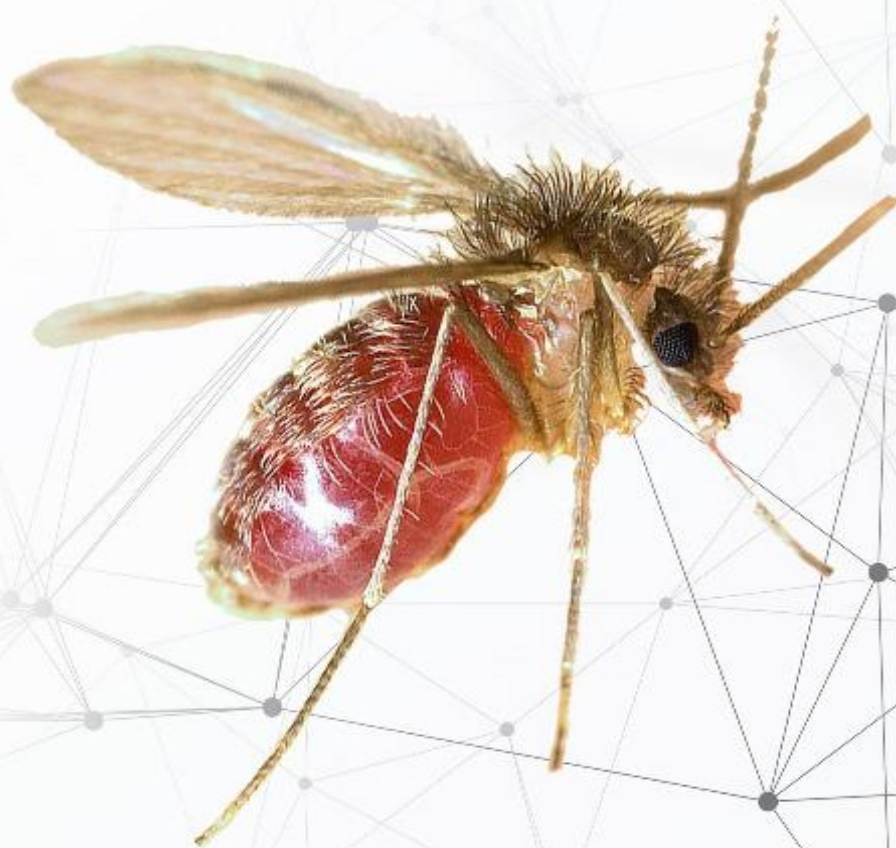


Al-Mukhtar Journal of Sciences

Volume 40

Issue 1

June 2025



ISSN ONLINE : 3006 - 6352
NL-LDN 280-2013

PUBLISHED BY
OMU



Al-Mukhtar Journal of Sciences

Peer-reviewed scientific journal, Volume Forty , Issue One, 2025

Published by Omar Al-Mukhtar University, Al-Bayda, Libya

Al-Mukhtar Journal of Sciences

NL – LDN 208-2013

The Author(s) 2025. This article is distributed under the terms of the *Creative Commons Attribution-NonCommercial 4.0 International License* ([<http://creativecommons.org/licenses/by-nc/4.0/>])(<http://creativecommons.org/licenses/by-nc/4.0/>)), which permits unrestricted use, distribution, and reproduction in any medium, *for non-commercial purposes only*, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

A peer-reviewed journal published by Omar Al-Mukhtar University, Al Bayda, Libya
Peer-reviewed scientific journal, Volume Forty, IssueOne, 2025
Email: omu.j.sci@omu.edu.ly
To pour. Box 919 Al Bayda - Libya, Fax: +218 69 463 7053

EDITORS & STAFF

Editor-in-Chief

Mabrouka Abdullah Bofarraaj

Faculty of Medicine, Omar Al-Mukhtar University, Libya

Editor

Abdulsalam F. Elfowiris

Faculty of Pharmacy, Omar Al-Mukhtar University, Libya

Nibras Saleam Al-Ammar

Faculty of Medicine, Basrah University, Iraq

Arwa Benkhaial

Faculty of Pharmacy, Benghazi University, Libya

Nourz A. Gheriani

Faculty of Medicine, Benghazi University, Libya

Naeima M. El Zalitni

Assistant Professor- Consultant Ophthalmic Surgeon, Faculty of Medicine, Benghazi University

Agzail Saad Elhddad

Professor of Obstetric & Gynaecology, Omar AlMukhtar University & Albayda Fertility Center.

Abdulaziz H. Alahlafi

Faculty of Medicine, Omar Al-Mukhtar University, Libya

Awatef Salem Elbouaishisi

Professor of pediatrics, Almergab University, Libya, Consultant Pediatric Nephrologist at Tripoli University Hospital (TUH)

Mohamed Owad Ezwaie

Consultant and head of the Kidney Transplant Department at Benghazi Medical Centre, University of Benghazi, Libya

Rashad El-habony

Senior Physician in the Department of Neurosurgery evangelisches Krankenhaus Duisburg, Germany

Nadia Abdalhafid Elsherif

Professor of Dermatology and Venereology. University of Benghazi, Libya.

Amina M. Elsaid

Community Medicine, Libyan International Medical University, Benghazi

Naziha Benrhuma

Professor of Paediatric. University of Tripoli, Libya.

Rasmia Husni Elfeituri

Consultant of Paediatric Cardiology, Al Hawary General Hospital and Benghazi Cardiac Center, Libya

Nadia Ali El Sahli

Professor of Paediatric Oncology, Benghazi, Libya

Nwara A. Mohamed

Faculty of Agriculture, Omar Al-Mukhtar University, Libya

Abdulsalam A. Albukhari

Faculty of Natural Resources, Omar Al-Mukhtar University, Libya

Copyeditor

Kamla M. Abdul Rahim

Faculty of Natural Resources, Omar Al-Mukhtar University, Libya

Mariam E. Abdulla

English language proof reader

Editorial Board

Anas Othman Issa Mohamed

Department of Pathology, Montefiore Medical Center Albert Einstein College of Medicine, NY

Omar Hussian

Consultant, Adult Cardiac Surgery, King Abdul Aziz Medical City, Heart Center, KSA

Faria Mansour Elbabour

Otolaryngology Head & Neck Department, University of Benghazi, Libya

Ali A. Banigesh

Faculty of Medicine, University of Saskatchewan, Canada

Attia I Attia Mustafa

Clinical Fellow, Cardiology, University Hospital Coventry Warwickshire UHCW - UK

FAISAL ELAGILI

Consultant Colorectal Surgeon International Islamic University Malaysia, Malaysia

Geith Yonis

Consultant Family Physician, Healthcare Department Qatar Energy, Qatar

Eman Ezz El-Regal Ibrahim Eisa

Nursing Department, Faculty of Nursing, Damietta University, Egypt

Widad Kamil Mohammed

College of Nursing, Baghdad University, Iraq

Abdulhafid A. Abudher

Professor of Gynaecology, Dean of Libyan Medical Academy (LMA) of Medical Science, and Founder of Libya International Forum for Obstetrics and Gynecology

Susan Ali Mohamed Ali

Community Health Nursing, Faculty of Applied Medical Science, University of Al-Butana, Sudan

Rabia Mohsen Ali Al-Yasiri

Faculty of Nursing, University of Baghdad, Iraq

Saeed A. Adheem

Faculty of Medicine, University of Tobruk, Libya

Abdullatif M. Amneena

Pediatric Department, Faculty of Medicine, University of Derna, Libya

Abdallah A. Juwid

Faculty of Medicine, Misrata University, Libya

Aisha Gaddafi Abd Allah

Faculty of Public Health, Arab Medical University, Benghazi, Libya

Gabriel Hewadi

Radiology Department, Faculty of Medicine, University of Benghazi, Libya

Hameda Asrafel

College of Medical Technology, Laboratory Medicine, Derna, Libya.

Support Team

Munay A. Jabullah

Text Editor

Fawzia Fathi Abdullah

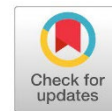
Designer

Al-Mukhtar Journal of Sciences 40: (1), 2025

Papers	Pages
An Epidemiological Study of Cutaneous Leishmaniasis in the Cities of Sirte and Jadu, Libya: During 2019-2020 Kaula. A. Saad Hanan. A. Ageehal Ahmed. S. Elgrari	01-09
Nurses' Knowledge Regarding Pediatric Febrile Convulsions and its Nursing Care Fatima E. Ahmed Susan A. Zroog Yassin H. M. Nor-Aldaiem	10-14
Obesogenic Factors in School-Aged Children in Tobruk City, Libya Nasren G. S. Al Fraik Amera M. Hamad Aya S. Balhouq Doaa F. Salih Rajaa J. Saleh Sana B. Aqoub	15-22
Combatting Fatigue and Bone Pain: The Impact of Vitamin D Treatment in the General Practice Setting Manal .H .Algraiw Huda. H. Al-griw Omar. I. Abusnena	23-29
Iliopsoas Abscess: Presentation, Etiology, Treatment Options, and Outcomes: A Retrospective Analysis of 19 Cases Khaled Faiz Jamal Gomati Tariq Elhoony Tariq Aldarat Salah Eltaktouk Muftah Elkhafifi Ali Abokiash Raouf Kwafi Issa Abuzied	30-37
Exploring the Role of Sociodemographic Factors in Influencing Dental Floss Knowledge and Practices among Adults in Sebha City, Libya: A Cross-Sectional Study Osama Ahmadi Mubarakah Abraheem Aisha Aloshiby Ibtisam Ahmadi Areej EL-Sallak Aram Elhashem Hunaida Budajaja	38-51
Epidemiological and Clinical Characteristics of Pediatric Urinary Tract Infections in Benghazi, Libya: A Two-Year Retrospective Study Jebrile S. Elabidi Asmaa F. Salih Monia faraj	52-56

Research Article

6 Open Access



An Epidemiological Study of Cutaneous Leishmaniasis in the Cities of Sirte and Jadu, Libya: During 2019-2020

Kaula. A. Saad ^{1*}, Hanan. A. Ageehal ², Ahmed. S. Elgrari ³

*Corresponding author : mohamedkaula@gmail.com, Libyan Authority for Scientific Research, Tripoli, Libya.

^{2, 3} Administration of Zoonotic Disease Control- National Centre of Diseases Control - Tripoli- Libya.

Received:
13 May 2024

Accepted:
13 January 2025

Publish online:
30 June 2025

Abstract

Cutaneous leishmaniasis CL is a complex clinical syndrome caused by transmitting an intracellular parasite to humans through sand fly bites. Libya is one of the countries endemic to CL. The goal of this study is to study the epidemiological aspects of CL from 2019 to 2020 in Sirte and Jadu. Demographic and epidemiological data for all patients were collected from health centers by the National Center for Disease Control in Libya. Descriptive statistics were used to describe the characteristics of the study data. A total of 355 people with CL were identified. 143 CL-positive cases in Jadu and 212 in Sirte. The highest prevalence of affected age groups was found among patients aged 10 to 19 (17 %). The peak incidence of the disease occurred in the autumn. The most common locations of lesions were the legs and hands. Treatment was mentioned only in 30 % of registered cases. CL remains a health problem with medical and social consequences in the cities of Sirte and Jadu. To minimize the risk of disease, it is highly recommended to manage reservoir hosts and disease vectors, as well as provide education on personal protection measures.

Keywords: Epidemiology; Cutaneous leishmaniasis; Sand fly; Parasite; Pentostam; Sirte; Jadu.

INTRODUCTION

Leishmaniasis is a complex clinical syndrome caused by the transmission of an intracellular parasite to humans through sand fly bites (Mostafa et al. 2021; Organization WHO 2013). It is a serious global health problem with potentially fatal consequences in its visceral form. It is considered one of the seven major tropical diseases identified by the World Health Organization (WHO) (Organization WHO 2013). There are more than 98 countries endemic to leishmaniasis, putting 350 million individuals at risk of infection. A high prevalence of leishmaniasis is found in the poorest countries due to neglect of health care and infrastructure by governments and a lack of knowledge and health awareness of diseases (Olias-molero et al. 2021). This zoonotic disease is induced by an intracellular protozoan of the genus *Leishmania*, which typically exists in a commensal relationship. The natural transmission of *Leishmania* parasites occurs through sandflies from the genera *Phlebotomus* (in the Old World) or *Lutzomyia* (in the New World) (Mandell 2005). Sand flies have a length of only 3.5 mm, are covered by thick hair, and are active between evening and dawn. The seasonal preferences and geographical range of sand flies



The Author(s) 2025. This article is distributed under the terms of the *Creative Commons Attribution-NonCommercial 4.0 International License* (<http://creativecommons.org/licenses/by-nc/4.0/>) (<http://creativecommons.org/licenses/by-nc/4.0/>)), which permits unrestricted use, distribution, and reproduction in any medium, *for non-commercial purposes only*, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

vary by species. The majority of species can endure temperatures between 16 and 44°C. Only the female sand fly consumes blood from mammals, as it requires these meals to ensure proper egg development (Doha and Samy 2010).

According to geographical location, leishmaniasis was divided into the Old and New World. Old World leishmaniasis is found in Asia, Africa, and Europe, primarily caused by *L. tropica*, *Leishmania major*, *Leishmania aethiopica*, *Leishmania infantum*, or *L. donovani*. Conversely, New World leishmaniasis occurs in the Americas and is mainly attributed to *Leishmania mexicana*, *Leishmania amazonensis*, *Leishmania braziliensis*, *Leishmania panamensis*, or *Leishmania infantum chagasi* (Lupi et al. 2009; Kevric et al. 2015). According to the Libya National Center for Disease Control (NCDCL), Libya is endemic to cutaneous and visceral leishmaniasis, the infection rate of CL has increased, with approximately 19,396 cases recorded between 1971 and 2011 in the cities of Nafusa Mountain, such as Nalut, Gharyan, and Yafran, in addition to Tawergha Al-Khoms and Tarhuna. Visceral leishmaniasis has been reported in Libya for over 80 years (Jain et al. 1990). All these reports originated from the northern coastal regions, close to Tripoli and the Green Mountain area. Since 2011, Libya has been embroiled in an armed conflict, which has exacerbated the healthcare system and hampered national disease-control programs. These risk factors have contributed to the spread of CL and increased the number of registered cases, which has risen to over 25039 between 2012 and 2022. Due to the high rate of cutaneous leishmaniasis in Libya over the past years, which requires monitoring the epidemiological situation of the disease in various regions, As a result, the current study sought to evaluate the current situation of CL disease in Sirte and Jadu cities during the years 2019–2020 in terms of prevalence, demographic parameters associated with CL disease, and the impact of seasonal changes.

MATERIALS AND METHODS

Study Areas: This study was conducted in the cities of Sirte and Jadu, Libya. Sirte is located in the central region of Libya, within 452 kilometers of Tripoli city. (31° 12' 17" N and 16° 35' 17" E). The coastal areas of Sirte are characterized by mild Mediterranean weather for most of the year, while the areas away from the coast are characterized by hot summers and cold winters. Jadu is a mountain city in western Libya in the Jabal al Gharbi District, approximately 180 km away from Tripoli (31°57'00" N and 12°01'00" E). Jadu enjoys a cold, humid climate in the winter and desert weather, which is hot, dry, and windy in the summer.

Data collection: The Administration of Zoonotic Disease-Control- National Center for Disease Control-Libya (NCDCL) collected data from 355 patients at hospitals in Sirte and Jadu from 2019 to 2020. CL was diagnosed using the direct smear technique, which detected amastigotes in smears prepared from the lesion margin after staining with Giemsa and then examined under a light microscope. All data collected was entered into a cutaneous leishmaniasis reporting form. This encompasses patients' demographic details, including age, gender, occupation, residence, the number of acute lesions, the date of lesion onset, any prior travel history to other endemic areas, findings from clinical examinations and laboratory tests, the treatment regimen employed, and patients' nationality. The data were analyzed using the Excel Microsoft program version 10 for Windows.

RESULTS

From 2019 to 2020, 355 CL cases were reported in Sirte and Jadu cities. During this time, there were 143 CL positives in Jadu and 212 in Sirte (Figure 2). The patients studied ranged in age from one to 71 years old, with females (36 %) and males (64 %) participating. Figure 2 depicts

the age distribution of CL patients. There were statistically significant differences in occurrence between age groups. CL cases were mostly reported among people aged 10 to 19 years.

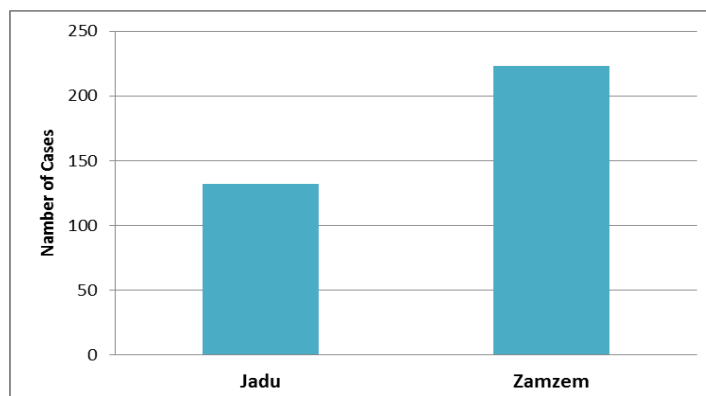


Figure: (1). Cutaneous leishmaniasis cases in Sirte and Jadu cities during 2019-2020.

The disease exhibited the highest prevalence (17 %) in the 10-19 age group, while the lowest prevalence (11 %) was observed in the 50-59 age group. Additionally, 12 % of the patients were over 60 years old, and 15% were under 10 years (see Figure 2).

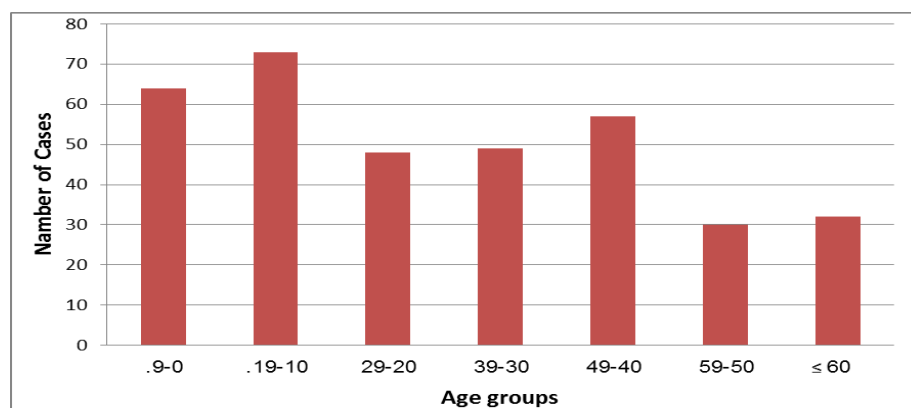


Figure: (2). Cutaneous leishmaniasis cases in Sirte and Jadu cities during 2019-2020 compared with age groups.

The percentage of cutaneous leishmaniasis (CL) cases among males was 64 % (228 out of 355), while the proportion of female cases was 36 % (127/355). In general, men were more likely than women to develop CL. There were significant differences between the sexes.

