on quantitative approaches undermines contextual variables and personal experiences that influence health behaviors, while qualitative approaches have limited generalizability and the statistical strength required for policy adaptation at broader scales. This gap limits the ability to fully understand and address public health challenges in a way that is both data-driven and contextually relevant [3]. The purpose of this study is to describe the importance of utilizing a mixed-methods approach when working in the field of public health. The integration will provide a better comprehension of health-related issues on both quantitative and qualitative data, thus enabling the bearing of the same on the setting of public health intervention and policy decisions to further advance the success of health improvement promotions. The aim is to advocate for a broader adoption of mixed-methods research as a standard practice in public health, enabling evidence-based interventions to be tailored to meet the particular needs and contexts of their target population.

1.1 Philosophical Underpinnings

The philosophical underpinnings of mixed methods studies are located in pragmatism, which holds that the choice of research method should be guided by the nature of the research question rather than adherence to a single paradigm. Pragmatism embraces the notion that there are different valuable perspectives and methodologies. In this respect, pragmatism allows an adaptable outcome-oriented approach. This philosophical stance contrasts with positivism, which underpins quantitative research in its emphasis on objectivity and measurable outcomes, and constructivism, guiding qualitative research in the subjective interpretation of social phenomena [4]. Pragmatism, being adaptable, is especially suitable for mixed methods studies where the aim is to provide actionable findings that combine empirical evidence and contextual understanding. A variety of design typologies supports mixed methods research, each tailored for specific research needs.

1.1.1 Convergent parallel design:

In this approach, quantitative and qualitative data are collected side by side but analyzed separately before being compared or merged to provide a comprehensive interpretation of the research problem as seen in Figure 1. This design allows for the cross-validation of findings but may become problematic when the results from quantitative and qualitative analyses do not agree.