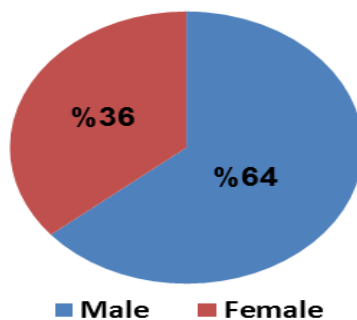
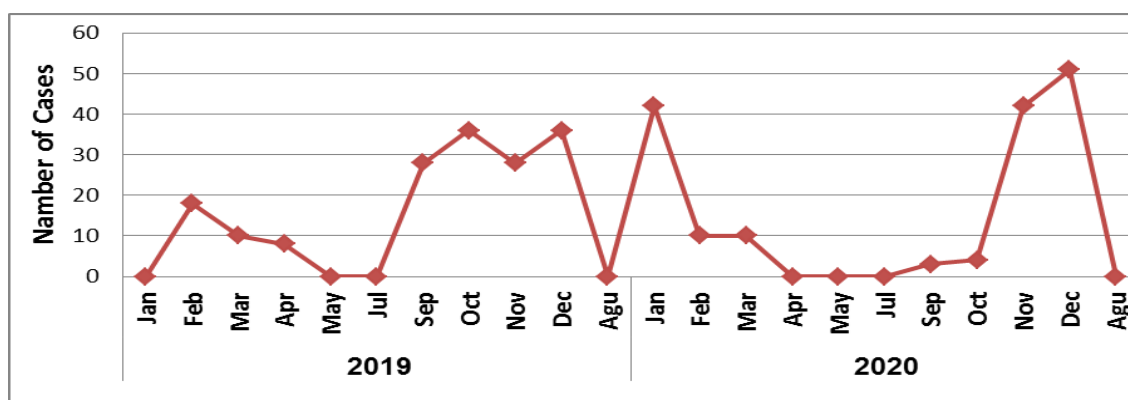


Figure: (3). Cutaneous leishmaniasis cases in Sirte and Jadu cities during 2019-2020 compared with gender

The majority of cases were documented during the autumn and winter seasons rather than during the summer, with prevalence varying by month. The highest number of cases was noted in December, November, October, and September, compared to the number of CL cases in January, February, March, and April of 2019. As for 2020, the highest infection rate occurred in January, followed by a decrease in February and March, followed by April. The number of cases increased again in October, November, and December. The final results clearly demonstrated that the prevalence of the disease varied by month. Figure 4 illustrates the fluctuations in cutaneous leishmaniasis prevalence across different years and months.



Figure; (4). Distribution of cutaneous leishmaniasis cases in Sirte and Jadu cities during 2019-2020 per month

A large number of reported CL cases in our results were found to have lesion(s) on their legs (28 %), followed by patients with CL lesions on hands (23 %), CL lesions were located on the face in 11% of cases and 18 % on the arms. In addition, the largest proportion of CL (23 %), were reported to have multiple lesions at more than one location. A study of the relationship between the location of lesions and gender revealed that 70 cases (30 %) of male CL patients had a leg lesion, while 56 cases (24 %) had a hand CL lesion. 18 % of male CL patients were found to have multiple lesions. The results showed that 38 cases (30 %) of females had CL lesions on their arms, while 33 cases (26 %) had CL lesions on their faces. 30 female cases (23.6 %) had skin CL lesions in more than one location. The results are shown in Figure 5.

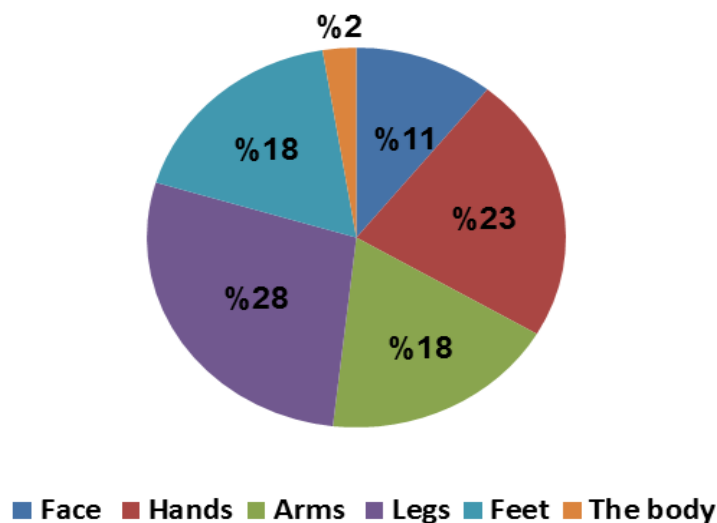


Figure: (5). Distribution of cutaneous leishmaniasis cases in Sirte and Jadu cities with regard to lesion site(s).

Among the 355 cases of cutaneous leishmaniasis recorded in the Sirte and Jadu cities in 2019-2020, only 105 cases were recorded for the type of treatment, and 70 % of cases were not recorded. In these cases, intralesional treatment with pentostam was the most effective treatment followed by antibiotics and then systemic treatment (pentostam IM) at 5 %. Cryotherapy was effective in only 2 % of cases (Figure 6).

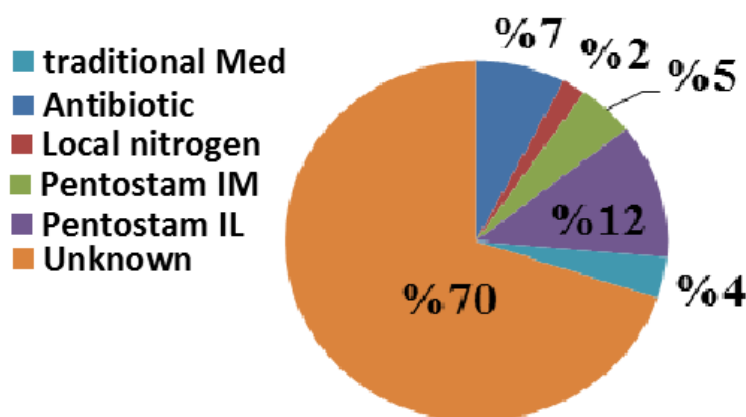


Figure: (6). Cutaneous leishmaniasis cases in Sirte and Jadu cities during 2019-2020 compared with treatment types.

DISCUSSION

The World Health Organization regards leishmaniasis as one of the most significant parasitic diseases, and the World Health Assembly has recommended prioritizing its management (Gonzalez et al. 2008). Due to the intricate epidemiological cycle of the disease, involving multiple reservoirs and vectors with complex ecological interactions, effective surveillance and control pose significant challenges. In Libya, cutaneous leishmaniasis is classified as an endemic disease (Aoun and Bouratbine 2014). Several studies have clearly confirmed the endemic city of CL in Libya's north-western areas (Ashford et al. 1976; Amro et al. 2012). The reported areas were Misrata (Beni Walid) (Aoun et al. 2006) Yafran, jebel-Naffussa, Nalut regions, Al-Jabal Al Gharbi, and Sirte (Fathy et al. 2009; Abdellatif et al. 2013; Ashford et al. 1977; Ashford et al. 1976; El-Buni et al. 1993). Despite previous reports of lower incidence in the West, cases have increased and extended to the Tunisian border (Kadiki and Ashraf 1971).

In our study, we investigated epidemiology, demographic parameters, and types of treatment for CL patients in Sirte and Jadu cities from 2019 to 2020. Our results confirmed that cutaneous leishmaniasis still represents a public health concern. Where during this time, a total of 355 CL cases were discovered. There were 143 CL-positives in Jadu and 212 in Sirte. The incidence of CL has increased significantly in Jadu in recent years, in comparison with a previous study conducted during the period from 2007 to 2011, which recorded 93 cases (AboAssara et al. 2015). While in Sirte, a study was published in 2006-2007 about registering 163 patients in the health centers of Al-Gadaheya and Al-Hisha villages (Fathy et al. 2009). Our findings indicated that the infection was related to gender, as the disease was more prevalent in males than females, with a percentage of 64%. Other studies in Libya Province yielded similar results (AboAssara et al. 2015; Elammari et al. 2008). Males may have a higher prevalence due to several risk factors, such as clothing habits, travel to endemic areas, the habit of sleeping outside their homes during hot nights, and environmental conditions that contribute to increased direct contact with sand fly habitats and vector-related influences. This suggestion is in agreement with a previous study (El-Buni et al. 2000).

Some researchers believe that levels of sex hormones may impact the development and progression

of certain parasitic diseases, potentially increasing males' susceptibility to protozoan infections. (Roberts and Walker 2001). In these studies, the overall prevalence of cutaneous leishmaniasis is greatest among individuals aged 0-9 and 10-19. These age groups, which encompass school-aged children and young adults in Libya, tend to engage in outdoor activities more frequently than others, increasing their exposure to environments associated with sand flies. Moreover, Mendonça SC (2016) indicates that cutaneous leishmaniasis infections lead to the establishment of lifelong immunity, which could explain the reduced incidences observed in older adults. Because the population in some parts of Libya has recently changed, the disease can now be seen in people of all ages.

As shown in Figure 4, patients were examined between January 2019 and December 2020. The greatest number of cases was recorded in September, October, November, and December 2019, followed by January, February, and Mars 2020. The number of cases decreased in April and May before increasing again in October, November, and December 2020. According to research in other areas of Libya, such as Yafran or Sirte (El-Buni et al. 2000), the highest prevalence occurred between November and February, or during the autumn months, likely attributable to the parasite's extended incubation period, which lasts from 4 to 12 weeks following a sand fly bite. Variations in incidence across seasons and/or regions may be explained by differences in distribution and ecological factors (Bounoua et al. 2013).

CL lesions can occur anywhere on the body, and there have been several reports of unusual locations (Kevric et al. 2015; Boelaert et al. 2008). In this study, both single and double lesions were present in different cases, with 77 % having a single lesion and 23 % having double or more lesions, contradicting Fathy et al. (2009), who indicated that most lesions were numerous (73 %). Furthermore, the most common location was the legs (28 %), followed by patients with CL lesions on the hands (23 %), 11 % cases with CL lesions on the face, and 18 % on the arm. Our findings are consistent with the findings of two other studies (Faraj et al. 2013; Alsamarai and Al obaidi 2009). The presence of cutaneous leishmaniasis lesions on the face and extremities can be attributed to patients' sleeping patterns, as their faces, hands, and limbs are more vulnerable to sand fly bites during the night when these insects are most active.

However, there is still a gap in CL treatment, and the lack of standardized protocols for evaluating anti-Leishmanial activity impedes and challenges drug development (Grobe et al. 2013). Only 105 of 355 cases of cutaneous leishmaniasis in the cities of Sirt and Jadu in 2019-2020 were recorded for treatment type, and 70 % of cases were not recorded. In these cases, intralesional pentostam was the most effective, followed by antibiotics, and then systemic treatment (pentostam IM) at 5 %. Cryotherapy had a 2 % efficacy rate. The first-line drugs for the treatment of CL, Pentavalent antimonial medications [meglumine antimoniate and sodium stibogluconate], as advised by the WHO, are not accessible for all cases of cutaneous leishmaniasis. In endemic regions of Libya, liquid nitrogen cryotherapy has been employed as the primary treatment for CL, especially in children, avoiding the adverse effects associated with local, multiple, and repeated injections, aligning with the results of a Libyan study (Abdellatif et al. 2013; Mosleh et al. 2008). The management and prevention of cutaneous leishmaniasis in Libya encounter numerous obstacles, including population displacement, high population density, civil conflict, inadequate health literacy, and limited access to healthcare services. Additionally, our study faced certain constraints in data collection and reporting, as individuals in endemic regions might forgo prescribed treatments due to the belief that the disease is easily curable. Not all patients underwent laboratory testing, with many diagnosed based solely on clinical signs. Moreover, some individuals may have utilized traditional remedies, which would not have been documented.

CONCLUSION

As in all endemic areas in Libya, leishmaniasis remains a health issue with medical and social im-

plications in Sirte and Jadu cities. Environmental changes and climate shifts have significantly contributed to the rising incidence of Leishmania infections in these regions. Additionally, the manifestation of lesions showed considerable variation among patients. These factors combined require more intensive and accurate research to determine the extent of the disease in this region, as well as sand fly control programs and host animal control, in addition to the need for community awareness.

Duality of interest: The authors declare that they have no duality of interest associated with this manuscript.

Author contributions: Contribution was equal between authors.

Funding: No specific funding was received for this study.

REFERENCES

- Abdellatif, M. Z., El-Mabrouk, K., & Ewis, A. A. (2013). An epidemiological study of cutaneous leishmaniasis in Al-Jabal Al-Gharbi, Libya. *Korean J Parasitol.* 51:75–84, DOI: 10.3347/kjp.2013.51.1.75
- Abdellatif, M. Z., El-Mabrouk, K., & Ewis, A. A. (2013). An epidemiological study of cutaneous leishmaniasis in Al-jabal Al-gharbi, Libya. *Korean J Parasitol.* 51: 75-84. DOI:10.3347/kjp.2013.51.1.75.
- AboAssara, A., Buishi, I., Fares, A., Gusbi, M., & Annajar, B. (2015). Retrospective Study for Cutaneous Leishmaniasis in Jadu Area, Libya *Libyan J. Vet. Med. Sci.* Vol. 1 (1): 24-32. https://www.researchgate.net/publication/322528535_Retrospective_Study_for_Cutaneous_Leishmaniasis_in_Jadu_Area_Libya.
- Alsamarai, A. M., & Al obaidi, H. S. (2009). Cutaneous leishmaniasis. in Iraq. *Journal of Infection in Developing Countries.*2009; 3: 123–129. DOI: <https://doi.org/10.3855/jidc.59>.
- Amro, A., Gashout, A., Al-Dwibe, H., Zahangir Alam, M., Annajar, B., Hamarsheh, O., & et al. (2012). First molecular epidemiological study of cutaneous leishmaniasis Libya. *PLoS Negl Trop Dis*, 6:e1700. DOI: 10.1371/journal.pntd.0001700.
- Aoun, K., & Bouratbine, A. (2014). Cutaneous leishmaniasis in North Africa: a review *Parasite* 2014; 21:1–9. DOI: 10.1051/parasite/2014014.
- Aoun, K., Bousslimi, N., Haouas, N., Babba, H., El-Buni, A., & et al. (2006). First report of Leishmania (L) killicki Rioux, Lanotte & Pratlong, 1986 in Libya. *Parasite.* 13: 87–88. PMID: 16605075. <https://pubmed.ncbi.nlm.nih.gov/16605075>.
- Ashford, R. W., Chance, M. L., Ebert, F., Schnur, L. F., Bushwereb, A. K., & Drebi, S. M. (1976). Cutaneous leishmaniasis in the Libyan Arab Republic: distribution of the disease and identity of the parasite. *Ann Trop Med Parasitol*, 70:401–409. DOI: 10.1080/00034983.1976.11687139.
- Ashford, R. W., Schnur, L. F., Chance, M. L., Samaan, S .A., & Ahmed, H .N. (1977). Cutaneous leishmaniasis in the Libyan Arab Republic: preliminary ecological findings. *Ann Trop Med*

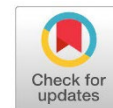
Parasitol, 71:265–271. DOI: 10.1080/00034983.1977.11687190.

- Boelaert, M., El-Safi, S., Hailu, A., Mukhtar, M., Rijal, S., Sundar, S., Wasunna, M., Aseffa, A., Mbui, J., Menten, J., & et al. (2008). Diagnostic tests for kala-azar: A multi-centre study of the freeze-dried DAT, rK39 strip test and KAtex in East Africa and the Indian subcontinent. *Trans. R. Soc. Trop. Med. Hyg.* 102, 32–40. DOI: 10.1016/j.trstmh.2007.09.003.
- Bounoua, L., Kahime, K., Houti, L., Blakey, T., Ebi, L., Zhang, P., & et al. (2013). Linking Climate to Incidence of Zoonotic Cutaneous Leishmaniasis (*L. major* in Pre-Saharan North Africa. *Int J Environ Res Public Health.* 10. 3191-3172. DOI: 10.3390/ijerph10083172.
- Doha, S. A., & Samy, A. M. (2010). Bionomics of phlebotomine sand flies (diptera Psychodidae) in the province of Al-Baha. *Saudi Arabia Mem. Inst. Oswaldo Cruz.* 105, 850–856. DOI: 10.1590/S0074-02762010000700002
- Elammari, N., Elhadar, J., & Annajar, B. (2008). Trends in Zoonotic Cutaneous Leishmaniasis (ZCL) in Eight Endemic Municipalities of North-West Libya During 2004 – 2008. *G.J.B.A.H.S., Vol.4(4):1-6, ISSN: 2319 – 5584.* https://www.researchgate.net/publication/289669245_Trends_in_Zoonotic_Cutaneous_Leishmaniasis_ZCL_in_Eight_Endemic_Municipalities_of_North-West_Libya_During_2004_-_2008
- El-Buni, A., Taleb, I., Ben-Darif, A., Refai, A., Al-Edodi, K., Tawall, A., & et al. (1993). Leishmaniasis in Libya and studies on sand flies. *Arch Inst Pasteur, Tunis.* 70:40–409. PMID: 7802501 .
- El-Buni, A.A., Jabeal, I., & Ben-Darif, A. T. (2000). Cutaneous leishmaniasis in the Libyan Arab Jamahiriya: a study of the Yafran area. *East Mediterr Health J.* 6, 884 -887. DOI:10.26719/2000.6.5-6.884.
- Faraj, C., Adlaoui, E., Ouahabi, S., El Kohli, M., El Rhazi, M., Lhoussine, L., & et al. (2013). Distribution and bionomic of sand flies in five ecologically different cutaneous leishmaniasis foci in Morocco. *ISRN Epidemiol.* 2013; 1-8. DOI: 10.5402/2013/145031.
- Fathy, F. M, El-Kasah, F., & El-Ahwal, A. M. (2009). Emerging cutaneous leishmaniasis in Sirte-Libya: epidemiology, recognition and management. *J Egypt Soc Parasitol,* 39:881–905. PMID: 20120753
- Gonzalez, U., Pinart, M., Reveiz, L., & Alvar, J. (2008). Intervention for Old World cutaneous leishmaniasis. *Cochrane Database Syst Rev* Oct 8; (4) :CD005067. PMID:18843677. DOI: 10.1002/14651858.CD005067.pub3.
- Groge, M., Hickman, M., Ellis, W., Hudson, T., Lazo, J., Sharlow, ER., & et al. (2013). Drug discovery algorithm for cutaneous leishmaniasis. *Am J Trop Med Hyg,* 88: 216-222. DOI:10.4269/ajtmh.11-0812.
- Jain, S., El Mangoush, M. A., El-Bouri, K., & Mahfouz, M. O. (1990). Kala azar in an adult Libyan and review of visceral leishmaniasis in Libya. *Tropical and geographical medicine.* Jul1; 42(3): 283-285. <https://pubmed.ncbi.nlm.nih.gov/2293439/>.

- Kadiki, O., & Ashraf, M A. (1971). Cutaneous leishmaniasis in the Libyan Arab Republic Mimeo. Ministry of Health, Tripoli, Libya. the national control program of leishmaniasis in Libya https://applications.emro.who.int/emhj/0605_6/EMHJ_2000_6_5-6_884_887.pdf.
- Kevric, M. A., Cappel, J. H., & Keeling. (2015). New World and Old World Leishmania Infections. A Practical Review Dermatol Clin., 33; pp. 579–5931. DOI: 10.1016/j.det.2015.03.018
- Lupi, B. L, Bartlett, R.N., Haugen, L.C., Sethi, S. N., Klaus, & et al. (2009). Tropical dermatology: tropical diseases caused by protozoa. J Am Acad Dermatol. 60; pp. 897-928. DOI: 10.1016/j.jaad.2009.03.004
- Mandell Douglas & Bennett's. (2005). principles and Practice of infectious diseases. In G.L. Mandell, J.E. Bennett, R. Dolin (Eds). 6th ed. Elsevier. DOI: 10.1001/jama.2010.1643
- Mendonça, S. C. (2016). Differences in immune responses against Leishmania induced by infection and by immunization with killed parasite antigen: implications for vaccine discovery. Parasite Vectors. 9: 492. DOI: 10.1186/s13071-016-1777-x.
- Mosleh, I. M., Geith, E., Natsheh, L., Schonian, G., Abotten, N., & Kharabsheh, S. (2008). Efficacy of cryotherapy regimen to treat Leishmania major cutaneous leishmaniasis. J Am Acad Dermatol. 58: 617-624. DOI: 10.1016/j.jaad.2007.12.032.
- Mostafa, E., Ghasemian, A., Abdinasir, A., Nematollahi Mahani, S. A., Rawaf, S., Salehi Vaziri, M., & et al. (2021). Emerging and re-emerging infectious diseases in the WHO eastern Mediterranean region, 2001–2018. Int J Heal Policy Manag, 11:1286–300 DOI: 10.34172/ijhpm.2021.131
- Olias-Molero, A. I., de la Fuente, C., Cuquerella, M., Torrado, J. J., & Alunda, J. M.(2021). Antileishmanial Drug Discovery and Development. Time to Reset the Model Microorganisms. 2021; 9:2500. DOI: 10.3390/microorganisms9122500.
- Organization WHO. (2014). Manual for case management of cutaneous leishmaniasis in the WHO Eastern Mediterranean Region. WHO Regional Publications. 2014. Retrieved from <https://www.who.int/publications/i/item/9789290219453>
- Roberts, C.W., Walker, W., & Alexander, J. (2001). Sex-associated hormones and immunity to protozoan parasites. Clin Microbiol Rev. 14: 476-88. DOI: 10.1128/CMR.14.3.476-488.2001

Research Article

Open Access



Nurses' Knowledge Regarding Pediatric Febrile Convulsions and its Nursing Care

Fatima E. Ahmed^{1*}, Susan A. Zroog², Yassin H. M. Nor-Aldaiem³

*Corresponding author:

fatimalhag2@gmail.com

Faculty of Nursing, Omar
Al-Mukhtar University,
Libya.