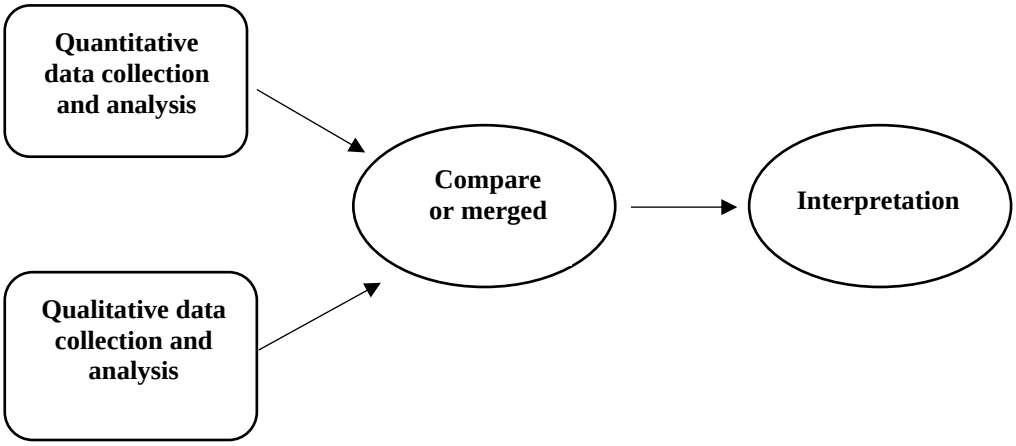

Figure 1. Convergent parallel design

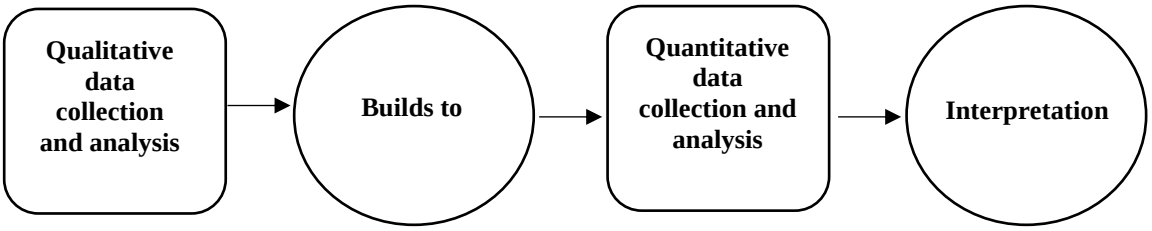

Figure 2. Exploratory sequential design

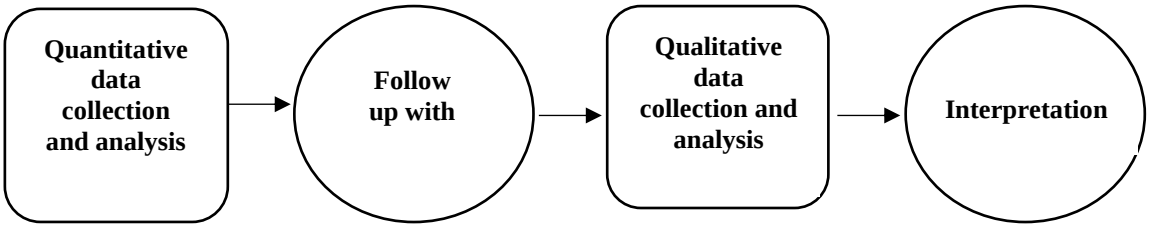

Figure 3. Explanatory Sequential Design

1.1.2 Exploratory Sequential Design:

This method involves gathering qualitative data to investigate a phenomenon first to construct themes from the interviews and build up questions to be tested and generalize the findings (Figure 2). This design is useful for investigating new or poorly understood disciplines.

1.1.3 Explanatory Sequential Design:

Quantitative data are collected and analyzed to

first find out the trends or relationships, followed by qualitative methods to explain these findings in greater detail (Figure 3). This is useful when initial quantitative results create questions that are best further explored.

1.2 Data Integration Strategies

Effective integration strategies for data are essential in successful mixed methods research, facilitating the complementarity of quantitative and qualitative results. Prominent strategies encompass data triangulation, pattern matching, and parallel analysis. Such methodologies contribute to the validation of results and offer a more comprehensive understanding of the research question[1].

2. Methodology

The review study adopted a narrative synthesis approach for evaluating the critical contribution of mixed-methods research in public health. Data collection was performed in three major steps involving the selection of case studies, analysis of applications of mixed methods, and hypothetical assessment of single-method scenarios.

2.1 Selection of Case Studies

A purposeful sampling strategy was adopted to select relevant case studies to illustrate the significance of the utilization of mixed methods in public health. Major academic databases were searched using a combination of keywords like "mixed methods," "public health," "health interventions," "disease surveillance," and "evaluation" through PubMed, Scopus, and Google Scholar. Inclusion criteria were limited to mixed-methods case studies published in peer-reviewed journals in the last 10 years. After reviewing the abstracts and full texts of eligible studies, four case studies were selected for in-depth analysis:

Case Study I: Assessing Health Needs in South Los Angeles, California, USA

Case Study II: Evaluating a Community-Based Cancer Prevention Intervention

Case Study III: Cardiovascular Health Promotion Capacity in Youth

C**ase Study IV:** Ebola Outbreak in Sierra Leone

2.2 Analysis of Mixed Methods Applications

All case studies were analyzed in detail to precisely explore what role the application of mixed methods plays in solving public health problems. In applying this analysis, attention was given to:

- The integrated quantitative and qualitative data that result in a more complete understanding of health issues.
- The added value of mixed methods concerning contextualization, depth of insight, and explanation of complex relationships between health determinants and outcomes.
- Identifying the respective contribution of each method, qualitative and quantitative, to the overall contribution of the study findings.

The review considered the extent to which mixed methods allow researchers to:

- Capture both statistical trends (quantitative data) and participant perspectives (qualitative data).
- Account for cultural and contextual issues not as clearly seen through a single method.
- Develop more holistic public health strategies and interventions.

2.3 Hypothetical Assessment of Single-Method Scenarios

A series of hypothetical scenario analyses were carried out to further assert the strength of mixed methods. In this stage, each case study was revisited with the assumption that either qualitative or quantitative methods have been adopted exclusively. This review outlined which gaps and limitations might have occurred with a single-method approach. Key aspects considered were:

- Quantitative-only studies lacking depth in context.
- Limited generalizability and statistical power are associated with qualitative-only studies.

- Missed opportunities in data triangulation and cross-validation of findings.

2.4 Synthesis of Findings

A comparative analysis of the key findings from each case study was conducted; in Table 1, a comparative of the key differences and strengths of mixed methods approaches concerning the use of quantitative and qualitative approaches separately was developed. The table showed how integrating quantitative and qualitative data yields more robust and actionable insights than if either method were used in isolation. Synthesis emphasized how mixed methods permitted an exploration of the complexities of public health issues and statistical trends to the constituent human experiences and the underlying human experiences and cultural contexts.

3.Results

The findings of this review highlight the benefits of applying mixed methods research in public health, reflected in the case studies presented. By mixing both quantitative and qualitative approaches, mixed methods can provide a holistic understanding of complex health issues that neither approach can achieve separately. The following discussion explores these benefits in detail, using real-world examples to contextualize the theoretical strengths of mixed methods research. These are discussed in greater detail below, using real examples to illustrate how the theoretical strengths of mixed-methods studies might be realized in actual practice. Accompanied by a comparison table to further illustrate the statistical properties and advantages such as validity, generalizability, depth of understanding across different research designs, statistical power, and reliability that mixed methods provide over purely quantitative or qualitative approaches.