² Faculty of Nursing, Omar
Al-Mukhtar University, Lib-
ya.

³ Faculty of Applied Medical
Sciences, University of Al-
Butana, Sudan.

Received:

10 November 2024

Accepted:

30 December 2024

Publish online:

30 June 2025

Abstract

Introduction: A seizure that happens in children who have a high body temperature is called a febrile convulsion. The most prevalent neurological condition in children, febrile convulsions are thought to be a major contributor to hypoxia and recurrent seizures. Consequently, nurses should possess comprehensive knowledge of managing febrile convulsions. Nurses' Knowledge Regarding Pediatric Febrile Convulsions & its Nursing Care. This descriptive study was conducted at Ahmed Nasr Allah Pediatric Hospital - Rufaa City in April 2023. The study population comprised 45 employed nurses in the hospital (census sample). Data was gathered through structured interview questionnaires, and the data was inputted and analyzed with the Statistical Package for Social Sciences (SPSS). Simple statistics such as mean and percentage were employed. Results indicated that the mean score for nurses' knowledge of pediatric febrile convulsions was poor (36.9%). The overall mean score for nurses' knowledge of nursing care for pediatric patients with febrile convulsions was good (61.5%). Nurses' knowledge was poor regarding pediatric febrile convulsion as a medical condition but good regarding the nursing care of patients with pediatric febrile convulsions.

Keywords: Febrile convulsion, Pediatric, Nurses' knowledge, Nursing care.

INTRODUCTION

Every ethnic group has febrile seizures. (Kim et al., 2017) Children from lower socioeconomic backgrounds are more likely to have the disorder, most likely due to limited access to healthcare. (Haerian et al., 2016) Febrile seizures are generally defined as seizures that occur in children, usually between the ages of 6 months and 5 years, coupled with a fever that is higher than 38°C (100.4 °F), and that do not have a history of an intracranial cause (such as infection, head trauma, or epilepsy), or another identifiable cause (such as electrolyte imbalance, hypoglycemia, drug use, or drug withdrawal). (Zare-shahabadi et al., 2015) Due to its high frequency in young children and propensity to recur, febrile seizures pose a significant issue in pediatric medicine. Usually, the convulsion only lasts for a few minutes. (Sharafi et al., 2017) Antipyretics like ibuprofen should be used to treat febrile convulsions (Zare-shahabadi et al., 2015). Rectal diazepam is used to stop the convulsion if it lasts longer than ten minutes. If the focus of the infection is unclear, it's crucial to conduct investigations to rule out dangerous illnesses. Future episodes of febrile convulsions affect about one-third of youngsters. As a result, parents need to learn how to control convulsions in the future. The outlook is favorable. While children



The Author(s) 2025. This article is distributed under the terms of the *Creative Commons Attribution-NonCommercial 4.0 International License* (<http://creativecommons.org/licenses/by-nc/4.0/>) (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, *for non-commercial purposes only*, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

who experience simple febrile convulsions are not more likely to develop epilepsy, they may be more susceptible to temporal lobe epilepsy if the convulsions last for more than 20 minutes. Overall, 2-3% of people are at risk for epilepsy (Jang & Cho, 2017).

In recent years, there has been a growing understanding of the possible complications associated with febrile seizures and how to manage this condition. The American Academy of Pediatrics (AAP) and the Japanese Society of Child Neurology released updated guidelines for the assessment and treatment of febrile seizures in 2011 and 2015, respectively (Canpolat et al., 2018). The nurse is typically the initial caregiver for the child and should be well-versed in applying universal precautions. After resuscitation and stabilization, emergency interventions are implemented, including therapeutic measures such as decontamination, antidote administration, and supportive care to address the needs of children experiencing febrile convulsions (Ali Hussein & Hatab, 2023). Nurses should update their knowledge regarding the care of children with febrile convulsions.

MATERIALS AND METHODS

Study Design

This descriptive hospital-based study was conducted to assess nurses' knowledge regarding the nursing care of pediatric patients with febrile convulsions.

Study Area

The study was conducted in Ahmed Nasr Allah Pediatric Hospital in Rufaa City, the capital of the East of Gezira locality, located northeast of Gezira state, Sudan.

Study subjects and sampling

All Nurses provided nursing care in the hospital and were available in April 2023, 45 nurses were obtained (census sample).

Data

Data were collected using a self-administered questionnaire designed by the researchers and analyzed using the Statistical Package for Social Science (SPSS). Simple statistics such as mean and percentage were employed.

Ethical Consideration

Permissions were obtained from the Scientific Committee of Research, Faculty of Applied Medical Sciences, University of Al-Butana, the manager of Rufaa Teaching Hospital, and the head of the pediatric department. The study's purpose was explained verbally to the participants before the questionnaire administration, and they all agreed to participate.

RESULTS

Table (1). Distribution of Nurses According to the Demographical Information

Information	Percentage (%)	Information	Percentage (%)
Sex		Years of experience	
Male	46.7	Less than 5 years	23.3
Female	53.3	5 -10 years	56.7
		11 and above	20
Age		Level of education	
20 -29	53.3		30
30 -39	26.7	Institutes	33.3
40 and above	20.0	Bachelor	36.7

Table (2). Assessment of the nurses' knowledge regarding pediatric febrile convulsion

Items	Poor (%)	Acceptable (%)	Good (%)
Definition of fever	27	43	30
The Signs of febrile convulsions	13	30	57
Incidence of pediatrics febrile convulsions	30	30	40
Period of fit	33	44	33
The risk factors	43	20	37
The causes	63	4	33
Classifications of pediatric febrile convulsions	53	14	33
The Complications	54	23	23
Use of antipyretic medications	30	50	20
Prevention of convulsions	23	4	73
Overall mean	36.9	26.2	37.9
Total		100	

Overall, the average score of nurses' knowledge about pediatric febrile convulsions was low (36.9%).

Table (3). Assessment of the nurses' knowledge regarding nursing care of pediatric patients with febrile convulsion

Items	Poor (%)	Acceptable (%)	Good (%)
Nursing role during the febrile convulsions.	40	17	43
Nursing procedures during fits	50	7	43
Priorities of treatment	7	10	83
Health education for parents	10	13	77
Overall mean	26.75	11.75	61.5

The overall mean of the knowledge level of nurses concerning nursing care for pediatric patients experiencing febrile convulsions was satisfactory, with a score of 61.5%.

DISCUSSION

The study revealed that the majority of nurses (n=45) were under 30 years old, with an average age of 53.3% (20–29) years, according to the percentage distribution of participants by age group obtained from the analysis of demographic data. According to a study done at the Al-Diwaniyah Hospital for Maternal and Children in Iraq, the majority of nurses were young people. These current findings are consistent with that study.

In keeping with a study done in Alexandria, Egypt in 2022, which found that the largest percentage of participants (n=24, 33.8%) had a diploma in nursing and nursing institute members (Ali Hussein & Hatab, 2023), this study found that institute nurses and diploma nurses were 30% and 33.3%, respectively.

Overall, nurses' knowledge of pediatric febrile convulsions had a low mean score (36.9%). This is because most of the study sample had a high level of education, with (63.3%) consisting of institute nurses and diploma nurses. A study by Faransa et al. stated that many of the participating nurses, due to their educational qualifications, may not have adequate knowledge about febrile convulsions (Ali et al., 2016).

The overall mean of knowledge about nursing care for pediatric patients experiencing febrile convulsions was good (61.5 %). This is related to the majority of the study participants' experience of more than five years and the nurses were knowledgeable about the principles of evidence-based fever management (Edwards et al., 2007).

A study revealed that (77%) of participants had good knowledge related to parents' education about pediatric febrile convulsions, and if medical staff lacked adequate knowledge on the topic, they were incapable of instructing families on fever management (Baran, 2018). Therefore, nurses should have sufficient knowledge of pediatric febrile convulsions.

CONCLUSION

The study concluded that while nurses are relatively well-prepared to provide appropriate care for pediatric patients with febrile convulsions, they lack sufficient knowledge about the underlying medical aspects of the condition. This highlights the need for an education program to improve their overall understanding.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the Faculty of Applied Medical Sciences, University of Al-Butana, Sudan.

Duality of interest: Yes, there is a conflict of interest in this manuscript.

Author contributions: Contribution is equal between authors.

Funding: No specific funding was received for this work

REFERENCES

- Ali, F., Ahmed, A., & Khalaf, S. (2016, 08/29). Impact of educational program about care of children with febrile convulsion on nurses' knowledge and performance. *Journal of Nursing Education and Practice*, 7. <https://doi.org/10.5430/jnep.v7n1p79>
- Ali Hussein, Z., & Hatab, K. (2023, 02/01). Effectiveness of Intervention Program on Nurses' Practices about Care of Children during Febrile Convulsion. 11.
- Baran, G. (2018). Investigation of the Effect of the Training on Fever and Febrile Convulsion Management Given to Pediatric Nurses on their Knowledge Level.
- Canpolat, M., Per, H., Gumus, H., Elmali, F., & Kumandas, S. (2018). Investigating the prevalence of febrile convulsion in Kayseri, Turkey: An assessment of the risk factors for recurrence of febrile convulsion and for development of epilepsy. *Seizure*, 55, 36-47.
- Edwards, H., Walsh, A., Courtney, M., Monaghan, S., Wilson, J., & Young, J. (2007). Improving paediatric nurses' knowledge and attitudes in childhood fever management. *Journal of advanced nursing*, 57(3), 257-269.
- Haerian, B. S., Baum, L., Kwan, P., Cherny, S. S., Shin, J.-G., Kim, S. E., Han, B.-G., Tan, H. J., Raymond, A. A., & Tan, C. T. (2016). Contribution of GABRG2 polymorphisms to risk of

epilepsy and febrile seizure: a multicenter cohort study and meta-analysis. *Molecular neurobiology*, 53(8), 5457-5467.

Jang, S.-S., & Cho, I.-S. (2017). Effect of the fever education program on pediatric nurses' expert knowledge, attitudes and nursing practice. *Journal of the Korean Society of Maternal and Child Health*, 149-158.

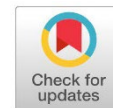
Kim, K., Kwak, B. O., Kwon, A., Ha, J., Kim, S.-J., Bae, S. W., Son, J. S., Kim, S.-N., & Lee, R. (2017). Analysis of plasma multiplex cytokines and increased level of IL-10 and IL-1Ra cytokines in febrile seizures. *Journal of neuroinflammation*, 14, 1-7.

Sharafi, R., Rad, A. H., & Aminzadeh, V. (2017). Circadian rhythm and the seasonal variation in childhood febrile seizure. *Iranian journal of child neurology*, 11(3), 27.

Zare-shahabadi, A., Soltani, S., Ashrafi, M. R., Shahrokhi, A., Zoghi, S., Pourakbari, B., Zamani, G. R., Mohammadi, M., & Rezaei, N. (2015). Association of IL4 single-nucleotide polymorphisms with febrile seizures. *Journal of child neurology*, 30(4), 423-428.

Research Article

Open Access



Obesogenic Factors in School-Aged Children in Tobruk City, Libya

Nasren G. S. Al Fraik^{1*}, Amara M. Hamad², Aya S. Balhouq², Doaa F. Salih²,
Rajaa J. Saleh², Sana B. Aqoub²

***Corresponding author:**

Nasren.Alfraik@tu.edu.ly

Department of Pediatric,
Faculty of Medicine, Tobruk
University, Libya

¹ Department of Pediatric,
Faculty of Medicine, Tobruk
University, Libya

² Medical Student, Faculty of
Medicine, Tobruk University,
Libya

Received:

24 September 2024

Accepted:

28 June 2025

Publish online:

30 June 2025

Abstract

Childhood obesity rates are globally on the rise. This study aims to assess the factors contributing to obesity in school-age children in Tobruk City, Libya, across various public and private schools. This epidemiological cross-sectional survey was conducted in May 2024. Students were divided into four groups according to their Body Mass Index: normal, underweight, overweight, and obese. Children were additionally categorized into two groups according to the type of school attended: public or private. Among 201 studied participants, only 18 students were obese all of whom were from the public school. Meanwhile, 89 students were found to be underweight, 12 were overweight, and the remainder 82, were within normal Body Mass Index. No obese children were reported in the private school, only 6 were overweight, but > 40% of children were underweight. Therefore, no correlation was found between school type and childhood obesity with a p value of 0.089. We found screen time to be more prevalent in obese and overweight children. There is no correlation between the student's gender and obesity with a p value of 0.573. The study found that the duration of activity was more extensive in the private school students. The current study concluded that there are many factors, rather than nutritional habits and activities that can affect a child's growth and body build. Further studies with large samples in our city are recommended.

Keywords: Obesity, Children, Pediatrics, Body weight, Nutrition

INTRODUCTION

Obesity in children is a serious public health concern that raises morbidity and mortality rates as well as in adult age groups (WHO, 2020). Childhood and adolescent obesity are a global health concern that is growing more prevalent in low- and middle-income countries (Lobstein, 2019). Childhood obesity can persist into adulthood (Llewellyn et al., 2016) and therefore, leads to an increased risk of many morbidities and chronic diseases. The primary external causes of childhood obesity are urbanization, a decrease in physical activity, and an increase in caloric consumption (CDC, 2010; Freitas et al., 2019). The World Obesity Federation projected in 2019 that 206 million children and adolescents would be obese by 2025, and 254 million in 2030 (Lobstein, 2019). Certain dietary practices and the consumption of highly processed foods account for a small portion of this age-related increase (Costa et al., 2019; Gingras et al., 2018). The primary causes of children and adolescents not getting enough exercise in most countries are the loss of public recreation areas and an increase in motorized transportation (Mahumud et al., 2021). A useful indicator of pediatric



The Author(s) 2025. This article is distributed under the terms of the *Creative Commons Attribution-NonCommercial 4.0 International License* (<http://creativecommons.org/licenses/by-nc/4.0/>) (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, *for non-commercial purposes only*, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

obesity is the body mass index (BMI) (Smetanina et al., 2015), along with the criteria established by the International Obesity Task Force (IOTF) (Rolland-Cachera, 2012). The tables provide international child cut-offs corresponding to the following body mass index (BMI) values at 18 years:

- 16 – thinness grade 3
- 17 – thinness grade 2
- 18.5 – thinness grade 1
- 23 – overweight (unofficial Asian cut-off)
- 25 – overweight
- 27 – obesity (unofficial Asian cut-off)
- 30 – obesity
- 35 – morbid obesity

The current study aimed to determine the differences in environmental factors between two different schools, evaluate certain factors linked to obesity such as dietary and lifestyle factors, and examine changes in children's BMI.

MATERIALS AND METHODS

Study type: cross-sectional epidemiological study.

Study population: The study covered two distinct age groups: six and eleven years old in the same geographic area within Tobruk city, Libya in one public and private school.

Study duration: May 2024

Inclusion criteria: every six and eleven-year-old child within both private and public schools was included in this study.

Exclusion criteria:

The family not filling in the questionnaire, and children aged other than 6 and 11 years old were excluded from the study. Data were collected by authors from parents after their consent through a questionnaire. We asked about the number of meals per day, their breakfast routine, how often and how much they eat snacks and carbonated beverages daily, how active they are, and how much time they spend on screens each day. The height and weight of each student were measured individually in the school by the authors. Following institutional guidelines, the parents of the youngsters gave their informed consent. The researchers performed all anthropometric measurements. A manual tape measure was used to measure height. Weight was measured using a well-calibrated digital electronic scale. We divided the students into four groups based on BMI: normal, underweight, overweight, and obese. The children were also divided into public and private groups.

Statistical methods:

RStudio software version 4.3.2 was used to analyze the data. Means, standard deviations, medians, and/or interquartile ranges were used to summarize numerical data. Numbers and percentages were used to summarize categorical data. The student's t-test was used to compare two groups for regularly distributed numerical data, while the Mann-Whitney test was used to compare two groups for non-normally distributed numerical variables. Notably, Kruskal-Wallis was used to investigate differences between more than two groups, and post hoc analysis was utilized if required (using the Bonferroni test).

RESULTS

This is a cross-sectional study showing the demographic data of 201 studied children aged 6 and 11 years in both public 154 (76.6%) and private schools 47 (23.4%) schools. Females 98 (48.8%) were nearly equal to males 103 (51.2%). Regarding BMI, most children were underweight >44%, normal BMI 40%, obese children were 9%, and overweight children were 6% as also, clearly explained in Figure (1). The current study noted in Table (1) no significant correlation between breakfast types, number of daily meals and snacks, and obesity in studied children, but the less water consumption the more unhealthier growth was noted.