3.1 Health Needs Assessment

The identification and addressing of health priorities within a specified population is important in health needs assessments. Mixed-methods approaches will be especially useful, whereby quantitative data in the form of health statistics and survey results are combined with qualitative insights through in-depth interviews or focus group discussions. This forms a complex and detailed understanding of the health need, thus explaining not only the "what" of health issues but also the underlying "why" relating to these. This integrative perspective enables public health professionals to formulate more inclusive and culturally sensitive strategies that tackle both the health issues and their underlying factors [5].

Case Study: Assessing Health Needs in South Los Angeles

A mixed-methods study was conducted to assess the health needs of residents living in South Los Angeles. Quantitative findings from health questionnaires indicated high rates of obesity and diabetes. However, the qualitative component, including focus groups and interviews, uncovered deeper contextual issues, such as limited availability of fresh food, financial barriers to healthcare access, and cultural tendencies toward traditional food choices. This integration of evidence-based, targeted interventions encompasses efforts to increase access to healthy affordable foods, and the provision of culturally competent nutrition education programs [6].

3.2 Intervention Evaluation

Mixed methods research is an integral part of the comprehensive assessment of public health interventions, allowing investigators to examine both quantifiable results and contextual elements that determine whether an intervention works or does not. By integrating the quantitative data, emphasizing efficacy and statistical significance, with qualitative data aimed at examining the lived experiences and perceptions of participants, mixed methods evaluations yield a deeper understanding of how interventions function in the real world.

Mixed-methods evaluation provides an expansive approach in the evaluation of public health interventions since they provide

Table 1. Comparison of Statistical Properties and Research Outcomes: Mixed Methods vs. Quantitative and Qualitative Approaches

ELEMENT	QUANTITATIVE METHODS	QUALITATIVE METHODS	MIXED METHODS	EXAMPLE FROM CASE STUDIES
VALIDITY	Provides statistical validity through numerical data (e.g., p-values, confidence intervals) but can miss context.	Offers contextual validity, explaining the 'why' behind phenomena, but lacks statistical rigor.	Combines statistical validity with contextual relevance, ensuring more robust and meaningful findings.	In the South Los Angeles study, high obesity rates (quantitative) were complemented by understanding cultural food preferences (qualitative).
GENERALIZABILITY	High generalizability due to large sample sizes and statistical analysis.	Low generalizability due to small, context-specific samples.	Balanced generalizability, where statistical findings are informed by real-world contexts and specific cases.	The cancer prevention intervention study showed broader statistical trends, while focus groups revealed issues with training and implementation that were not generalizable.
DEPTH OF UNDERSTANDING	Provides breadth of data but can overlook underlying causes.	In-depth exploration of themes, but lacks statistical metrics.	Offers both breadth and depth, ensuring comprehensive understanding supported by data.	The South Los Angeles study captured health statistics (quantitative) and paired them with insights about access to healthy food (qualitative), offering both the “what” and the “why” of health outcomes.
RELIABILITY	Ensures reliability through replicable statistical procedures.	Reliability depends on researcher skill and interpretation.	Increases reliability through quantitative verification of qualitative insights, reducing subjective errors.	In the cardiovascular health promotion study, statistical surveys (quantitative) were supported by consistent themes from focus group discussions (qualitative), enhancing reliability.
STATISTICAL POWER	Strong, especially with large datasets, but limited to predefined hypotheses and variables.	No statistical power; relies on non-numerical exploration.	Increases statistical power by combining the strengths of both numerical data and qualitative depth.	In the cancer prevention study, the statistical relationship between high-quality program implementation and outcomes was strengthened by qualitative insights explaining the reasons behind program failures.

empirical evidence of the efficacy, while at the same time, outlining the nuanced comprehension of contextual elements that influence this process. This integrative approach guarantees that public health initiatives are effective not only in principle but also practical, viable, and adaptable to the needs and circumstances of the population they target to serve [7].

Case Study: Evaluating a Community-Based Cancer Prevention Intervention

The study tested how a community-based cancer prevention program was being

implemented and how the quality of its implementation was affecting participants' outcomes. The authors combined qualitative and quantitative strategies to assess multiple facets of program success with use of the Consolidated Framework for Implementation Research. Such a combination allowed a thorough and detailed assessment of both kinds of data. The quantitative findings showed the clear relationship of high-quality program implementation to better participant outcomes, such as increased physical activity and healthier lifestyle intentions. Qualitative data explain why the effective implementation was not realized in this study-that is, training, program design, and leadership were particularly problematic. These insights were critical in identifying ways for improvement that might not have been captured as clearly in quantitative measures alone. The study has stressed the importance of using mixed methods in assessing public health interventions, as only a combination of quantitative data and in-depth qualitative information can lead to a more comprehensive understanding of the factors behind the success or failure of programs [8].