Table (1): Nutritional habits in studied children

		Underweight (n=89) Median (IQR)	Normal (n =82) Median (IQR)	obese (n = 18) Median (IQR)	Overweight (n=12) Median (IQR)	P
(%) Breakfast	Home breakfast	(79.8) 71	60 (73.2)	14 (77.8)	10 (83.3)	0.82
	School breakfast	(9.0) 8	14 (17.1)	2 (11.1)	1 (8.3)	
	Money-paid breakfast	(11.2) 10	8 (9.8)	2 (11.1)	1 (8.3)	
Breakfast type	Sandwiches	(32.6) 29	22 (26.8)	4 (22.2)	4 (33.3)	0.128
8-	Juices	(40.4) 36	36 (43.9)	4 (22.2)	5 (41.7)	
4+	Cola	(6.7) 6	11 (13.4)	2 (11.1)	1 (8.3)	
	Water	(15.7) 14	9 (11.0)	4 (22.2)	2 (16.7)	
	Fruits	(4.5) 4	3 (3.7)	2 (11.1)	0 (0.0)	
	Vegetables	0 (0.0)	1 (1.2)	2 (11.1)	0 (0.0)	
Breakfast Beverage	Natural juices	(39.3) 35	26 (31.7)	6 (33.3)	6 (50.0)	0.724
(%) Types	Industrial juices	(39.3) 35	34 (41.5)	6 (33.3)	3 (25.0)	
	Soft drinks	(12.4) 11	15 (18.3)	3 (16.7)	3 (25.0)	
	Flavored milk	(9.0) 8	7 (8.5)	3 (16.7)	0 (0.0)	
Number of snacks/day		[2.00, 3.00] 2.00	2.00 [2.00, 3.00]	2.00 [2.00, 3.00]	2.00 [2.00, 3.00]	0.441
Number of daily meals		[3.00, 4.00] 4.00	3.00 [3.00, 4.00]	3.00 [3.00, 4.00]	4.00 [3.00, 4.00]	0.624

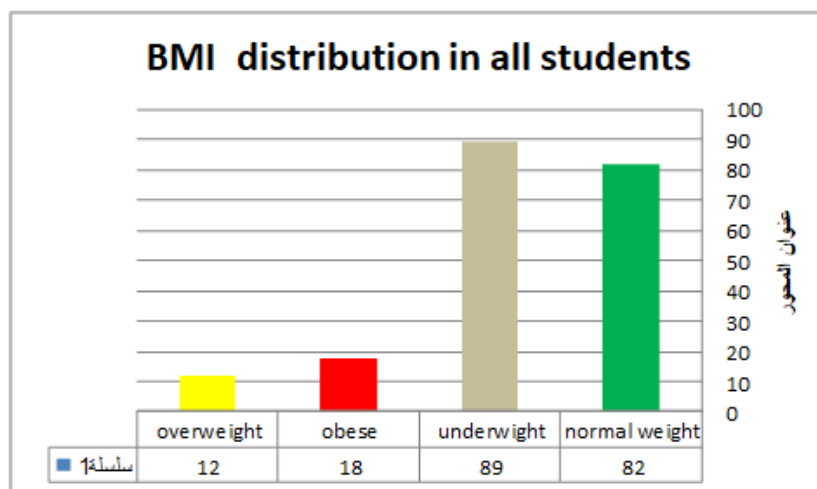


Figure (1): BMI distribution in all students

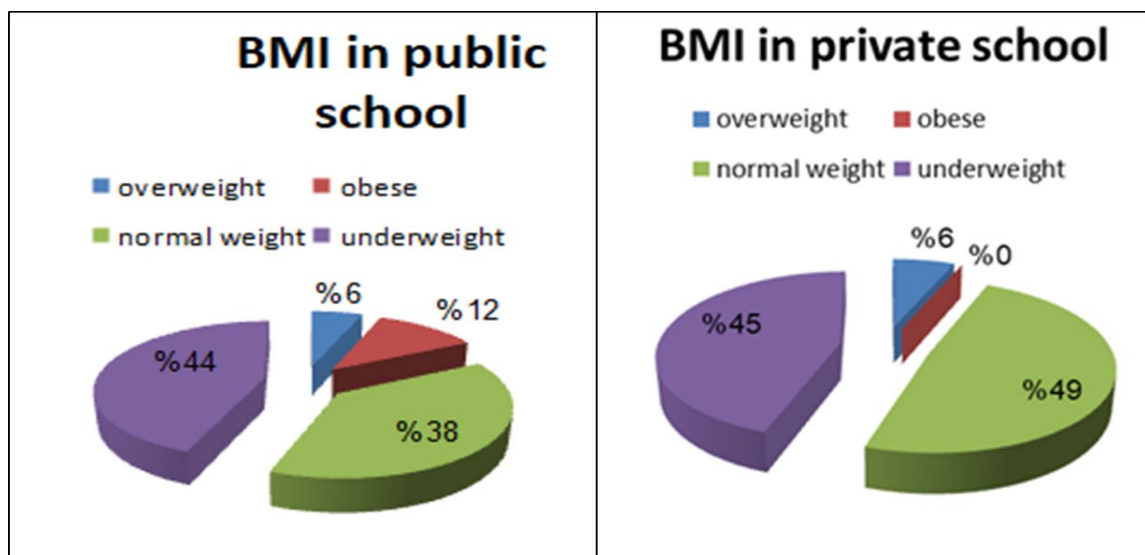


Figure (2): Comparison of BMI for both schools

As we noted in the diagram, there were no obese children reported in the private school, with only 6 overweight, but > 40% of children were underweight. Therefore, no correlation was found between school type and childhood obesity with a P value of 0.089.

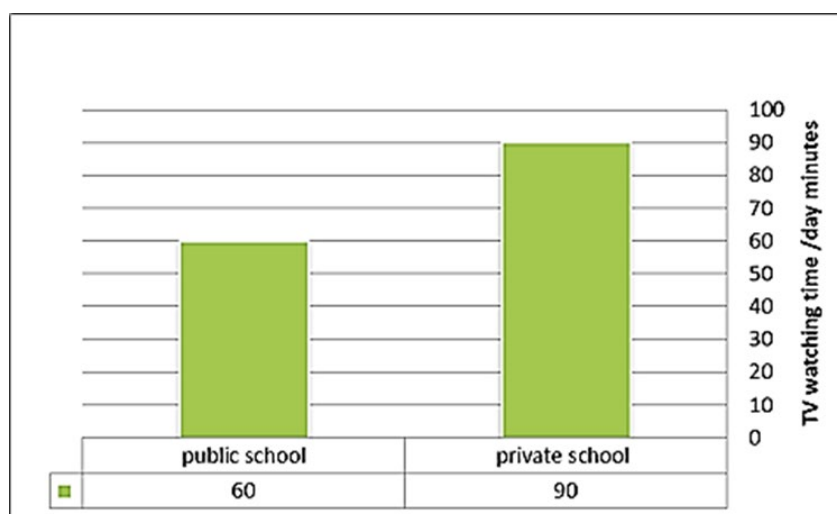


Figure (3): A comparison between public and private schools in TV watching time/day for their studied children

In able (2), the TV watching time was observed to be about 90 minutes per day in both overweight and obese children, while it was about 60 minutes per day in normal and underweight children.

Table (2): TV watching time in correlation to the BMI of studied children

	Underweight (n=89)	Normal (n =82)	Obese (n = 18)	Overweight (n=12)	P value
TV time minutes/day	60.00 [60.00,120.00]	60.00 [48.75,112.50]	90.00 [32.50, 120.00]	90.00 [52.50, 180.00]	0.32

As mentioned in Table (3), overweight and obese children spent more active time per day than the normal and underweight children. Therefore, no correlation was presented between daily activity and obesity in studied children with a P value of 0.585.

Table (3): Daily activity in studied students

	Underweight (n=89)	Normal (n=82)	Obese (n=18)	Overweight (n=12)	P value
Daily activity minute/day	120.00 [60.00,180.00]	130.00 [60.00,180.00]	140.00 [60.00, 180.00]	180.00 [60.00, 180.00]	0.585

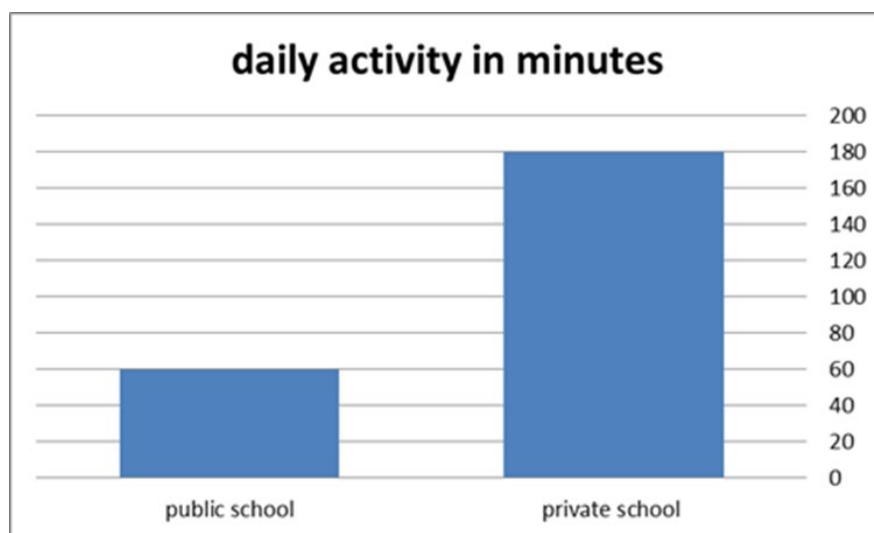


Figure (4): Daily activity per day in minutes for studied children in both public and private schools

We noted in Table (4) that there is no correlation between the student's gender and obesity with a P value of 0.573

Table (4): Correlation between students' gender and BMI

Gender	Underweight (n=89)	Normal (n=82)	Obese (n=18)	Overweight (n=12)	P
Female	45 (50.6)	4636 (43.9)	11 (61.1)	6 (50.0)	0.573
Male	44 (49.4)	46 (56.1)	7 (38.9)	6 (50.0)	

DISCUSSION

The two schools (private and public) where this cross-sectional epidemiological investigation was conducted, were located in Tobruk City, Libya, in May 2024. This is one of the first studies in Tobruk City focused on the risk factors for childhood obesity. Only about 90% of the included families filled in the questionnaire. The other children with incomplete data were excluded. The number of students in the public school was more than double that of the private school 77%:23%. The study found that the atmosphere at the public school was obesogenic and the number of obese students was 6%. The BMI of most of the children in both schools was underweight >44%, normal BMI at 40%, obese children were 9%, and overweight children at 6%, as also clearly explained in Figure (1).

These results agreed with (Yılmazbaş & Gökçay, 2021), showing that the proportion of children with underweight and normal BMI (62.6%) was higher than that of overweight (21.5%) and obese children (15.9%).

In the current study, there were no obese children reported in the private school, and only 6 were overweight, but > 40% of the children were underweight. Therefore, no significant correlation was found between school type and childhood obesity with a P value of 0.089. The study by (Yılmazbaş & Gökçay, 2021) found obesity in both school types, with a lower prevalence in private schools (6%) compared to public schools (15.9%).

In this study, over 77% of obese children consumed breakfast at home. Among them, 22% had a home-prepared sandwich along with juice and water. Additionally, 66% consumed juice, with equal proportions choosing natural (33%) and industrial (33%) options. Notably, a large percentage (40%) of underweight children relied primarily on juice in their breakfast.

Therefore, no significant correlation between breakfast types, number of daily meals and snacks, and obesity in studied children was noted. This finding disagrees with the report by (Mahumud et al., 2021), which identifies dietary factors as contributors to the increased risk of childhood and adolescent obesity. While (Rathnayake et al., 2014; Smetanina et al., 2015) agree with our results. We also observed low water consumption across all study groups, regardless of whether the children were obese or had a normal body build, unlike (Maffeis et al., 2016; Milla-Tobarra et al., 2016), who found that children who were obese used less water than their peers.

We noted in our study that screen time in the private school was more than that in the public school. Also, the TV watching time was about 90 minutes per day in both overweight and obese children while about 60 minutes per day in normal and underweight children. These findings are in agreement with (Rathnayake et al., 2014; Reilly et al., 2005; Yılmazbaş & Gökçay, 2021). Also, (Barr-Anderson et al., 2008) demonstrated that having a television in the bedroom increases the chance of developing obesity. The overweight and obese children in this study spend more active time per day than the normal and underweight children. This finding may be due to parental awareness regarding the increasing body mass. There was no correlation presented between daily activity and obesity in studied children with a P value of 0.585. In addition, the students in the private school spend more active time per day than the students in the public school, which may explain the absence of obesity in the private school.

Limitations: The private school sample was low. Only self-reporting allowed us to gauge the children's activity levels, and this may not accurately represent their actual levels of physical activity. Also, there are endogenous factors such as genetic, endocrinal, and many other factors that were not taken into account in the current study.

CONCLUSION

The current study was the first in our city to focus on obesity and poor growth among school children. We concluded from our research that the school and home environment could increase the risk of obesity, but daily eating patterns and physical activity levels are not the primary risk factors for childhood obesity in our city and that there is no single cause for it; rather, a variety of factors may interact to cause obesity. We recommend conducting further studies with larger sample sizes to cover multiple schools and collect more detailed information on potential confounding factors such as socioeconomic status, family-related emotional stress, sleep duration, transportation methods, parental awareness, and other factors affecting child growth.

ACKNOWLEDGEMENT

We thank our parents and lovely children for their cooperation. Also, we thank the school council and teachers at both AlHoria public school and ABC private school and the entire research team.

ETHICS

The Ethics Committee of Tobruk University, Tobruk School, gave its approval to this project (approved number NBC: 009.H.24.1).

Duality of interest: The authors declare that they have no duality of interest associated with this manuscript.

Author contributions: Contribution was equal between authors.

Funding: no funding

REFERENCES

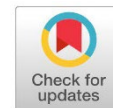
- Barr-Anderson, D. J., Van Den Berg, P., Neumark-Sztainer, D., & Story, M. J. P. (2008). Characteristics associated with older adolescents who have a television in their bedrooms. *121*(4), 718-724.
- CDC, C. f. D. C. P. (2010). Vital signs: state-specific obesity prevalence among adults--United States, 2009. *59*(30).
- Costa, C. S., Rauber, F., Leffa, P. S., Sangalli, C. N., Campagnolo, P. D., Vitolo, M. R. J. N., Metabolism, & Diseases, C. (2019). Ultra-processed food consumption and its effects on anthropometric and glucose profile: a longitudinal study during childhood. *29*(2), 177-184.
- Freitas, A. I., Moreira, C., & Santos, A. C. J. I. j. o. o. (2019). Time trends in prevalence and incidence rates of childhood overweight and obesity in Portugal: Generation XXI birth cohort. *43*(2), 424-427.
- Gingras, V., Rifas-Shiman, S. L., Taveras, E. M., Oken, E., Hivert, M.-F. J. I. J. o. B. N., & Activity, P. (2018). Dietary behaviors throughout childhood are associated with adiposity and estimated insulin resistance in early adolescence: a longitudinal study. *15*(1), 129.
- Llewellyn, A., Simmonds, M., Owen, C. G., & Woolacott, N. J. O. r. (2016). Childhood obesity as a predictor of morbidity in adulthood: a systematic review and meta - analysis. *17*(1), 56-67.
- Lobstein, T. J. O. R. (2019). Obesity prevention and the Global Syndemic: Challenges and opportunities for the World Obesity Federation. *20*.
- Maffeis, C., Tommasi, M., Tomasselli, F., Spinelli, J., Fornari, E., Scattolo, N.,...Morandi, A. J. E. j. o. c. n. (2016). Fluid intake and hydration status in obese vs normal weight children. *70*(5), 560-565.
- Mahumud, R. A., Sahle, B. W., Owusu-Addo, E., Chen, W., Morton, R. L., & Renzaho, A. M. J. I. j. o. o. (2021). Association of dietary intake, physical activity, and sedentary behaviours

with overweight and obesity among 282,213 adolescents in 89 low and middle income to high-income countries. 45(11), 2404-2418.

- Milla-Tobarra, M., García-Hermoso, A., Lahoz-García, N., Notario-Pacheco, B., Lucas-de La Cruz, L., Pozuelo-Carrascosa, D. P.,...Martínez-Vizcaíno, V. J. N. H. (2016). The association between water intake, body composition and cardiometabolic factors among children: the Cuenca study. 33, 19-26.
- Rathnayake, K. M., Roopasingam, T., & Wickramasighe, V. P. J. B. p. h. (2014). Nutritional and behavioral determinants of adolescent obesity: a case-control study in Sri Lanka. 14(1), 1291.
- Reilly, J. J., Armstrong, J., Dorosty, A. R., Emmett, P. M., Ness, A., Rogers, I.,...Sherriff, A. J. B. (2005). Early life risk factors for obesity in childhood: cohort study. 330(7504), 1357.
- Rolland - Cachera, M. F. J. P. o. (2012). Towards a simplified definition of childhood obesity? A focus on the extended IOTF references. In (Vol. 7, pp. 259-260): Wiley Online Library.
- Smetanina, N., Albaviciute, E., Babinska, V., Karinauskiene, L., Albertsson-Wikland, K., Petrauskiene, A., & Verkauskiene, R. J. B. p. h. (2015). Prevalence of overweight/obesity in relation to dietary habits and lifestyle among 7–17 years old children and adolescents in Lithuania. 15(1), 1001.
- WHO, W. H. O. (2020). Overweight and obesity.
- Yılmazbaş, P., & Gökçay, G. J. T. T. J. o. P. (2021). Assesment of obesogenic factors in school-age children. 63(2), 185-192.

Research Article

Open Access



Combatting Fatigue and Bone Pain: The Impact of Vitamin D Treatment in the General Practice Setting

Manal .H .Algraiw¹, Huda. H. Al-griw^{2*}, Omar. I. Abusnena¹

¹ Department of Epidemiology and Community Medicine, Faculty of Medicine, University of Tripoli, Tripoli. Libya

***Corresponding author:**
h.algriw@uot.edu.ly, Department of Microbiology and Parasitology, Faculty of Veterinary Science, University of Tripoli, Libya

Received:
02 December 2024

Accepted:
14 June 2025

Publish online:
30 June 2025

Abstract

Vitamin D deficiency is a global health problem associated with chronic musculoskeletal pain. Addressing this deficiency is vital for managing pain and fatigue syndromes. Objective: To assess if treating vitamin D deficiency in patients with persistent unspecific pain of the muscular and skeletal system reduces symptoms. Methods: This study involved 80 patients in Tripoli, Libya, suffering long-term, unexplained bone and muscle pain receiving treatment at primary health care centers. Vitamin D levels were measured, injections were administered to those with deficiencies, followed by blood levels and pain severity assessments. Eighty participants (18 men, 62 women) were studied. Mean serum vitamin D levels increased from 8.4 to 36.1 post-treatment. The average age was 38.9 ± 7 years (range 18-70). Pre-treatment levels were 11.1 in men and 7.6 in women, rising to 28.9 in men and 38.5 in women. A significant reduction in chronic non-specific bone pain was noted, with serum levels improving from 8.4 ± 7.4 to 36.11 ± 5.1 (79) = -16.6, $p < 0.001$. Participants with chronic fatigue and muscle pain had low vitamin D levels, which significantly improved after treatment. More research is needed to determine how optimal vitamin D levels can reduce fatigue, chronic bone pain, and muscle weakness. Routine vitamin D deficiency testing should be standard for individuals with chronic pain, particularly those experiencing bone pain and fatigue. Public education on the importance of vitamin D, its natural food sources, and the benefits of sunlight exposure is crucial for increasing levels.

Keywords: Vitamin D deficiency, Chronic pain, Musculoskeletal pain, Fatigue, Intervention studies.

INTRODUCTION

Vitamin D deficiency is a prevalent issue affecting populations worldwide, particularly in sunny regions where higher vitamin D levels might be expected. Alarmingly, studies suggest that between 44% and 95% of individuals in many countries such as Saudi Arabia, Egypt, and India are vitamin D deficient, with many having circulating levels of serum 25(OH)D lower than the critical limit of 20ng/mL (Holick, 2007; Lotfi et al., 2007).

This deficiency is often exacerbated by cultural practices that limit sun exposure, particularly for women who cover most of their skin with clothing (Micka, 2014). Additionally, dietary habits significantly contribute to vitamin D levels, because many people do not consume enough vitamin D foods, which can lead to various health complications, including chronic pain syn-



The Author(s) 2025. This article is distributed under the terms of the *Creative Commons Attribution-NonCommercial 4.0 International License* (<http://creativecommons.org/licenses/by-nc/4.0/>) (<http://creativecommons.org/licenses/by-nc/4.0/>)), which permits unrestricted use, distribution, and reproduction in any medium, *for non-commercial purposes only*, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

dromes and other systemic diseases (Sichert-Hellert et al., 2006).

The implications of vitamin D deficiency extend beyond musculoskeletal health, with research suggesting its involvement in the pathogenesis of numerous disorders, including cardiovascular diseases, autoimmune conditions, and metabolic disorders (Pittas et al., 2006). Furthermore, Vitamin D deficiency is often linked to unspecific symptoms such as fatigue and generalised myalgia, which can lead to misdiagnosis of conditions like fibromyalgia or chronic fatigue syndrome (Holick, 2003).

Given the complex role of vitamin D in health, this study aims to investigate the correlation between vitamin D levels and chronic pain, focusing on how addressing vitamin D deficiency may alleviate symptoms and improve overall health outcomes.

MATERIALS AND METHODS

Study design

A cross-sectional vitamin D study was conducted on 80 adults (age range: 21-65 years) attending the Arada Polyclinic for non-specific musculoskeletal pain and fatigue. Chronic conditions that affect vitamin D absorption, such as hepatic and renal disease, or drugs such as steroids and anti-epileptic drugs that can affect vitamin D levels, were excluded from the study.

Data collection

The methodology included a comprehensive questionnaire that collected demographic information, medical history, and symptoms related to fatigue and musculoskeletal pain.

Study duration and follow-up

The study, conducted from January to September 2019, began with the collection of data on vitamin D deficiency levels over the first three months. Patients followed up four weeks after receiving their initial treatment dose and continued to be monitored for three additional months to complete their treatment course.

Serum 25(OH) D measurement

Blood samples were analyzed for serum 25-hydroxyvitamin D (25(OH)D) levels, the primary indicator of vitamin D status due to its 2-3 week half-life, reflecting skin synthesis and diet absorption. At the visit's end, a 5 mL blood sample was collected from each participant. All tests for 25-OH vitamin D were done in the clinical lab using an ELISA kit. Participants were classified by vitamin D levels, with deficiency set as a serum concentration below 20 ng/ml.

Vitamin D treatment

Patients were advised to receive an intramuscular injection of active vitamin D3 at a dose of 200,000 IU on the same day their suboptimal serum vitamin D levels were confirmed. They were instructed to return for a follow-up after four weeks, during which their symptom improvement would be assessed, and a second dose of vitamin D3 would be administered. The treatment regimen consists of three monthly doses of 200,000 IU intramuscular injection (IM).

Sunlight and diet questionnaire

The study aimed to link vitamin D deficiency with symptom prevalence, considering factors like skin pigmentation, which affects vitamin D synthesis by influencing UVB ray absorption. Participants reported their sun exposure habits, which are vital for vitamin D production, with recommendations of 5-30 minutes of sun exposure at least twice a week. Regarding dietary habits, participants categorized their consumption of vitamin D-rich foods (e.g. fish and milk) as never, yes, or specify-

ing the frequency. Additionally, the regular use of multivitamin supplements containing vitamin D was noted.

Data management and analysis

Questionnaire and clinical data were entered into a Microsoft Access database and analyzed using SPSS version 16. Quantitative data were reported as mean $\pm$ SD and qualitative data were shown as counts and percentages.

An independent samples t-test with $p < 0.05$ compared results before and after treatment, while serum vitamin D and bone pain changes were evaluated using a paired t-test. Patients were informed about the study's objectives, especially regarding vitamin D levels, and encouraged to attend follow-ups. Informed consent was collected from all participants, ensuring voluntary participation and data confidentiality.

RESULTS

A study of eighty patients with fatigue and musculoskeletal pain revealed significant vitamin D deficiency in the entire cohort. The demographic analysis showed that the predominant age group was 18 to 30 years, accounting for 30% of the participants (Table 1).

Table (1): Distribution of study participants by age group

Age group by years	No	(%)
18-30	24	30%
31-40	20	25%
41-50	18	22.5%
51-60	16	20%
61-70	2	2.5%
Total	80	100%

Notably, there was a higher prevalence of female patients, with 62 out of the 80 participants being female. It also evaluated the distribution of patients with various comorbid conditions, especially diabetes and hypertension. A key aspect of the research was to assess the link between low serum vitamin D and vitamin-rich food intake, such as seafood and dairy. Patients consuming sufficient amounts of these foods had higher serum vitamin D than those who did not. Additionally, sunlight exposure for over an hour daily significantly raised serum vitamin D levels.

An evaluation of patients' knowledge regarding natural sources of vitamin D revealed that only 26 participants were aware of the importance of sunlight as a source. A mere 10 patients recognized dietary sources of vitamin D. The predominant type of pain reported was nonspecific musculoskeletal pain, affecting 55% of the patients (Table 2).

To assess the impact of vitamin D treatment on patients' symptoms, a t-test was employed, yielding statistically significant results ($t = -16.6$). Mean serum vitamin D levels rose from 8.4 ng/mL to 36.4 ng/mL after treatment, demonstrating the effectiveness of supplementation for deficiency symptoms. Results are in Table 3.

Table (2): Impact of Vitamin D Treatment on Demographic Parameters: A Comparative Analysis

Variables	Distribution details	No.	Percentage change %	Pre-treatment mean	Post-treatment mean
Gender	Male	18	22.5	11.1 ±5.9	28.9 ±1.2
	Female	62	77.5	7.6 ±4.0	38.5 ±1.5
	Total	80	100	8.4 ±4.7	36.4 ±1.5
Daily exposure to sun-light	One hour	32	40%	11.6 ± 5.3	35.6 ± 1.8
	Less than 1 hour	48	60%	6.3 ±2.8	36.9 ± 1.2
	Total	80	100	8.4 ±4.7	
Usages of sunscreen	Yes	12	15%	5.5 ± 2.8	36.2 ± 6.3
	No.	68	85%	8.9 ± 4.8	36.4 ± 1.6
	Total	80	100%	8.4 ±4.7	36.4 ±1.5
Multivitamin supplements	Yes	18	22.5%	14.8 ± 4.6	38.4 ± 1.6
	No.	62	62.5%	6.6 ± 2.8	35.8 ± 1.4
	Total	80	100%	8.4 ±4.7	36.4 ±1.5
Dairy products intake	Non	18	22.5	5.6 ±3.2	35.9 ±1.2
	weekly	48	60	8.6 ±3.8	36.5 ±1.4
	Daily	14	17.5	11.2 ±7.1	36.3 ±1.9
	Total	80	100	8.4 ±4.7	36.4 ±1.5
Seafood Consuming	Non	18	22.5	4.6 ± 2.1	34.8 ± 1.3
	Once	38	47.5	8.0 ± 3.7	35.8 ± 1.5
	>Once	24	30	12 ±5.1	38.4 ± 1.6
	Total	80	100	8.4 ±4.7	36.4 ±1.5
Chronic bone pain	Chronic nonspecific bone pain	44	55%	8.4± 5.1	36.7± 1.5
	Leg pain	16	20%	9.4± 5.6	37.1± 1.6
	Back pain	20	22%	7.6± 2.9	35.1± 1.3
	Total	80	100%	8.4± 4.7	36.4± 1.5

Table (3): T-test applied to investigate if chronic pain improvement after vitamin D Treatment:

T-test	Treatment	No.	Mean	+ SD	P value	t	df
	before	80	8.46	4.77			
	After	80	36.40	15.14	0.001	-16.6	79

M= mean

SD= standard deviation

The result showed that the amount of $t_{(79)}$ is ($t = -16.6$) and the result was statistically significant $p < 0.001$, which is less than 0.05. Thus, the findings are statistically different.

DISCUSSION

Recent research has focused on vitamin D deficiency and its effects on fatigue and musculoskeletal pain. This study focused on the improvement in chronic bone pain and fatigue following vitamin D fortification and treatment of vitamin D deficiency. Several studies have shown a strong correlation between low levels of vitamin D and an increase in the severity of fatigue symptoms. For example, a retrospective observational study of 98 patients demonstrated that improvement in fatigue was significantly more common in those who received vitamin D supplementation versus placebo, with rates of 72% versus 50% ($P < 0.01$) (Nowak et al., 2016).

This finding is consistent with other studies that have reported similar improvements in fatigue symptom scores following the normalisation of vitamin D levels with supplementation (Khan et al., 2010). The mechanisms underlying these improvements are complex. Vitamin D is essential for various physiological functions, including immune response and muscle regulation (Holick, 2011). A study of 174 adults found that supplementing deficient vitamin D significantly reduced fatigue severity, indicating its role in energy metabolism and muscle performance. (Roy et al., 2014). In

addition, vitamin D receptors are present in various tissues, including skeletal muscle, which may explain the observed improvements in muscle pain and weakness following treatment (Vasquez et al., 2004). In addition, our study showed that the prevalence of vitamin D deficiency is particularly high in certain populations, such as women and those with limited sun exposure. This finding is consistent with our previous study and other studies that have reported marked vitamin D deficiency due to lifestyle or clothing choices (Al-Graiwi et al., 2020; Hatun et al., 2005; Mallah et al., 2011). Studies indicate that conservative clothing choices among adolescent girls in Turkey are linked to lower vitamin D levels, while men, who generally participate in more outdoor activities, tend to have higher levels of this essential nutrient (Hatun et al., 2005).

This gender difference in vitamin D status may worsen the prevalence of fatigue and musculoskeletal pain in women. Research shows that over 90% of female patients with low vitamin D experienced relief from pain and muscle weakness after treatment (Jalili et al., 2015; Shipton & Shipton, 2015). Thus, vitamin D deficiency is a significant contributor to fatigue and musculoskeletal pain, and normalizing vitamin D levels through supplementation can alleviate these symptoms. Routine screening for vitamin D deficiency in patients reporting fatigue and pain is essential, prompting healthcare providers to prioritize vitamin D status in managing these common issues (Jalili et al., 2015).

Vitamin D is vital for muscle function and pain relief. This might explain why women suffering from pain and fatigue often improve with increased vitamin D levels (Bertone-Johnson & Manson, 2012). Our study demonstrated that vitamin D supplementation significantly elevated levels from 8.4 ng/mL to 36.4 ng/mL across all patient groups, highlighting its effectiveness in alleviating deficiency-related symptoms. Indeed, Vitamin D, as explained by Di Molfetta et al. (2024), helps alleviate fatigue by reducing oxidative stress and inflammation, which are major contributors to fatigue. It does this by lowering levels of oxidative molecules and inflammatory cytokines, regulating neurotransmitters such as dopamine and serotonin, and improving mitochondrial function in the muscles, thereby increasing energy production and overall well-being.

CONCLUSION

Addressing low vitamin D levels, especially in women, is crucial for alleviating these health concerns. The current study underscores the importance of vitamin D in managing fatigue and musculoskeletal pain symptoms and highlights the need for proper diet and sunlight exposure to maintain adequate vitamin D levels.

ACKNOWLEDGEMENT

We thank Souq Aljuma facilities for their vital support, all study participants, and our colleagues for their guidance and insights. Their dedication and expertise were crucial to the success of this research.

ETHICS AND CONSENT

All trial participants were informed about the study's goals and procedures, including vitamin D levels at various stages. They were urged to attend follow-ups to monitor changes. Informed consent was obtained to confirm their understanding, voluntary participation, and assurance that data would be used solely for research.

Duality of interest: The authors declare that they have no duality of interest associated with this

manuscript.

Author contributions: Contribution was equal between authors.

Funding: No specific funding was received for this study.

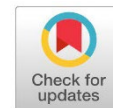
REFERENCES

- Al-Graiw, M. H., Draid, M. M., Zaidi, A. M., & Al-Griw, H. H. (2020). Serum Vitamin D Levels and Associated Risk Factors among Libyan Females Living in Tripoli, Libya: A Cross-Sectional Study. *Libyan Journal of Medical Sciences*, 4(4), 169-173. https://doi.org/10.4103/ljms.ljms_64_20
- Bertone-Johnson, E. R., & Manson, J. E. (2012, Feb 27). Vitamin d for menstrual and pain-related disorders in women: comment on "improvement of primary dysmenorrhea caused by a single oral dose of vitamin d". *Arch Intern Med*, 172(4), 367-369. <https://doi.org/10.1001/archinte.172.4.367>
- Di Molfetta, I. V., Bordoni, L., Gabbianelli, R., Sagratini, G., & Alessandroni, L. (2024). Vitamin D and Its Role on the Fatigue Mitigation: A Narrative Review. *Nutrients*, 16(2), 221. <https://www.mdpi.com/2072-6643/16/2/221>
- Hatun, S., Islam, O., Cizmecioglu, F., Kara, B., Babaoglu, K., Berk, F., & Gokalp, A. S. (2005, Feb). Subclinical vitamin D deficiency is increased in adolescent girls who wear concealing clothing. *J Nutr*, 135(2), 218-222. <https://doi.org/10.1093/jn/135.2.218>
- Holick, M. F. (2003, Dec). Vitamin D deficiency: what a pain it is. *Mayo Clin Proc*, 78(12), 1457-1459. <https://doi.org/10.4065/78.12.1457>
- Holick, M. F. (2007). Optimal vitamin D status for the prevention and treatment of osteoporosis. *Drugs Aging*, 24(12), 1017-1029. <https://www.ncbi.nlm.nih.gov/pubmed/18020534>
- Holick, M. F. (2011, Jan). Vitamin D: evolutionary, physiological and health perspectives. *Curr Drug Targets*, 12(1), 4-18.
- Jalili, A., Bahrabadi, M., & Zare, S. (2015). Prevalence of Vitamin D Deficiency in Nonspecific Musculoskeletal Pain [Research Article]. *Shafa Ortho J*, 2(4), e4052. <https://doi.org/10.17795/soj-4052>
- Khan, Q. J., Reddy, P. S., Kimler, B. F., Sharma, P., Baxa, S. E., O'Dea, A. P., Klemp, J. R., & Fabian, C. J. (2010, Jan). Effect of vitamin D supplementation on serum 25-hydroxy vitamin D levels, joint pain, and fatigue in women starting adjuvant letrozole treatment for breast cancer. *Breast Cancer Res Treat*, 119(1), 111-118. <https://doi.org/10.1007/s10549-009-0495-x>
- Lotfi, A., Abdel-Nasser, A. M., Hamdy, A., Omran, A. A., & El-Rehany, M. A. (2007, Nov). Hypovitaminosis D in female patients with chronic low back pain. *Clin Rheumatol*, 26(11), 1895-1901. <https://doi.org/10.1007/s10067-007-0603-4>

- Mallah, E. M., Hamad, M. F., ElManaseer, M. A., Qinna, N. A., Idkaidek, N. M., Arafat, T. A., & Matalka, K. Z. (2011, 08/04 05/24/received 08/04/accepted). Plasma concentrations of 25-hydroxyvitamin D among Jordanians: Effect of biological and habitual factors on vitamin D status. *BMC Clinical Pathology*, 11, 8-8. <https://doi.org/10.1186/1472-6890-11-8>
- Micka, A. (2014). *Vitamin D Status among Bangladeshi Women of Reproductive Age* (Publication Number 1911) University of Massachusetts Amherst].
- Nowak, A., Boesch, L., Andres, E., Battegay, E., Hornemann, T., Schmid, C., Bischoff-Ferrari, H. A., Suter, P. M., & Krayerbuehl, P. A. (2016, Dec). Effect of vitamin D3 on self-perceived fatigue: A double-blind randomized placebo-controlled trial. *Medicine (Baltimore)*, 95(52), e5353. <https://doi.org/10.1097/MD.0000000000005353>
- Pittas, A. G., Dawson-Hughes, B., Li, T., Van Dam, R. M., Willett, W. C., Manson, J. E., & Hu, F. B. (2006, Mar). Vitamin D and calcium intake in relation to type 2 diabetes in women. *Diabetes Care*, 29(3), 650-656. <https://www.ncbi.nlm.nih.gov/pubmed/16505521>
- Roy, S., Sherman, A., Monari-Sparks, M. J., Schweiker, O., & Hunter, K. (2014, Aug). Correction of Low Vitamin D Improves Fatigue: Effect of Correction of Low Vitamin D in Fatigue Study (EViDiF Study). *N Am J Med Sci*, 6(8), 396-402. <https://doi.org/10.4103/1947-2714.139291>
- Shipton, E. A., & Shipton, E. E. (2015). Vitamin D and Pain: Vitamin D and Its Role in the Aetiology and Maintenance of Chronic Pain States and Associated Comorbidities. *Pain Res Treat*, 2015, 904967. <https://doi.org/10.1155/2015/904967>
- Sichert-Hellert, W., Wenz, G., & Kersting, M. (2006, May). Vitamin intakes from supplements and fortified food in German children and adolescents: results from the DONALD study. *J Nutr*, 136(5), 1329-1333. <https://doi.org/10.1093/jn/136.5.1329>
- Vasquez, A., Manso, G., & Cannell, J. (2004, Sep-Oct). The clinical importance of vitamin D (cholecalciferol): a paradigm shift with implications for all healthcare providers. *Altern Ther Health Med*, 10(5), 28-36; quiz 37, 94.

Research Article

Open Access



Iliopsoas Abscess: Presentation, Etiology, Treatment Options, and Outcomes: A Retrospective Analysis of 19 Cases

Khaled Faiz¹, Jamal Gomati¹, Tariq Elhoony², Tariq Aldarat¹, Salah Eltaktouk¹, Muftah Elkhafifi³, Ali Abokiash³, Raouf Kwafi¹, Issa Abuzied¹

² 7th October Hospital Benghazi-Libya.

³ Al-hawari Center-Urology Department Benghazi-Libya

***Corresponding author:**
kfe.yosif@yahoo.com Department of Surgery, Benghazi Medical Center.

Received:
13 February 2025

Accepted:
18 June 2025

Publish online:
30 June 2025

Abstract

Iliopsoas abscess (IPA) is an exceptional condition with high rates of mortality and morbidity. Pyogenic abscesses (PAs), which account for more than half of iliopsoas abscesses, have developed comparatively more frequently as the prevalence of tuberculosis disease has diminished. Our study aims to analyze the presentation, treatment, and outcomes in 19 patients with a diagnosis of IPA. A retrospective analysis of 19 consecutive IPA cases managed at teaching hospitals (Benghazi Medical Center and Urology Center) Benghazi-Libya. Among 19 patients with a diagnosis of IPA, 12 were males (63.1 %) with a mean age of 50 years (range, 11 to 78 y). and 7 were females (36.9 %) with an average age of 41 (16 - 67) years the most frequent feature was lower abdominal pain (73.6 %), fever (57.8 %), followed by limping (36.8 %), and Weight loss (21.1 %). Leukocytosis was the most common laboratory finding (86.4 %), whereas anemia was the second most common laboratory finding found in (26.3%). Three patients (15.8 %) underwent ultrasound (U/S) with negative results before CT (computed tomography) which was the confirmatory scan for all patients. Six patients underwent open surgical drainage (31.6 %) and thirteen (68.4 %) were submitted to percutaneous drainage (PCD) under ultrasound guidance with an overall success rate of 97 %. Compared to surgery, PCD had a lower mean in-hospital stay. US-guided PCD along with the proper antibiotic medication is safe, effective, and results in a shorter hospital stay.

Keywords: Iliopsoas Abscess, Percutaneous Drainage, Open Drainage.

INTRODUCTION

The term "psoitis" was initially used by (Mynter & Journal, 1881) to characterize an accumulation of purulent material in the iliopsoas compartment, which is now known as an iliopsoas abscess (IPA) (Mynter & Journal, 1881). Due to its subtle onset and vague clinical presentation, the condition is frequently overlooked (Benkhadoura et al., 2019). IPA is categorized into primary or secondary types. Secondary IPA due to the continuous spread of contamination from an adjacent organ (appendix, sigmoid colon, vertebra, and kidney).

Primary IPA because of the hematogenous spread from an unknown source of infection (Taiwo, 2001). It frequently arises as a result of spinal TB dissemination. However, the incidence of tuberculosis is declining because of progress in contemporary antituberculosis therapies. The ma-



majority of iliopsoas abscesses are of bacterial origin (Mallick et al., 2004). The classical triad of pain, fever, and limp, for clinical diagnosis of IPA, are uncommonly seen (Tabrizian et al., 2009). When patients suffer vague symptoms, IPA is frequently diagnosed using Computed Tomography (CT), ultrasonography (US), and magnetic resonance imaging (MRI) (Kinoshita et al., 2016).

Percutaneous drainage (PCD) has been conventionally employed to manage intra-abdominal or pelvic abscesses, and it has now become the primary treatment for an IPA (Yamagami et al., 2009). Given that PCD is less invasive and demands a shorter hospital stay, it is favored over open surgical drainage when conducted under ultrasound guidance. The expenses associated with CT-guided PCD are greater, and there is a risk of radiation exposure. We explore our experiences with IPAs and evaluate the various drainage methods.

MATERIALS AND METHODS

The medical records of 19 consecutive patients admitted and managed in two major Teaching Hospitals (Benghazi Medical Center and the Urology Center) in Benghazi, Libya, between March 2015 and July 2023 were retrospectively analyzed. The choice of performing PCD is dependent on surgeons' and radiologists' experience. The analyzed variables were age, sex, image findings, clinical presentation, treatment outcome, therapeutic effectiveness, in-hospital stay, and mortality.

Procedure:

Before PCD, all patients underwent CT scans with a slice thickness ranging from 5 to 10 mm before and after the intravenous administration of a 100 to 120 ml contrast bolus. Ultrasound-guided aspiration and catheter drainage are primarily employed for single abscesses. Open surgery, however, is advised for complicated abscesses (Christin & Sarosi, 1992; Li et al., 2017; Livne et al., 1994). For abscesses situated on the lateral wall of the pelvis, an anterior approach, positioned just above the anterior iliac spine, was utilized, whereas a posterolateral approach, via paravertebral muscles, was favored for abscesses involving the psoas muscle; a catheter (nephrostomy tube 14-16 Fr or a chest tube No. 24) was placed into the cavity and linked to a non-suction drainage system.