3.3 Health Promotion Programs

The development and evaluation of health promotion programs benefit from the mixed-methods research. Such an approach allows program developers to adapt their interventions through iterations in real-world settings where they are implemented. Mixed methods approach ensure that participants feel empowered, and their experiences are considered when designing the program through integrating both quantitative and qualitative data. This translates to improved public health results as well as enhanced community involvement [1; 5]

Case Study: Cardiovascular Health Promotion Capacity in Youth

An article entitled "Building School-based Cardiovascular health promotion capacity in youth: A mixed methods study" is an exemplary use of mixed methods in evaluating health promotion programs. The research focused on a school-based intervention aimed at empowering students to promote cardiovascular health. The study assessed how such intervention impacts students' decisions as well as their understanding of what it means to have a healthy heart by using qualitative data (focus groups and journals) along with quantitative measures (surveys.). This design provided insights into both the process and outcomes, demonstrating how mixed methods can offer a holistic evaluation of health interventions [9].

3.4 Disease Surveillance and Outbreak Investigation

A mixed methods approach considerably improves disease surveillance and outbreak investigation by synthesizing the advantages of quantitative and qualitative methodologies. For instance, quantitative data like disease incidence metrics, death rates as well as infection rates provide basic information regarding the magnitude and evolution of an epidemic. However, these statistics do not provide enough context to comprehend the underlying behavioral, social and cultural determinants that induce disease transmission on their own. Community behaviors, public perception and risk factors which can influence disease dynamics need to be properly understood through qualitative techniques for example interviewing people focusing groups or ethnographic studies.

Case Study: Ebola Outbreak in Sierra Leone

A research was conducted during the Ebola outbreak in Sierra Leone used a mixed methods approach in disease surveillance and outbreak investigation. It evaluated infection prevention and control (IPC) measures in primary healthcare settings using both quantitative and qualitative methods. In addition to analyzing IPC compliance and changes in practice over time, it included interviews with healthcare workers (HCWs) and community members to understand psychosocial impacts. This

combination of approaches ensured that both the technical and human aspects of disease control during the Ebola outbreak were fully understood, enabling adjustments to IPC policies according to the exigencies of a health crisis[10].

4. Discussion

4..1 Health Needs Assessments in South Los Angeles

If only quantitative methods had been used in this health needs assessment, researchers would have identified the high rates of obesity and diabetes in the population, but they would lack the understanding of the deeper, context-specific issues contributing to these trends. Factors such as access to fresh food, financial barriers to healthcare, and cultural practices related to diet would not be uncovered. This could lead to interventions focused only on reducing obesity or diabetes through generalized programs that might not address the real, underlying causes of these health problems. Without the qualitative insights from interviews and focus groups, public health professionals might implement programs that are poorly suited to the community's actual needs and are less likely to be effective.

4.2 Evaluating a Community-Based Cancer Prevention Intervention:

In the case of the cancer prevention intervention studied here, a purely quantitative approach would most likely result in the statistical processing of the effective running of the program in terms of quantitative outcomes, such as family physical activity levels or behavioral intentions to change to healthier alternatives. While this is important information, by itself it would not provide insight into the issues of implementation that might have occurred, such as problems with training, leadership, and design of the program. Researchers and program developers would not know through qualitative data why certain parts of the program did not work and how those parts could be improved. Without qualitative data, researchers and program developers would miss out on understanding why certain aspects of the program were not effective and how they could be improved. The lack of mixed methods might result in future interventions replicating the same problems without addressing critical program delivery issues, leading to lower participant engagement and suboptimal outcomes.

4.3 Cardiovascular Health Promotion in Youth:

In this school-based intervention, if there had solely been quantitative questionnaires to measure the outcomes, it is likely that the researchers would have measured knowledge and behavior change about cardiovascular health in students. Quantitative data alone, devoid of any focus group input or journal entries from students, would fail to provide insight into how well the program was received by the students, how the program was perceived by the students, or if they were more empowered to make healthier choices in lifestyle. The qualitative aspect also gives good insight into the cultural and social dynamics that may play a role in the success of the program. These are elements that perhaps might be lost with a purely quantitative approach, which would thus yield a less adaptable and less effective intervention, especially as aspects of the program may not be consistent with the experience of the students participating in it.

4.4 Disease Surveillance and Outbreak Investigation during the Ebola Outbreak in Sierra Leone :

If only quantitative data were used, then such attention would have been given to infection rates, mortality rates, and compliance with IPC measures during the outbreak of Ebola. Such data would provide a very clear view of both the progress of the outbreak and the true effectiveness of the IPC protocols in place but without the key qualitative insights into the psychosocial impacts on both healthcare workers and the community. Understanding fear, stigma, and misinformation through interviews with the affected individuals and healthcare providers was paramount to getting to the bottom of community reluctance to

adhere to IPC guidelines. Without these insights, pure quantitative surveillance would provide only an incomplete portrait of an outbreak and pave the way for policies that might be technically sound but socially ineffective.