A- iliopsoas mass.

B- percutaneous drainage

Figure (1). Percutaneous drainage of iliopsoas abscess

RESULTS

Among 19 patients with a diagnosis of IPA, 12 were males (63.2 %) with a mean age of 66 years (range, 11-78 y), and 7 were females (36.8 %) with an average age of 42 (16-67) years. Thirteen patients (68 %) presented with secondary abscess. The most common etiologies were *Staphylococcus aureus* (8 cases) and *Escherichia coli* infection (5 cases). Tuberculosis of the spine was the underlying condition in 6 patients (32 %) with secondary IPAs.

Table (1). Patients Age and Sex

	Primary n=6	Secondary n=13
Age years	24-50	11-78
Sex		
Male	4	8
Female	2	5
Recurrence	1	1
Mortality	0	0

At clinical presentation, the most common symptom was lower abdominal pain (73.6 %) and fever (57.8 %), followed by limping (36.8 %) and weight loss (21.1 %). Mynter's triad, composed of fever, back pain, and limp was present in a limited number of patients. Leukocytosis was the most common laboratory finding (86.4 %), whereas anemia was the second most common laboratory finding identified (26.3 %).

Table (2). Clinical presentation

Clinical finding	No. of patients	Percentage
Lower abdominal pain	14	73.6 %
Flank mass	3	15.8 %
Fever	11	57.8 %
Limping	7	36.8 %
Weight loss	4	21.1 %
Anemia	5	26.3 %
Leukocytosis	13	86.4 %

CT was recommended for all patients, although three patients (15 %) had a prior ultrasound that resulted negatively before undergoing CT, which served as the confirmatory scan for all patients. Blood cultures revealed positive results in 31.6 % of the patients. In terms of treatment, six patients underwent surgical open drainage (31.6 %), while thirteen patients (68.4 %) underwent percutaneous drainage (PCD) guided by ultrasound. No patient was treated with antibiotics alone; antibiotics were administered concurrently to all patients in both groups.

Table 3: Site of occurrence of IPA

Site of occurrence of IPA	Number of cases	percentage
Right	13	68.4 %
Left	6	31.6 %

Compared to surgery, PCD had statistically significant shorter mean hospital stay (5.92 vs 21.29 days with a P value of 0.0458). Among a total of 19 cases, PCDs were performed in 13 patients with an overall success rate of 92 %. On the other hand, 6 patients underwent open surgical drainage.

Hospital stay was significantly shorter in patients treated via PCD compared to those who received open drainage. The overall recurrence rate was 10 % (2/19). No recurrence was noted in patients treated via open surgical drainage. Of the 13 patients who underwent PCD, two (15.4 %) presented with recurrence 3-6 months into their follow-up periods. Two patients with recurrent IPA (one primary case and one secondary) were successfully managed via repeat PCD under ultrasound guidance. No mortality was recorded.

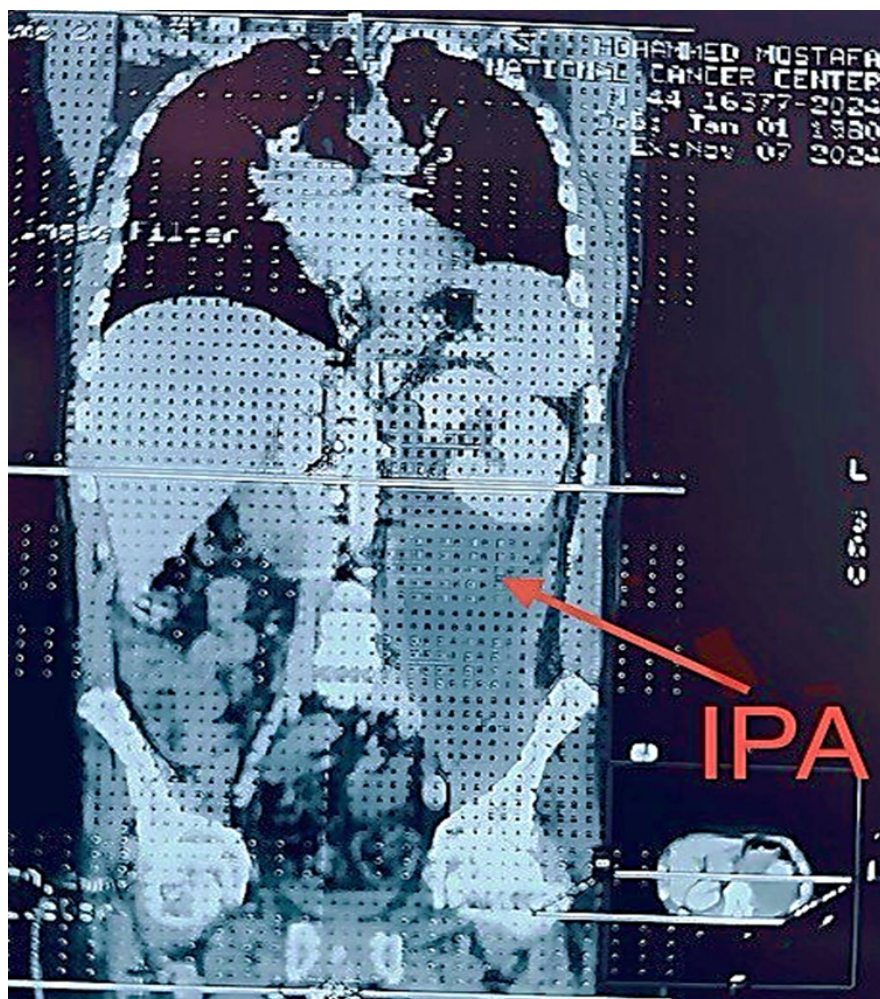


Figure (2). Axial CT scan of left iliopsoas abscess

Table 3: Comparison of PCD vs Open Drainage

	Open drainage (n=6)	Percutaneous drainage (n=13)	P Value
Primary	2	4	
Secondary	4	9	
Length of hospital stay	5-60 days Mean 21.29	2-10 days Mean 5.92	P value 0.0458 significant
Recurrence	0	2	
Mortality	0	0	

DISCUSSION

The iliopsoas muscles have an abundant blood supply and are wrapped in retroperitoneal lymphatic systems, rendering them susceptible to infections from nearby structures and distant lo-

cations. Due to its subtle onset and the possibility of life-threatening acute sepsis, IPA is often overlooked. Although the exact frequency of IPA is unknown, the rising use of CT in patients suspected of having IPA is resulting in the diagnosis of more cases. Regarding imaging techniques, CT has a well-established position as the standard method for examining retroperitoneal abscesses, demonstrating a reported sensitivity of 100 %, specificity of 77 %, and accuracy of 88% (Yeh et al., 1995).

The infectious source is likely to be identified since these imaging techniques can distinctly outline surrounding tissues, specifically the vertebrae and epidural space. Additionally, CT has proven to be advantageous in strategizing a surgical approach. While MRI currently lacks the adaptability of either CT or ultrasound as a tool for drainage procedures, it may provide supplementary information when spinal or vertebral involvement is suspected (Negus & Sidhu, 2000). Despite recent developments in diagnostic techniques, the mortality rate of IPA has not significantly decreased (6.7 % in a study by (Ricci et al., 1986) and 5 % in a study by (López et al., 2009). The actual incidence of the condition is unknown (Yacoub et al., 2008).

Nevertheless, the existing literature suggests that this condition is becoming increasingly common globally. For effective management of IPA patients, antibiotic treatment accompanied by abscess drainage is essential. PCD or surgery are possible drainage methods. Surgery is usually required to eliminate or address the infected sources in IPA patients who also present concurrent intra-abdominal or retroperitoneal complications, such as perforated appendicitis or ruptured infected aortic aneurysm.

IPA patients were often treated with surgical drainage throughout the 1980s, in an era when imaging techniques were not commonly employed (Ricci et al., 1986). Afaq et al. likewise observed that there were no deaths in 72 cases in Nepal, where every patient underwent surgical treatment as the primary approach (Afaq et al., 2002).

Recent studies have shown that IPA can be successfully treated with a combination of antibiotics and PCD (Cantademir et al., 2003). The primary contributor to secondary IPA is Crohn's disease (Ricci et al., 1986). Wong et al. found that spondylitis (spondylodiscitis involving the disc) was the foremost reason for secondary psoas abscesses. IPAs are often overlooked at the time of initial presentation (Wong et al., 2013).

In the present study, lower back/flank pain was the most common symptom; back pain, limping, and fever were not often noted. Patients treated with PCD had an average hospital stay of 9.5 days, which was considerably shorter than those treated with open drainage. Tabrizian et al. reported a mean hospital stay of 25 days, while Cantademir et al. noted a mean of 11.5 days (Cantademir et al., 2003; Tabrizian et al., 2009). Yacoub et al. documented a median hospital stay of 29 days (Yacoub et al., 2008). In this research, the average length of hospital stay for patients receiving PCD was significantly shorter than that for those undergoing open surgical drainage; thus, the expenses associated with PCD are considerably lower than those for open surgical drainage. The participants in this study had a mean hospital stay similar to that reported by Cantademir et al. (Cantademir et al., 2003).

The reduced hospital duration in our study may be linked to the early discharge of patients with drainage catheters (especially those managed with PCD), along with follow-up as required, and the rapid diagnosis enabled by the increased use of CT. In the present study, the total recurrence rate was found to be 10.5 % (2/19). The recurrence rates observed in two additional studies were 16.7 % and 7.7 %, respectively (Cantademir et al., 2003; Yacoub et al., 2008). On the

other hand, Baier et al. reported a comparatively high recurrence rate of 37.5 % (Baier et al., 2006). In the present study, no underlying pathology was identified to explain the recurrence. However, the likely reason for the recurrence in those three patients was the premature removal of the drainage catheter. Kim et al., Tabrizian et al., and Yacoub et al., documented mortality rates of 11.2 %, 5 %, and 3 %, respectively (Kim et al., 2013; Tabrizian et al., 2009; Yacoub et al., 2008). According to Baier et al., 15 % of patients (6/40) died; all patients were treated with open-access drainage. Three individuals lost their lives due to sepsis, while three others died from ischemic heart attacks (Baier et al., 2006). The authors report no cases of mortality, which might be attributed to the young age and absence of comorbidities among the majority of the patients in the study.

CONCLUSION

- Iliopsoas abscess is not an uncommon condition, and its symptoms are typically non-specific.
- To make an early diagnosis of this illness, a high index of suspicion is necessary.
- Imaging modalities such as CT and US help manage and diagnose IPA.
- PCD was attended with shorter hospital stays and lower costs compared with open drainage.
- Along with the proper antibiotics, US-guided percutaneous drainage serves as the primary treatment of iliopsoas abscess and is considered to be a safe and successful technique.

ACKNOWLEDGEMENT

We thank all the doctors for their technical assistance, cooperation, and support in participating in this research and sharing their experiments and data analysis.

ETHICS

Participants were informed of the study's purpose and procedures, and their participation was voluntary. Participants were provided with a detailed information sheet outlining the study's aims, the interview process, and the measures taken to ensure confidentiality. Written informed consent was obtained from all participants at the time of admission.

Duality of Interest: The authors declare that they have no competing interests.

Author Contributions: All authors contributed equally to this work. Contributions by performing surgery, sharing notes, and analysis of data.

Funding: Resources, facilities, equipment, and staff time are all funded by the main hospitals (Benghazi Medical Center and Al Hawari Center for Urology).

REFERENCES

- Afaq, A., Jain, B. K., Dargan, P., Bhattacharya, S. K., Rauniyar, R. K., & Kukreti, R. J. T. d. (2002). Surgical drainage of primary iliopsoas abscess—safe and cost-effective treatment. 32(3), 133-135.

- Baier, P., Arampatzis, G., Imdahl, A., & Hopt, U. J. L. s. A. o. S. (2006). The iliopsoas abscess: aetiology, therapy, and outcome. *391*(4), 411-417.
- Benkhadoura, M. O., El-Mogassabi, A. H., Mansor, S. M., Abuzaid, I. A., Manita, M. A., Etabbal, A. M.,...Elshaikhy, A. I. J. I. S. J. (2019). Iliopsoas abscess: clinical presentation, management, and outcome. *International Surgery Journal*, 6(1), 17-21. <https://doi.org/https://doi.org/10.18203/2349-2902.isj20185458>
- Cantasdemir, M., Kara, B., Cebi, D., Selcuk, N., & Numan, F. J. C. r. (2003). Computed tomography-guided percutaneous catheter drainage of primary and secondary iliopsoas abscesses. *58*(10), 811-815.
- Christin, L., & Sarosi, G. A. J. C. I. D. (1992). Pyomyositis in North America: case reports and review. *15*(4), 668-677.
- Kim, Y. J., Yoon, J. H., Kim, S. I., Wie, S. H., & Kim, Y. R. J. I. J. o. S. (2013). Etiology and outcome of iliopsoas muscle abscess in Korea; changes over a decade. *11*(10), 1056-1059.
- Kinoshita, M., Takao, S., Takechi, K., Takeda, Y., Miyamoto, K., Yamanaka, M.,...Tani, H. J. T. J. o. M. I. (2016). Percutaneous drainage of psoas and iliopsoas muscle abscesses with a one-step technique under real-time computed tomography fluoroscopic guidance. *63*(3.4), 323-327.
- Li, Y., Funakoshi, H., Shiga, T., & Fujitani, S. J. C. C. J. M. (2017). Iliopsoas abscess. *84*(11), 833-834.
- Livne, M., Serour, F., Aladjem, M., & Vinograd, I. J. E. j. o. p. s. (1994). General peritonitis induced by rectal examination: an unusual complication of primary psoas abscess. *4*(03), 186-187.
- López, V. N., Ramos, J. M., Meseguer, V., Arellano, J. L. P., Serrano, R., Ordóñez, M. A. G.,...Conde, A. J. M. (2009). Microbiology and outcome of iliopsoas abscess in 124 patients. *88*(2), 120-130.
- Mallick, I., Thoufeeq, M., & Rajendran, T. J. P. m. j. (2004). Iliopsoas abscesses. *80*(946), 459-462.
- Mynter, H. J. B. M., & Journal, S. (1881). Acute psoitis. *21*(5), 202.
- Negus, S., & Sidhu, P. J. T. B. j. o. r. (2000). MRI of retroperitoneal collections: a comparison with CT. *73*(872), 907-912.
- Ricci, M. A., Rose, F. B., & Meyer, K. K. J. W. j. o. s. (1986). Pyogenic psoas abscess: worldwide variations in etiology. *10*(5), 834-842.
- Tabrizian, P., Nguyen, S. Q., Greenstein, A., Rajhbeharrysingh, U., & Divino, C. M. J. A. o. s. (2009). Management and treatment of iliopsoas abscess. *144*(10), 946-949.
- Taiwo, B. J. S. m. j. (2001). Psoas abscess: a primer for the internist. *94*(1), 2-5.
- Wong, O., Ho, P., & Lam, S. J. H. K. m. j. X. y. x. z. z. (2013). Retrospective review of clinical presentations, microbiology, and outcomes of patients with psoas abscess. *19*(5), 416-423.

- Yacoub, W. N., Sohn, H. J., Chan, S., Petrosyan, M., Vermaire, H. M., Kelso, R. L.,...Mason, R. J. J. T. A. J. o. S. (2008). Psoas abscess rarely requires surgical intervention. *196*(2), 223-227.
- Yamagami, T., Terayama, K., Yoshimatsu, R., Matsumoto, T., Miura, H., & Nishimura, T. J. S. r. (2009). Percutaneous drainage of psoas abscess under real-time computed tomography fluoroscopic guidance. *38*(3), 275-280.
- Yeh, P., Jaw, W., Wang, T., Yen, T. J. Z. y. x. z. z. C. M. J., & ed, F. C. (1995). Evaluation of iliopsoas compartment disorders by computed tomography. *55*(2), 172-179.

Research Article

Open Access



Exploring the Role of Sociodemographic Factors in Influencing Dental Floss Knowledge and Practices among Adults in Sebha City, Libya: A Cross-Sectional Study

Osama Ahmadi^{1*}, Mubarakah Abraheem¹, Aisha Aloshiby¹, Ibtisam Ahmadi², Areej EL-Sallak¹, Aram Elhashem¹, Hunaida Budajaja¹

*Corresponding author:

Osama.ahmadi@uob.edu.ly,

Department of Preventive and Dental Public Health, Faculty of Dentistry, University of Benghazi, Benghazi.

¹ Department of Preventive and Dental Public Health, Faculty of Dentistry, University of Benghazi, Benghazi, Libya.

² Department of Botany, Faculty of Arts and Science, Al-Abyar, University of Benghazi, Benghazi, Libya.

Received:

22 February 2025

Accepted:

09 June 2025

Publish online:

30 June 2025

Abstract

Dental diseases are influenced by several sociodemographic factors. This study aims to examine the impact of age, education, and occupation on the knowledge and use of dental floss among adults in Sebha, Libya. A cross-sectional study was conducted among 601 adults in Sebha City using a structured questionnaire. Data were collected on participants' sociodemographic characteristics, and dental floss knowledge and practices. Descriptive statistics and Pearson's chi-square test were employed to analyze the relationships between variables. Out of 601 respondents, 54.4% had general knowledge about dental floss, but only 31.4% reported using it. Females demonstrated better oral hygiene practices, with 41% using floss, compared to 19% of males. Significant differences in flossing habits were observed based on age, education, and occupation, with younger individuals and those with higher educational levels showing greater knowledge and better practice. Additionally, socioeconomic status was a strong determinant of interdental cleaning practice. In conclusion, sociodemographic factors significantly affect dental floss knowledge and practice in Sebha. Public health initiatives should focus on improving education and access to dental care, particularly for lower-income and less-educated groups. The study highlights the need for targeted public health initiatives to promote dental floss usage, particularly among socioeconomically disadvantaged groups.

Keywords: Dental Hygiene, Dental Floss, Knowledge, Oral Health Practice, Sociodemographic Factors.

INTRODUCTION

The prevalence and incidence of dental caries and periodontal diseases are influenced by more than just biological factors. Socioeconomic, educational, and environmental conditions play a significant role in the development of oral diseases (Bastos et al., 2009). Various studies have asserted that social inequalities are closely linked to disparities in oral health outcomes, with individuals from lower socioeconomic groups experiencing a higher burden of these conditions compared to those from more affluent backgrounds (Ahmadi et al., 2019; Elani et al., 2012; Sabbah et al., 2009; Sisson, 2007).

According to 2019 epidemiological data from the World Health Organization (WHO), the prevalence of severe periodontal disease in Libya in people aged 15 and older was estimated at 15.3%, with 36% of individuals aged 5 and older exhibiting untreated dental caries, measured using the



*The Author(s) 2025. *This article is distributed under the terms of the *Creative Commons Attribution-NonCommercial 4.0 International License* (<http://creativecommons.org/licenses/by-nc/4.0/>) (<http://creativecommons.org/licenses/by-nc/4.0/>)), which permits unrestricted use, distribution, and reproduction in any medium, *for non-commercial purposes only*, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

Decayed, Missing and Filled Teeth (DMFT) index. Furthermore, the rate of complete tooth loss among individuals over the age of 20 was reported to be 7.6% (WHO, 2022). Sebha city is the major city in southern Libya, approximately 640 kilometers south of Tripoli, where there is a lack of research on oral health. The two existing studies, by Hassan (2000) and Peeran et al. (2013), demonstrated that oral hygiene in Sebha was poor. Hassan (2000) reported that 54% of tooth extractions were due to cavities, while 41% were related to periodontal disease. Also, Peeran et al. (2013) highlighted periodontal disease as a significant dental issue in this population.

Dental plaque is a primary etiological factor and a major contributor to the onset of chronic periodontal disease (Abdallah, 2022; Almagtoub et al., 2024; Kida et al., 2006) and proximal dental caries (Featherstone, 2003), which can be mitigated through effective interdental cleaning with tools such as dental floss (Sambunjak et al., 2011). Dental biofilm tends to accumulate on proximal surfaces, the areas between teeth, where it triggers gingival inflammation and can advance to periodontitis (Rahouma et al., 2022; Terézhalmy et al., 2008). Furthermore, proximal dental plaque, which occurs between adjacent teeth, is particularly unreachable due to improper interdental cleaning. Dental caries and periodontal diseases remain the main causes of tooth loss (Doshi et al., 2007), leading to functional problems such as difficulties in chewing and speaking, along with aesthetic and social challenges. These complications tend to be more pronounced among individuals from lower socioeconomic backgrounds who may face significant barriers to accessing rehabilitative dental care, such as dentures (Frias et al., 2012).

Regular and effective removal of interdental plaque has been shown to significantly reduce both the prevalence and severity of gingivitis (Greenwell, 2001) and proximal caries (Sambunjak et al., 2011). However, toothbrushing is often insufficient in eliminating plaque from proximal surfaces (Corby et al., 2008). To be more specific, a toothbrush alone cannot fully remove plaque from the spaces between teeth. Therefore, various interdental cleaning tools are available, such as dental floss, wooden sticks, interdental brushes, single-tuft brushes, rubber-tip stimulators, and irrigators (Worthington et al., 2019). According to the American Dental Association, dental floss is the most widely used method for cleaning teeth (Sambunjak et al., 2011). Previous research showed that dental floss alone is more effective than a manual toothbrush for removing interdental plaque from the areas between teeth, yet its use, even as an addition to regular brushing, is not widely practiced globally (Corby et al., 2008; Gufran et al., 2015) and is more common in developed nations (Goryawala et al., 2016). Therefore, proper tooth-cleaning techniques should emphasize thorough cleaning of all tooth surfaces, particularly the interdental areas, which are the most challenging to clean (Butt et al., 2017).

Lack of knowledge and financial constraints are key reasons for non-compliance with oral hygiene routines (Awartani, 2009). Additional factors were identified that linked to low dental flossing rate and affected oral health practices in adults; included socioeconomic status (Neamatollahi & Ebrahimi, 2010; Soofi et al., 2020a), educational level (Peeran et al., 2015), urbanization (Gaber et al., 2018), gender (Elani et al., 2022) and type of dental cleaning tool (Tarannum et al., 2012).

Due to the wide variety of factors influencing an individual's daily oral hygiene as well as the limited studies explored the social determinants of dental floss usage among adults in Libya, this study aimed to examine the impact of sociodemographic factors on the use and knowledge of dental floss. Insights from this research could guide public health initiatives designed to improve oral hygiene behaviours.

MATERIALS AND METHODS

Study design

A cross-sectional study design was carried out amongst the selected population of patients residing in Sebha City.

Study population and participants

The study population consisted of Libyan adults aged 18 years and older residing in Sebha City, Libya. Exclusion criteria were patients from nationalities other than Libya, and patients younger than 18 years old.

Sample size and sampling procedure

A total of 601 subjects were selected using a simple random sampling method from patients who visited public dental clinics in Sebha. The appropriate sample size for this study, based on a target population of 217,880 individuals (Sakhnoub, 2024), was calculated using the Krejcie and Morgan (1971) formula for a finite population, which estimated a sample size of 384 individuals. However, our final sample exceeded this estimate, reaching 601 participants.

Data collection

Data were collected from January to August 2023. A structured, questionnaire-based face-to-face interview was conducted. Since there was no standardized questionnaire, a new instrument was created. Initially, the instrument consisted of 18 questions and was administered in a pilot study of 25 patients for validation.

The final version consisted of 15 items, which fulfilled the study objective. The knowledge variables used in the analysis included five items, while the practice variable included four items. Socio-economic indicators included levels of education and occupation classification. The education variable used in the analysis included three groups: having a high education (university degree or higher), lower education (high school and below), and no education.

Occupation classification was based on the three-class version of the national statistics socio-economic classification and included four groups: professional, intermediate, manual, and never worked. Other variables used in the analysis were age (18-30, 31-45, 46-65, 65+), sex (male, female), frequency of tooth brushing (none, once a day, twice a day), and use of dental floss (yes, no).

Statistical Analysis

Data entries and analysis of results were carried out using SPSS for Windows (version 23.0, SPSS, Chicago, IL, USA) statistical software package. Descriptive statistics such as frequencies and percentages were calculated. Pearson Chi-square test was used to identify the difference between variables. The P-value was fixed at 0.05.

RESULTS

A total of 601 complete questionnaires were analyzed. Table 1 summarizes the participants' socio-demographic characteristics. More than half (54.1%) of the respondents were females, with more than one-third (34.4%) of the age group between 18-30 years. Almost half (49.9%) of respondents received a higher education.

Table (1). Demographic and Socioeconomic Characteristics of Participants (N=601)

Variable	Category	n	%
Gender	Male	276	45.9
	Female	325	54.1
Age Group	18–30 years	207	34.4
	31–45 years	198	32.9
	46–65 years	178	29.6
	Older than 65 years	18	3.0
Occupation	Unemployed	45	7.5
	Professional	108	18.0
	Intermediate	216	35.9
	Manual	232	38.6
Education Level	No Education	60	10.0
	Low Education	241	40.1
	High Education	300	49.9

Table 2 presents the knowledge and practice of the surveyed adults toward dental flossing. It was found that 43.4% of individuals were aware that brushing teeth alone without dental floss is insufficient to clean all tooth surfaces. However, 64.6% of the respondents believed that dental floss causes bleeding of the gums. Moreover, 54.4% of patients had general knowledge about dental floss. In addition, 41.9% of them thought that dental floss polishes the tooth surface as it removes dental plaque and debris. Furthermore, 52.9% believed that dental floss reduces gingival inflammation preventing periodontal disease. In terms of practice, only 31.4% of the respondents reported using dental floss. Nevertheless, 50.4% of patients stated that their dentist had explained how to use dental floss during an appointment. Additionally, 40.6% of dental clinic attendees were advised to practice using dental floss. On the other hand, a high percentage, 83.9% of respondents, had used wooden or rubber interdental cleaning picks (Table 2).

Table (2). Knowledge and Practice of the Participants toward Dental Floss

Questions related to knowledge about dental floss		Response				Total	
		Yes		No			
		N	%	N	%	N	%
1.	Do you know that; tooth brushing alone is not sufficient to clean all tooth surfaces?	261	43.4	340	56.6	601	100
2.	Do you think that dental floss can cause bleeding in the gum?	388	64.6	213	35.4	601	100
3.	Do you have any knowledge about dental floss?	327	54.4	274	45.6	601	100
4.	Do you know that dental floss is essential to remove plaque and debris from the interdental area?	252	41.9	349	58.1	601	100
5.	Do you think that the use of a toothbrush and dental floss can prevent periodontal disease?	318	52.9	283	47.1	601	100
Questions related to practice about dental floss		Response				Total	
		Yes		No			
		N	%	N	%	N	%
6.	Do you use dental floss?	189	31.4	412	68.6	601	100
7.	During your dentist appointment, did your dentist explain to you how to use dental floss?	303	50.4	298	49.6	601	100
8.	Did anyone recommend you to practice dental flossing?	244	40.6	357	59.4	601	100
9.	Have you used wooden or rubber interdental cleaning picks?	504	83.9	97	16.1	601	100

Figure 1 describes and compares the teeth brushing and dental flossing of males and females. A statistically significant higher percentage (68%) of females brush twice daily, compared to 48% of males. Regarding dental floss usage, 41% of females reported incorporating it into their oral hygiene routine, compared to only 19% of males. On the other hand, a statistically significant higher percentage (80%) of males refrain from using dental floss, as compared to 58% of females who do not floss. The data indicated that females demonstrate more consistent oral hygiene habits than males, both in terms of brushing frequency and the use of dental floss.

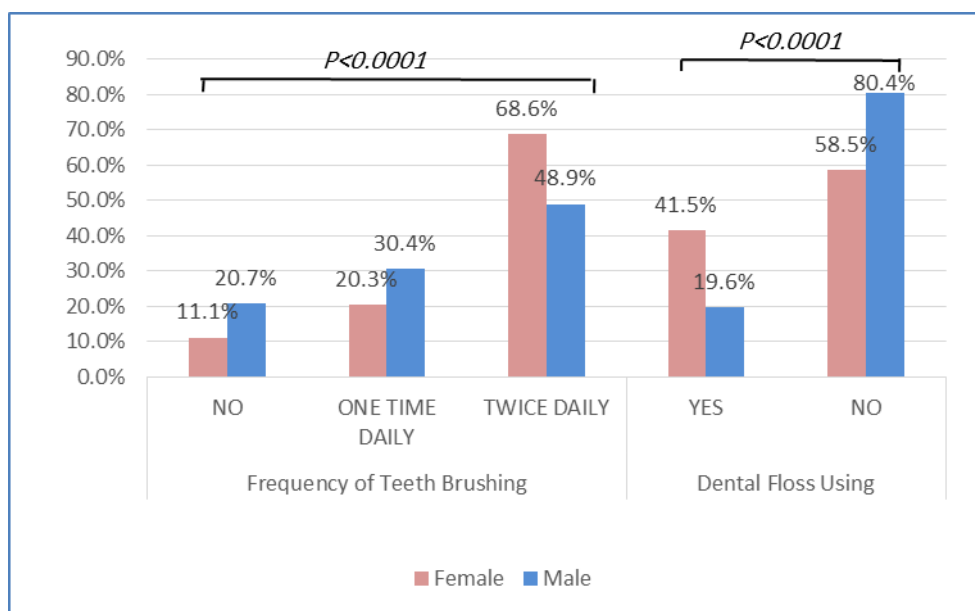


Figure (1). Comparison of Dental Hygiene Behaviors (Brushing and Flossing) by Gender

Table 3 illustrated the significant association between age, education, and occupation levels with the knowledge of dental floss benefits. Among age groups, respondents aged 18–30 years (65.2%) reported the highest affirmative responses, particularly for general dental floss knowledge. Higher education levels (84%) strongly correlated with better dental floss knowledge, with those having advanced education showing significantly higher positive responses compared to individuals with lower (25%) or no education. Intermediate (44.4%) and professional workers (58.3%), especially those with higher incomes, reported better interdental cleaning practices.

Table 4 represents the association between age, education, and occupation levels with the practice of dental floss. Age, education, and occupation significantly impact dental floss usage and interdental cleaning practices. Respondents aged 18–30 years old (40.6%) were most likely to use dental floss. Education strongly influenced flossing behaviours, with higher education levels linked to higher flossing rates (49%) and the use of interdental picks (87%), while those with no or lower education reported significantly lower engagement in these practices. The occupational also played a role, with professionals flossing (36.1%) more frequently. Although manual laborers (78.9%) and those in intermediate occupations (94.4%) showed higher adoption of interdental cleaning picks than professionals (75%), despite the latter's generally better dental care practices.

Table (3). Association between age, education, and occupation levels with the knowledge of dental floss.

Sociodemographic Characteristics		Q1	P value	Q2	P value	Q3	P value	Q4	P value	Q5	P value
Age groups											
18-30 years	Yes	129 (62.3%)		138 (66.7%)		135 (65.2%)		123 (59.4%)		132 (63.8%)	
	No	78 (37.7)		69 (33.3%)		72 (34.8%)		84 (40.6%)		75 (36.2%)	
31-45 years	Yes	72 (36.4%)		117 (59.1%)		111 (56.1%)		75 (37.9%)		108 (54.5%)	
	No	126 (63.6%)		81 (40.9%)		87 (43.9%)		123 (62.1%)		90 (45.5%)	
46-65 years	Yes	54 (30.3%)	0.000	124 (69.7%)	0.083	72 (40.4%)	0.000	45 (25.3%)	0.000	66 (37.1%)	0.000
	No	124 (69.7%)		54 (30.3%)		106 (59.6%)		133 (74.7%)		112 (62.9%)	
More than 65 years	Yes	6 (33.3%)		9 (50%)		9 (50%)		9 (50%)		12 (66.7%)	
	No	12 (66.7%)		9 (50%)		9 (50%)		9 (50%)		6 (33.3%)	
Level of education											
No Education	Yes	9 (15%)		36 (60%)		15 (25%)		9 (15%)		9 (15%)	
	No	51 (85%)		24 (40%)		45 (75%)		51 (85%)		51 (85%)	
Lower Education	Yes	9 (3.7%)		115 (47.7%)		60 (24.9%)		18 (7.5%)		36 (14.9%)	
	No	232 (96.3%)	0.000	126 (52.3%)	0.000	181 (75.1%)	0.000	223 (92.5%)	0.000	205 (85.1%)	0.000
Higher Education	Yes	243 (81%)		237 (79%)		252 (84%)		225 (41.9)		273 (91%)	
	No	57 (19%)		63 (21%)		48 (16%)		75 (25%)		27 (9%)	
Occupation groups											
Unemployed	Yes	9 (20%)		24 (53.3%)		12 (26.7%)		9 (20%)		18 (40%)	
	No	36 (80%)		21 (46.7%)		33 (73.3%)		36 (80%)		27 (60%)	
Manual	Yes	87 (37.5%)		124 (53.4%)		117 (50.4%)		84 (36.2%)		99 (42.7%)	
	No	145 (62.5%)	0.000	108 (46.6%)	0.000	115 (49.6%)	0.000	148 (63.8%)	0.000	133 (57.3%)	0.000
Intermediate	Yes	102 (47.2)		162 (75%)		138 (63.9%)		96 (44.4%)		138 (63.9%)	
	No	114 (52.8%)		54 (25%)		78 (36.1%)		120 (55.6%)		78 (36.1%)	
Professional	Yes	63 (58.3%)		78 (72.2%)		60 (55.6%)		63 (58.3%)		63 (58.3%)	
	No	45 (41.7%)		30 (27.8%)		48 (44.4%)		45 (41.7%)		45 (41.7%)	
Total		601		601		601		601		601	

p value < 0.05= Significant. Q1: Do you know that; tooth brushing alone is not sufficient to clean all tooth surfaces? Q2: Do you think that dental floss can cause bleeding in the gum? Q3: Do you have any knowledge about dental floss? Q4: Do you know that dental floss is essential to remove plaque and debris from the interdental area? Q5: Do you think that the use of a toothbrush and dental floss can prevent periodontal disease?

Table (4). Association of age, education, and occupation levels with the practice of dental floss.

Sociodemographic factors	Response	Q6	P value	Q7	P value	Q8	P value	Q9	P value
Age groups									
18-30 years	Yes	84 (40.6%)		114 (55.1%)		78 (37.7%)		168 (81.2%)	
	No	123 (59.4%)		93 (44.9%)		129 (62.3%)		39 (18.8%)	
31-45 years	Yes	63 (31.8%)		87 (43.9%)		81 (40.9%)		177 (89.4%)	
	No	135 (68.2%)	0.000	111 (56.1%)	0.071	117 (59.1%)	0.534	21 (10.6%)	0.000
46-65 years	Yes	30 (16.9%)		90 (50.6%)		79 (44.4%)		150 (84.3%)	
	No	148 (83.1%)		88 (49.4%)		99 (55.6%)		28 (15.7%)	
More than 65 years	Yes	12 (66.7%)		12 (66.7%)		6 (33.3%)		9 (50%)	
	No	6 (33.3%)		6 (33.3%)		12 (66.7%)		9 (50%)	
Level of education									
No Education	Yes	15 (25%)		33 (55%)		21 (35%)		48 (80%)	
	No	45 (75%)		27 (45%)		39 (65%)		12 (20%)	
Lower Education	Yes	27 (11.2%)		96 (39.8%)		82 (34%)		195 (80.9%)	
	No	214 (88.8%)	0.000	145 (60.2%)	0.000	159 (66%)	0.006	46 (19.1%)	0.111
Higher Education	Yes	147 (49%)		174 (58%)		141 (47%)		261 (87%)	
	No	153 (51%)		126 (42%)		159 (53%)		39 (13%)	
Occupation groups									
Unemployed	Yes	12 (26.7%)		15 (33.3%)		27 (60%)		36 (80%)	
	No	33 (73.3%)		30 (66.7%)		18 (40%)		9 (20%)	
Manual	Yes	69 (29.7%)		108 (46.6%)		85 (36.6%)		183 (78.9%)	
	No	163 (70.3%)	0.592	124 (53.4%)	0.014	147 (63.4%)	0.019	49 (21.1%)	0.000
Intermediate	Yes	69 (31.9)		117 (54.2%)		93 (43.1%)		204 (94.4%)	
	No	147 (68.1%)		99 (45.8%)		123 (56.9%)		12 (5.6%)	
Professional	Yes	39 (36.1%)		63 (58.3%)		39 (36.1%)		81 (75%)	
	No	69 (63.9%)		45 (41.7%)		69 (63.9%)		27 (25%)	
Total		601		601		601		601	

p value < 0.05= Significant Q6: Do you use dental floss? Q7: During your dentist appointment, did your dentist explain to you how to use dental floss? Q8: Did anyone recommend you to practice dental flossing? Q9: Have you used wooden or rubber interdental cleaning picks?

DISCUSSION

Dental floss has been used since ancient times, but Levi Spear Parmly, a dentist from New Orleans, is credited with inventing modern dental floss. He recommended using a piece of silk thread for flossing in 1815 (Sanoudos & Christen, 1999). This led to the development of the dental floss we use today, which has evolved since then (Chernin & Shklar, 2003).

Although using dental floss alongside regular tooth brushing is commonly recommended for preventing gum disease, global statistics show low usage rates (Poklepovic et al., 2013; Eke et al., 2018). Toothbrushing and dental flossing were found to be less common among individuals with lower socioeconomic status (Fleming et al., 2018; Soofi et al., 2020b). The use of dental floss, in particular, was shown to decrease as its price increases. This highlights the importance of understanding how sociodemographic factors, such as age, education, and occupation, influence the knowledge and practice of dental flossing habits among subjects to identify gaps and help guide appropriate actions. Despite global evidence highlighting disparities in flossing behavior across various demographic groups, there remains a lack of local data from Libya. This study aims to address that gap by focusing on a specific Libyan population. To the best of our knowledge, it is the first study to explore the role of sociodemographic factors in influencing dental floss knowledge and practices within the Libyan context.

While the current study focused on the Libyan population, similar studies have been conducted in neighboring countries. In Tunisia, a study reported poor interdental cleaning practices among Tunisian dental students, with socioeconomic status playing a significant role in oral hygiene behaviors (Jemli et al., 2007). Ogunbodede et al. (2015) also highlighted regional disparities in oral health outcomes, noting that underserved populations in the African and Middle East regions exhibited lower access to and use of dental care tools. Findings from Jordan and Saudi Arabia corroborate this pattern, where limited floss use and reliance on traditional tools such as miswak or wooden sticks remain prevalent (Baseer et al., 2012; Tubaishat et al., 2005). These similarities suggested a regional pattern of oral health behavior influenced by socioeconomic, educational, and cultural factors.

The most interesting finding was that only 31.4% of participants used dental floss. Similar results were found in other studies, with 31.9% of American adult patients and 28.4% of Japanese patients using floss, as reported by Fleming et al. (2018) and Haresaku et al. (2023), respectively. In contrast, Hamilton and Coulby (1991) found that a high percentage (44%) of Canadians in northeastern Ontario used dental floss. The reason for this may be the educational program that is carried out in Canada, which is lacking in our society. This emphasizes the urgent need to educate and motivate the public to use this efficient method for oral healthcare.

Although the United States has established goals to reduce disparities in oral health, Su et al. (2022) observed that American females floss more frequently than males. Our study reflects a similar pattern, with female respondents reporting higher flossing frequency than their male counterparts, thereby reinforcing evidence of persistent gender-based differences in oral hygiene behaviors. Females tend to be more concerned with facial appearance and are strongly influenced by current dental aesthetics, often leading to greater attention to oral care behaviors such as toothbrushing and flossing. This increased focus on oral hygiene positively impacts their overall oral health. This may be due to social norms and communication styles that discourage men from seeking or engaging in discussions about personal health matters, potentially resulting in men receiving less comprehensive health information and pieces of advice (Pinkhasov et al., 2010). Additionally, frequent preventive

dental visits and discussions during these appointments may play a role in enhancing oral health. Regular dental check-ups grant more opportunities for education and reminders about the importance of oral care, leading to better oral hygiene practices.