5. Conclusions

This review emphasizes the critical contribution of mixed methods research to public health by showing that in such situations, it may provide comprehensive insight into complex health issues. The use of case studies from various areas of health needs assessment, intervention evaluation, health promotion, and disease surveillance gave the impression that mixed-methods approach offered some advantages not observed with purely quantitative or qualitative approaches. It embeds statistical strength in contexts, hence allowing subtle and more culturally appropriate interventions that could address not only the measurable outcomes but also facilitating and inhibiting contexts of the challenges at hand. In Conclusion, the application of mixed methods enhances the robustness of public health research by combining empirical data with the lived experiences of communities. This leads to more effective, adaptable, and inclusive health strategies. With the absence of a mixed-methods approach in the case studies reviewed, key factors, such as the social determinants of health, community behavior, and problems in program implementation, may not have been captured and will result in poorly effective interventions and policies. Hence, mixed-methods studies have become an instrument of high value and importance for unraveling the complex nature of issues concerned with public health.

Conflict of Interest and Financial Disclosure

The author(s) declare no conflict of interest regarding the publication of this paper. Additionally, no financial support, grants, or funding was received from any organization or individual that could influence the outcomes or interpretations of this study.

References

1- Creswell JW, Clark VLP. Designing and Conducting Mixed Methods Research. Sage Publications; 2017.
2- Johnson RB, Onwuegbuzie AJ, Turner LA. Toward a definition of mixed methods research. J Mixed Methods Res. 2007;1(2):112-133. doi:10.1177/1558689806298224.
3- Fetters MD, Curry LA, Creswell JW. Achieving integration in mixed methods designs—principles and practices. Health Serv Res. 2013;48(6 Pt 2):2134-2156. doi:10.1111/1475-6773.12117.
4- Tashakkori A, Teddlie C. SAGE Handbook of Mixed Methods in Social and Behavioral Research. Sage Publications Inc.; 2002. doi:10.4135/9781506335193.
5- Palinkas LA, Aarons GA, Horwitz S, Chamberlain P, Hurlburt M, Landsverk J. Mixed method designs in implementation research. Adm Policy Ment Health. 2011;38(1):44-53. doi:10.1007/s10488-010-0314-z.
6- Qualitative Methods in Social Work Research. SAGE Publications Ltd.; September 21, 2024. Accessed September 30, 2024. https://uk.sagepub.com/en-gb/eur/qualitative-methods-in-social-work-research/book239301.
7- Sage Research Methods. Mixed Methods Design in Evaluation. Accessed September 30, 2024. https://methods.sagepub.com/book/mixed-methods-design-in-evaluation.
8- King ES, Moore CJ, Wilson HK, Harden SM, Davis M, Berg AC. Mixed methods evaluation of implementation and outcomes in a community-based cancer prevention intervention. BMC Public Health. 2019;19(1):1051. doi:10.1186/s12889-019-7315-y.
9- Woodgate RL, Sigurdson CM. Building school-based cardiovascular health promotion capacity in youth: a mixed methods study. BMC Public Health. 2015;15:421. doi:10.1186/s12889-015-1759-5.
10- Ho LSY, Ratnayake R, Ansumana R, Brown H. A mixed-methods investigation to understand and improve the scaled-up infection prevention and control in primary care health facilities during the Ebola virus disease epidemic in Sierra Leone. BMC Public Health. 2021;21(1):1603. doi:10.1186/s12889-021-11634-7.

Libyan Journal of Public Health Practices (LJPHP)

Journal homepage: https://journals.uob.edu.ly/LJPHP
ISSN: 3008-1467 (Online)

Case report

Policy Brief: Better Data for Breast Cancer in Libya

Tariq Alferis

Faculty of Medicine, University of Tripoli, Libya

ARTICLE INFO

Article history:
Received 30/9/2024
Revised 14/10/2024
Accepted ,24/10/2024

Keywords:
Breast Cancer
Healthcare Policy
Data Standardization

ABSTRACT

Breast cancer represents a growing health challenge in Libya, where data management gaps hinder effective diagnosis, treatment, and research efforts. This policy brief highlights the urgent need for a consolidated data framework to improve the quality and accessibility of breast cancer data across the country. Through standardized data collection protocols and a centralized database, healthcare professionals can better monitor trends, enabling early diagnosis and timely interventions. The proposed approach includes training healthcare personnel in data management best practices and establishing a multi-stakeholder steering committee to oversee data governance, privacy, and security. By addressing these issues, Libya can enhance breast cancer treatment outcomes, support evidence-based policymaking, and contribute to international research efforts. This initiative underscores the critical role of data-driven approaches in advancing public health and improving patient outcomes.

Corresponding author:
Email : tta13@student.london.ac.uk

1. Introduction

Breast cancer is a significant public health concern in Libya, with an incidence rate of 18 percent, translating to eight new cases per 100,000 women. Gynaecological cancers, including breast cancer, are particularly fatal due to delayed detection, largely caused by inefficient data collection processes [1]. These challenges hinder effective screening, research, and strategic planning, leading to late-stage diagnoses when treatment success is lower. Reliable data collection is essential for tracking cases, understanding the disease's impact, and allocating resources effectively [2]. However, Libya's current data systems are fragmented and inconsistent, limiting their usefulness. This policy brief aims to address these gaps by proposing improved data management standards to enhance breast cancer care. By strengthening data recognition, storage, and sharing, healthcare providers and policymakers can make informed decisions to improve early detection, treatment options, and survival outcomes for Libyan women.

2. Problem Statement

The primary issue currently confronting breast cancer health care in Libya is a lack of effective and efficient information collection tools. Without consistent quality data, healthcare providers are unable to make the required judgements that aid in diagnosis and treatment, causing delays [3]. Because of the paucity of data collection, a high percentage of women arrive at the clinic with advanced breast cancer when nothing can be done to control the disease. Current procedures in Libya comprise fragmented data- athering tactics for both the general population and breast cancer patients; hence, there is no effective data monitoring system. As a result, policymakers are in the dark about screening programs, unable to execute them efficiently, distribute resources in a timely way, or adjust healthcare intervention tactics to demographics. This limitation affects not just patient treatment but also Libyan health institutions and researchers' ability to undertake development research that might aid in the knowledge and management of breast cancer in Libya.

There are other structural problems to consider, such as a shortage of data management professionals and a lack of norms for data collection, storage, and analysis. Thus, multiple methodologies and standards for data documentation exist in Libyan medical care institutions, resulting in inadequate and erroneous record systems [4]. Furthermore, institutions are more concerned with safeguarding patient confidentiality and data continuity than with fostering widespread data exchange, resulting in limited good-quality data. Healthcare professionals' lack of preparedness for data management best practices also contributes to the persistence of these issues. In many businesses, even obtained data is seldom used efficiently, owing to a lack of important aspects such as sufficient staff training and established procedures and systems. They end up in a situation where Libyan women do not receive treatment for illnesses that are still detectable and treatable, resulting in an accelerated worsening of their health status. Indeed, addressing these factors may help improve the quality and efficiency of Libya's breast cancer management to provide prompt, suitable diagnosis and treatments athering tactics for both the general population and breast cancer patients; hence, there is no effective data monitoring system. As a result, policymakers are in the dark about screening programs, unable to execute them efficiently, distribute resources in a timely way, or adjust healthcare intervention tactics to demographics. This limitation affects not just patient treatment but also Libyan health institutions and researchers' ability to undertake development.

3. Proposed Solution

Given the data gathering issues in breast cancer in Libya, developing and implementing a consistent data gathering plan, as well as establishing an overall breast cancer database. The aim of utilizing this strategy is to allow for accurate observation and tracking of the disease in various locations of the country.

Setting and implementing uniform protocols for data input, data storage, and data interchange would allow healthcare institutions to contribute to the development of a consistent data framework, which would improve the quality of data gathered in the healthcare system [5].Training for healthcare personnel will begin to ensure that they can handle data and use linked systems correctly. As a result, this suggested database would help discover patterns, trends, and potential risk factors for the creation of preventative measures as well as early illness diagnosis. These modifications will not only improve data management procedures but will also contribute to more comprehensive analysis, boosting the efficacy and efficiency of breast cancer therapy in Libya.

The solution calls for the development of a cross-sectional executive council made up of representatives from the Ministry of Health, healthcare institutions, research centers, and patient groups. This committee's recommendations will have a significant impact on policy execution and data gathering concerning the country's health needs and international standards. Roundtable meetings, focus group talks, and workshops will be necessary for stakeholders to sit and interact on challenges of breast cancer care to build a shared understanding as well as a road map for how breast cancer care may be better. The strategies that must be implemented during the strategic analysis and evaluation include the development of an efficient data governance framework that will address issues of data privacy and ethical usage, the protection of patient confidentiality, and the establishment of trust in the data system [6]. The sustainability of the data-gathering project will be ensured by funding the program from both national and international sources, as well as by integrating the data system into the national health information architecture.

3. Implementation Plan

The given solution will be implemented gradually since the data collection techniques and the database will first be integrated for standard use. At first, specialists specializing in data control, healthcare, and policymaking will strive to build and alter these standards in response to the Libyan environment and global trends [7]. This phase will also entail the procurement of technological assistance, such as secure servers and software for data entry, sorting, and storage. Concurrently, general healthcare practitioners will be trained to understand the need to collect accurate data and use the new system. These training sessions will be held both onsite and online to guarantee maximum coverage for as many persons as feasible. To monitor progress and address any concerns, healthcare professionals will be given open input on the collected data, and the procedure will be adjusted accordingly. These activities are planned to be completed during the first six months of the project's implementation and, presumably, will provide the groundwork for subsequent activities.

The next phase will focus on optimizing and integrating the core database and data-collecting techniques. During this phase, the Ministry of Health, healthcare institutions, research institutions, and patient organizations will form a multi-stakeholder Guiding committee. This committee will also oversee the implementation process, which will aim to fulfil the goal of adherence to national health goals while also responding to any new challenges that may develop. Regular roundtable meetings and workshops will enable efficient contact between readers, authors, and researchers from institutions and other groups involved in the provision of breast cancer care. A strong emphasis will be placed on developing a sound data governance structure to ensure data protection and correct use. Other efforts will be made to secure long-term support for the measure from national and international sources.

3. Expected Benefits and Stakeholder Engagement

The given solution will bring major positive shifts in the facilitation of patients’ early diagnosis, enhancement of treatment results, and further research in the area of healthcare.

The patient will be able to receive a timely diagnosis and an individual approach to the treatment, and the healthcare practitioners will be able to obtain more objective data to improve patient outcomes. Qualified data will be provided to the researchers on breast cancer, enabling them to improve on their research in Libya [8]. All these improvements will culminate in this in the long run, making the mortality rates drop and the quality of life of patients improve. Stakeholders' involvement is important; there is the multilateral steering committee for the implementation of measures, round tables, and workshop meetings. The value, efficiency, and prolongation of this system will be achieved based on continuous feedback, which in turn will concern the needs of all the participants.

3. Best Practices for Data Management in Breast Cancer Care

Using more effective data collection methods can therefore improve breast cancer remedies in Libya. Procedures for gathering information should be made standard across all health institutions to allow for comparisons across them. Electronic health records (EHRs) should be adopted and used to guarantee that accurate information is entered, and healthcare practitioners should be taught on how to use them. That is why adequate data protection should be implemented, which may be accomplished by connecting to secure cloud services, performing frequent backups, and encrypting the patient's information. Integrating systems and specialized data sharing memoranda across institutions that prioritize patients' interests through a thorough de-identification procedure might improve data interchange. Access control, extensive audit trails, and the implementation of the most up-to-date security standards are critical for protecting health information

3. Potential of artificial intelligence (AI) in Breast Cancer Data Analysis

In Libya, breast cancer data analysis is set to be transformed by the use of artificial intelligence (AI). The program can assist radiologists with early identification and diagnosis by assessing lesions for indicators of a malignant tumor or by utilizing predictors to evaluate particular risk factors for a given patient. From a therapeutic standpoint, AI can evaluate huge amounts of patient data and develop treatment plans and prognoses for the patient's condition, possibly improving the level of care provided to patients. In research and clinical trials, decision and cognitive intelligence can locate information and connections in huge data that a person might ignore, aiding in the development of novel medications. However, there are several downsides to employing AI in breast cancer treatment. As closely connected to the subject of machine learning (ML) and AI, the issue of data quality, as well as any biases in the ML algorithms utilized, must be addressed to avoid the reinforcement of uneven treatment results. Some of the obstacles include ethical decision making over patient data privacy and the use of AI on patients, both of which require informed permission. Furthermore, implementing AI systems in the field of healthcare necessitates sophisticated procedures for optimal integration into current healthcare systems, as well as appropriate investments and personnel training.

Breast cancer data in Libya has the potential to be given a new lease on life through the intervention of artificial intelligence (AI), with the following values: As a result, general AI-assisted diagnosis may improve the efficacy of early detection and identification of breast disorders while maintaining mammogram accuracy. Deep learning applications in AI can contribute to aiding radiologists to notice aspects that would not readily be noticed by a human eye, thereby increasing the possibilities of early diagnosis and hence higher chances of survival. In addition, AI may apply extensive and efficient prediction models of the patient's data, such as genetics, lifestyle, and family history, to better assess risk levels. This indicates that cost-effective screening might be provided in order to assist these individuals who are at high risk, so efficiently using the Libyan healthcare system's resources.

AI can also have a revolutionary impact on treatment planning and research. The use of

sophisticated big data, complete patient histories, therapy progress, and molecular information can assist in providing more accurate and perhaps better treatment programs with fewer side effects than traditional ones. It also speeds up drug discovery by allowing for the identification of an effective chemical compound and the selection of a molecule based on its expected performance, a procedure that would otherwise be time-consuming and expensive. In clinical trials, AI might automatically identify patients, determine candidates for certain therapies, and detect signals of bad responses to those treatments, hence boosting the speed and efficacy of clinical studies. However, because this is such a delicate subject, the use of AI in breast cancer therapy in Libya must be approached with caution. As a result, the quality and representativeness of data used to train AI models is important to preventing current gaps in healthcare services from widening further. Concerns about how patients' information would be protected, who would have access to patients' information, and how patients would give their consent to the use of AI-generated insights are critical questions that cannot be overlooked due to the potential infringements of patient rights depicted in the current section. There should also be more investment in infrastructure and human training, as well as significant collaboration between AI developers and the Libyan healthcare system on how to utilize cutting-edge technology for the benefit of patients.

4. Recommendations

The following recommendations are judged important in light of the reported limitations in collecting and managing breast cancer data in Libya. To achieve this, protocols for data collection in all healthcare facilities have to be developed. These protocols should be designed in such a way that standardization is attainable, allowing for the methodical gathering of data and the creation of a cohesive national database. It is advised that healthcare practitioners undergo a time of professional development that focuses on the effective application of these procedures, primarily because the new system must be integrated and executed. [9] Such training should be continual and advisory in nature, taking into account new technology and ways of working that are implemented. There is a need to create a breast cancer data warehouse that can facilitate the safe storage, analysis, and exchange of breast cancer data. This database will also allow for real-time access to patients' data and the integration of multiple entities involved in healthcare service delivery. Also included is a proposal to build strong data governance to ensure privacy and ethical data use. The implementation of these policies should be by international standards to preserve patients' privacy and to provide them with assurances about the information revealed in the health system. A multi-stakeholder steering committee should be constituted to ensure adequate coordination and monitoring of the implementation process, as well as relevance to the national health goals. This group should include members from the Ministry of Health, healthcare facilities, a research centre, and patient associations. Daily/weekly roundtable meetings and seminars should be held to bring all stakeholders together to share knowledge and experiences. Such events will help to disseminate practice models and provide applicable solutions. Another requirement is to establish a steady resource basis to fund the program in the long run via national and international funding. The study's funds will be used primarily to maintain and improve the data-gathering technology that will be used, as well as to improve the data-collection procedure. Others will need to integrate the new data system into the national health information infrastructure before it can function. There will be seamless data exchange and reporting, which will lead to a better solution for breast cancer in Libyan women

Acknowledgements

This paper was developed under the auspices of the Young Leader Society Leadership Program, led by the Anna Lindh Foundation. The research was funded by Med Dialogue for Rights and Equality, DAI Global and

implemented in partnership with the Sand for Oncology Patients Foundation to ensure its quality and adherence to academic standards

Conflict of Interest

The authors declare that there is no conflict of interest.

References

1. Ismail F, El-Garawani I, Abdelsameea E. Cancer incidence in Tobruk area, eastern Libya: First results from Tobruk medical center. Epidemiol Health. 2021;2(1) . doi:10.4178/epih.e2021050
2. Kwok CS, Muntean EA, Mallen CD, Borovac JA. Data collection theory in healthcare research: The minimum dataset in quantitative studies. Clin Pract. 2022;12(6):832-844. doi:10.3390/clinpract12060088esults from Tobruk medical center. Epidemiol Health. 2021;2(1) . doi:10.4178/epih.e2021050
3. Ermiah E, Abdalla F, Buhmeida A, et al. Diagnosis delay in Libyan female breast cancer. BMC Research Notes. 2012;5(1):452. doi:10.1186/1756-0500-5-452
4- Ngusie HS, Shiferaw AM, Bogale AD, Ahmed MH. Health data management practice and associated factors among health professionals working at public health facilities in resource-limited settings. Adv Med Educ Pract. 2021;12(2):855-862. doi:10.2147/amep.s320769
5- Amshahar HA, Muftah SA, Salem KM. Breast cancer histology and hormonal status characterization in Libyan patients; a sample from the middle region. Sirte Journal of Medical Sciences 2022;1(2):9-15. doi:10.37375/sjms.v1i2.320
6- Hussein R, Griffin AC, Pichon A, Oldenburg J. A guiding framework for creating a comprehensive strategy for mHealth data sharing, privacy, and governance in low- and middle-income countries (LMICs). J Am Med Inform Assoc. 2022;30(4):787-794. doi:10.1093/jamia/ocac198
7- Karbaj MMO, Anbaiwa RS, Esehaim MHL. Electronic archiving and the extent of its application in the municipality of Kufra, Libya: A case study in monitoring health services and its affiliated clinics. J Comput Sci Technol Stud. 2023;5(1):24-37. doi:10.32996/jcsts.2022.5.1.4
8- Engle RL, Mohr DC, Holmes SK, et al. Evidence-based practice and patient-centered care: Doing both well. Health Care Management Review. 2021;46(3):174-184. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8162222/
9- Manley K, Martin A, Jackson C, Wright T. A realist synthesis of effective continuing professional development (CPD): A case study of healthcare practitioners' CPD. Nurse Educ Today. 2018;69(1):134-141. doi:10.1016/j.nedt.2018.07.010