Only half (50.4%) of the present study contributors reported dentists as the source for their information concerning oral hygiene practices, including interdental cleaning, which was higher than that reported in textbooks and findings of Ehizele et al. (2011) and Kamil and Bashir (2017) studies, which were 32.8% and 10.2%, respectively. Since daily flossing is uncommon in Libya, it is likely that dental professionals may not regularly recommend flossing to their patients. This is supported by an Indian study (Goryawala et al., 2016), which found that 36.1% of dentists in academic institutions did not routinely prescribe dental floss for interdental plaque control. This might also be the case in Sebha where many dentists in public clinics consider patient's education, occupation, and socioeconomic status important when prescribing dental floss. The low rate of floss prescriptions may be due to the assumption that most patients visiting these clinics come from lower socioeconomic backgrounds.

Our findings also indicated that a significant majority of patients (83.9%) preferred using traumatic wooden interdental cleaning picks, a finding consistent with the results of Ehizele et al. (2011), who reported a similar preference rate of 84.7%. This widespread use of wooden picks may be attributed to their availability, affordability, or cultural factors. However, the preference rate observed in this study was remarkably higher than those reported in other studies. For instance, Awartani (2009) found a preference rate of 37%, while Al-Johani (2008) and Neamatollahi and Ebrahimi (2010) reported rates of 35.6% and 52%, respectively. These discrepancies may reflect differences in patient demographics, awareness of oral hygiene practices, or accessibility to alternative interdental cleaning tools across different populations. Further investigation is needed to understand the underlying reasons for these variations and their potential impact on oral health outcomes.

As seen in the results section, age, education, and occupation have significantly affected dental flossing habits. Younger individuals and those with higher education are more likely to floss regularly. These results aligned with existing literature (Galdas et al., 2005), which emphasizes the role of education in shaping health behaviours. Given these findings, public health initiatives should prioritize raising awareness about the importance of flossing, particularly among older adults and individuals with lower education levels, who may be less familiar with proper oral hygiene practices. Additionally, targeting lower-income groups may help reduce disparities in oral hygiene practices. Occupational status emerged as the least prominent factor but still indicated notable trends. Those in manual labour or intermediate roles demonstrated higher adoption of interdental cleaning practices, which could suggest that these groups are more responsive to health recommendations despite their lower overall socioeconomic status. Although professionals occasionally faced challenges, possibly due to time constraints.

The current study revealed significant differences in responses to knowledge-based questions according to the studied sociodemographic factors. Higher education levels were linked to greater awareness of the benefits of dental floss, emphasizing the role of education in oral health. Similarly, Khanal et al. (2015) and (Mårtensson et al., 2006) concluded that education status significantly affected knowledge of oral hygiene, as higher education is associated with greater knowledge. In addition, younger individuals and those in professional occupations are more likely to know about and use interdental cleaning tools. These findings highlight the need for educational interventions by dental professionals, particularly for older or less educated populations, to increase flossing awareness and practices. Public health campaigns should focus on increasing awareness of the importance

of dental flossing, especially among older adults and individuals with lower education levels. Additionally, interventions targeting lower-income groups could help address the disparities in oral hygiene practices identified in this study.

LIMITATIONS

While this study provided important insights, it is important to recognize certain limitations. The cross-sectional design hinders the ability to confirm causal relationships between sociodemographic factors and dental flossing habits. Additionally, reliance on self-reported data opens the possibility of recall bias or social desirability bias, potentially impacting participants' responses. Furthermore, the research was confined to Sebha City, hence diminishing the applicability of the results to other areas in Libya or wider populations. Another constraint was the lack of clinical evaluations, as the data relied solely on survey answers without any clinical confirmation of the respondents' oral health condition. Also, the sampling method, which included enlisting individuals from public dental clinics, may have introduced bias by excluding those who do not access dental services or visit private practices. Finally, this research did not thoroughly investigate the qualitative aspects of dental floss usage, such as cultural norms and psychological obstacles. So future research is recommended to explore the role of these factors in oral hygiene practices.

CONCLUSION

Sociodemographic factors significantly influence dental floss knowledge and practice, and interventions should focus on improving education and accessibility to dental care tools like dental floss. Public health strategies should prioritize older adults, less educated individuals, and men, who were shown to engage less frequently in proper oral hygiene routines.

ETHICS

Ethical clearance for the study was obtained from the ethics review and research board of the Faculty of Dentistry, University of Benghazi, Libya.

Duality of interest: The authors declare that they have no duality of interest associated with this manuscript.

Author contributions: Contribution was equal between authors.

Funding: This research did not receive any specific grant from public, commercial, or not profit funding facilities.

REFERENCES

- Abdalrahman, L. S. (2022). Survey of Dental Caries, Gingivitis Prevalence, Dietary, and Oral Hygiene Habits among Patients Visiting Dental Clinic in Zawia, Libya. *Surman Journal of Science and Technology*, 4(1), 033-043.
- Almagtoug, A., Arara, A., & Shaglouf, E. (2024). Causes and Prevalence of Tooth Loss among Patients Attending Dental Clinics in Gharian, Libya. *AlQalam Journal of Medical and Applied Sciences*, 1219-1224
- Ahmadi, O., Machuca, C., & Sabbah, W. (2019). Socioeconomic inequality in the provision of health advice in dental setting in England, Wales and Northern Ireland. *Patient Education*

and Counseling, 102(11), 2068–2072.

- Awartani, F. (2009). Oral health knowledge and practices in Saudi diabetic female patients. *Pakistan Oral & Dental Journal*, 29(1), 149–152.
- Baseer, M. A., Alenazy, M. S., AlAsqah, M., AlGabbani, M., & Mehkari, A. (2012). Oral health knowledge, attitude and practices among health professionals in King Fahad Medical City, Riyadh. *Dental research journal*, 9(4), 386.
- Bastos, J. L., Antunes, J. L. F., Frias, A. C., Souza, M. D. L. R. D., Peres, K. G., & Peres, M. A. (2009). Color/race inequalities in oral health among Brazilian adolescents. *Revista Brasileira de Epidemiologia*, 12, 313–324.
- Butt, F., Iqbal, M., Jawed, A., Khan, U., Hanif, M., & Sarwar, A. (2017). Interdental cleaning. *Pakistan Oral & Dental Journal*, 37(3), 452–454.
- Chernin, D., & Shklar, G. (2003). Levi Spear Parmly: Father of dental hygiene and children's dentistry in America. *Journal of the History of Dentistry*, 51(1), 15–18.
- Corby, P. M., Biesbrock, A., Bartizek, R., Corby, A. L., Monteverde, R., Ceschin, R., & Bretz, W. A. (2008). Treatment outcomes of dental flossing in twins: Molecular analysis of the interproximal microflora. *Journal of Periodontology*, 79(8), 1426–1433.
- Doshi, D., Baldava, P., Anup, N., & Sequeira, P. S. (2007). A comparative evaluation of self-reported oral hygiene practices among medical and engineering university students with access to health-promotive dental care. *Journal of Contemporary Dental Practice*, 8(1), 68–75.
- Ehizele, A., Chiwuzie, J., & Ofili, A. (2011). Oral health knowledge, attitude and practices among Nigerian primary school teachers. *International Journal of Dental Hygiene*, 9(4), 254–260.
- Eke, P. I., Thornton-Evans, G. O., Wei, L., Borgnakke, W. S., Dye, B. A., & Genco, R. J. (2018). Periodontitis in US adults: National Health and Nutrition Examination Survey 2009–2014. *The Journal of the American Dental Association*, 149(7), 576–588.
- Elani, H. W., Harper, S., Allison, P. J., Bedos, C., & Kaufman, J. S. (2012). Socio-economic inequalities and oral health in Canada and the United States. *Journal of Dental Research*, 91(9), 865–870.
- Featherstone, J. D. (2003). The caries balance: Contributing factors and early detection. *Journal of the California Dental Association*, 31(2), 129–133.
- Fleming, E. B., Nguyen, D., Afful, J., Carroll, M. D., & Woods, P. D. (2018). Prevalence of daily flossing among adults by selected risk factors for periodontal disease—United States, 2011–2014. *Journal of Periodontology*, 89(8), 933–939.
- Frias, A. C., Mysuguti, A. H., Sanchez, T. P., Mantovani, G. L. D. S., & Pestana, S. R. C. D. C. (2012). Social determinants and use of dental floss by 35–44-year-old adults. *RGO (Porto Alegre)*, 321–327.
- Gaber, A., Galarneau, C., Feine, J. S., & Emami, E. (2018). Rural-urban disparity in oral health-

related quality of life. *Community Dentistry and Oral Epidemiology*, 46(2), 132–142.

- Galdas, P. M., Cheater, F., & Marshall, P. (2005). Men and health help-seeking behaviour: Literature review. *Journal of Advanced Nursing*, 49(6), 616–623.
- Goryawala, S. N., Chavda, P., Udhani, S., Pathak, N. V., Pathak, S., & Ojha, R. (2016). A survey on oral hygiene methods practiced by patients attending Dentistry Department at a Tertiary Care Hospital from Central Gujarat. *Journal of International Society of Preventive and Community Dentistry*, 6(2), 115–119.
- Greenwell, H. (2001). Position paper: Guidelines for periodontal therapy. *Journal of periodontology*, 72(11), 1624–1628.
- Gufran, K., Indrajit, M. G., Aljeaidi, Z., & Hamza, M. O. B. (2015). Self-care of oral health status and uses of interdental aids among dental students: A cross-sectional study. *International Journal of Dental and Medical Specialty*, 2(4), 5–9.
- Hamilton, M. E., & Coulby, W. M. (1991). Oral health knowledge and habits of senior elementary school students. *Journal of Public Health Dentistry*, 51(4), 212–219.
- Haresaku, S., Chishaki, A., Hatakeyama, J., Yoshinaga, Y., Yoshizumi, J., Yamamoto, M., & Yoneda, M. (2023). Current status and factors of periodontal disease among Japanese high school students: A cross-sectional study. *BDJ Open*, 9(1), 29.
- Hassan, A. K. (2000). Reasons for tooth extraction among patients in Sebha, Libyan Arab Jamahiriya: A pilot study. *Eastern Mediterranean Health Journal*, 6(1), 176–178.
- Jemli, S., Besbes, A., Snene, S., & Jaouadi, J. (2024). Knowledge, Attitude and Behavior of Tunisian Dental Students about Oral Health: A Cross Sectional Study.
- Johani, H. A. (2008). Oral hygiene practice among Saudi patients in Jeddah. *Cairo Dental Journal*, 24, 395–401.
- Kamil, M. A., & Bashir, R. O. (2017). Interdental cleaning aids knowledge, awareness and practices among Jazan University students, Saudi Arabia. *International Journal of Dental Health Sciences*, 4, 85–93.
- Khanal, K., Shrestha, D., Ghimire, N., Younjan, R., & Sanjel, S. (2015). Assessment of knowledge regarding oral hygiene among parents of pre-school children attending pediatric outpatient department in Dhulikhel Hospital. *Kathmandu University Medical Journal*, 13(1), 38–43.
- Kida, I. A., Åström, A. N., Strand, G. V., & Masalu, J. R. (2006). Clinical and socio-behavioral correlates of tooth loss: a study of older adults in Tanzania. *BMC Oral Health*, 6, 1-10
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and psychological measurement*, 30(3), 607-610.
- Lipsky, M. S., Su, S., Crespo, C. J., & Hung, M. (2021). Men and oral health: A review of sex and gender differences. *American Journal of Men's Health*, 15(3), 15579883211016361.
- Mårtensson, C., Söderfeldt, B., Andersson, P., Halling, A., & Renvert, S. (2006). Factors behind

change in knowledge after a mass media campaign targeting periodontitis. *International Journal of Dental Hygiene*, 4(1), 8–14.

Neamatollahi, H., & Ebrahimi, M. (2010). Oral health behavior and its determinants in a group of Iranian students. *Indian Journal of Dental Research*, 21(1), 84–88.

Ogunbodede, E. O., Kida, I. A., Madjapa, H. S., Amedari, M., Ehizele, A., Mutave, R., & Okoye, L. (2015). Oral health inequalities between rural and urban populations of the African and Middle East region. *Advances in dental research*, 27(1), 18-25.

Peeran, S. A., Peeran, S. W., Al Sanabani, F., Almakramani, B., Elham, E. I., & Kumar, P. G. N. (2015). "Education level" responsible for inequities in oral practices among 15–34-year-old individuals in Jizan, Saudi Arabia. *Journal of International Society of Preventive and Community Dentistry*, 5(2), 120–124.

Peeran, S. W., Singh, A. R., Alagamuthu, G., Abdalla, K. A., & Kumar, P. G. N. (2013). Descriptive analysis of toothbrushing used as an aid for primary prevention: A population-based study in Sebha, Libya. *Social Work in Public Health*, 28(6), 575–582.

Pinkhasov, R. M., Wong, J., Kashanian, J., Lee, M., Samadi, D. B., Pinkhasov, M. M., & Shabsigh, R. (2010). Are men shortchanged on health? Perspective on health care utilization and health risk behavior in men and women in the United States. *International Journal of Clinical Practice*, 64(4), 475–487.

Poklepovic, T., Worthington, H. V., Johnson, T. M., Sambunjak, D., Imai, P., Clarkson, J. E., & Tugwell, P. (2013). Interdental brushing for the prevention and control of periodontal diseases and dental caries in adults. *Cochrane Database of Systematic Reviews*, (12).

Rahouma, N., Buzinin, S., & Ftis, K. (2022). Evaluation of Gingival Bleeding Awareness among Dental Students at University of Tripoli. *Khalij-Libya Journal of Dental and Medical Research*, 57-62.

Sabbah, W., Tsakos, G., Sheiham, A., & Watt, R. G. (2009). The role of health-related behaviors in the socioeconomic disparities in oral health. *Social Science & Medicine*, 68(2), 298–303.

Sakhnoub, A. W. (2024). Modeling population density in the city of Sebha using dasymetric maps. *Libya Journal of Geographical studies*. 4(2), 282-259.

Sambunjak, D., Nickerson, J. W., Poklepovic, T., Johnson, T. M., Imai, P., Tugwell, P., & Worthington, H. V. (2011). Flossing for the management of periodontal diseases and dental caries in adults. *Cochrane Database of Systematic Reviews*, (12).

Sanoudos, M., & Christen, A. G. (1999). Levi Spear Parmly: The apostle of dental hygiene. *Journal of the History of Dentistry*, 47(1), 3–6.

Sisson, K. L. (2007). Theoretical explanations for social inequalities in oral health. *Community Dentistry and Oral Epidemiology*, 35(2), 81–88.

Soofi, M., Karami-Matin, B., Pasdar, Y., Hamzeh, B., Moradi-Nazar, M., Ameri, H., & Najafi, F. (2020a). What explains socioeconomic inequalities in dental flossing? Cross-sectional re-

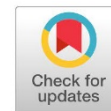
sults from the RaNCD cohort study. *Journal of Preventive Medicine and Hygiene*, 61(2), E215.

- Soofi, M., Pasdar, Y., Karami-Matin, B., Hamzeh, B., Rezaei, S., Karyani, A. K., & Najafi, F. (2020b). Socioeconomic-related inequalities in oral hygiene behaviors: A cross-sectional analysis of the PERSIAN cohort study. *BMC Oral Health*, 20, 1–11.
- Su, S., Lipsky, M. S., Licari, F. W., & Hung, M. (2022). Comparing oral health behaviours of men and women in the United States. *Journal of Dentistry*, 122, 104157.
- Tarannum, F., Faizuddin, M., Swamy, S., & Hemalata, M. (2012). Efficacy of a new interdental cleaning aid. *Journal of Indian Society of Periodontology*, 16(3), 375–380.
- Terézhalmy, G. T., Bartizek, R. D., & Biesbrock, A. R. (2008). Plaque-removal efficacy of four types of dental floss. *Journal of Periodontology*, 79(2), 245–251.
- Tubaishat, R. S., Darby, M. L., Bauman, D. B., & Box, C. E. (2005). Use of miswak versus toothbrushes: oral health beliefs and behaviours among a sample of Jordanian adults. *International Journal of Dental Hygiene*, 3(3), 126-136.
- World Health Organization. (2022). *Global oral health status report: Towards universal health coverage for oral health by 2030*. World Health Organization.
- Worthington, H. V., MacDonald, L., Pericic, T. P., Sambunjak, D., Johnson, T. M., Imai, P., & Clarkson, J. E. (2019). Home use of interdental cleaning devices, in addition to toothbrushing, for preventing and controlling periodontal diseases and dental caries. *Cochrane Database of Systematic Reviews*, (4).

Research Article

Open Access

Epidemiological and Clinical Characteristics of Pediatric Urinary Tract Infections in Benghazi, Libya: A Two-Year Retrospective Study



Jebrile S. Elabidi ^{1*}, Asmaa F. Salih ² and Monia faraj ³

*Corresponding author:

Jebril.elabidi@uob.edu.ly,

Department of Pediatrics,
Faculty of Medicine,
University of Benghazi,
Libya.

^{2, 3} Department of Pediatrics,
Faculty of Medicine,
University of Benghazi,
Libya

Received:

27 May 2025

Accepted:

27 June 2025

Publish online:

30 June 2025

Abstract

Urinary tract infections (UTIs) are among the most prevalent bacterial infections in children and represent a significant cause of pediatric morbidity worldwide. This study examines the epidemiological and clinical characteristics of UTIs among children admitted to Benghazi pediatric hospitals for two years. A retrospective analysis of 176 pediatric patients (January 2021-December 2022) was conducted at Benghazi Children's Hospital. Data included demographics, clinical presentation, laboratory findings, and imaging results. UTI prevalence among nephrology admissions was 17.6 %, with a female predominance of (62.5 %). *E. coli* was the predominant pathogen (71.4 %). Common symptoms included abdominal pain (35.8 %), discolored urine (31.3 %), and vomiting (26.7 %). Ultrasound revealed abnormalities in 31.8 % of cases. Pediatric UTIs in Benghazi show similar patterns to global trends, with *E. coli* as the primary pathogen. These findings emphasize a need for prompt diagnosis and tailored antibiotic therapy in our region.

Keywords: Pediatric UTI, Escherichia Coli, Vesicoureteral Reflux, UTI Epidemiology, Retrospective Study, Libya.

INTRODUCTION

Urinary tract infections (UTIs) represent a significant cause of morbidity among the pediatric population worldwide (Ali, 2022). They can affect both the lower (cystitis) and upper (pyelonephritis) urinary tracts (AL-Mendalawi, 2020). The clinical presentation of UTIs in children varies significantly by age, with indistinct symptoms in infants making early diagnosis challenging (Al-Qurashi, 2020). Undiagnosed or inadequately treated UTIs can lead to long-term complications, such as renal scarring, hypertension, and chronic kidney disease (American Academy of Pediatrics, 2021). Recurrent UTIs are also common and may be linked to underlying anatomical abnormalities such as vesicoureteral reflux (VUR), bladder dysfunction, or immune deficiencies (Chua, 2023). In newborns, particularly males, the incidence is higher during the first few months of life, especially in uncircumcised boys (downs, 2024). As children age, females become more commonly affected due to their shorter urethra and proximity to the perineal region (Freedman, 2024).

Geographic, socioeconomic, and cultural factors could influence UTI prevalence and microbial resistance patterns, particularly in developing regions (Johnson, 2021). Thus, a region-specific understanding of UTI characteristics is crucial for implementing effective diagnostic, preventive, and therapeutic strategies (Mohamed, 2021). This study aims to fill this gap by analyzing the



The Author(s) 2025. This article is distributed under the terms of the *Creative Commons Attribution-NonCommercial 4.0 International License* (<http://creativecommons.org/licenses/by-nc/4.0/>)(<http://creativecommons.org/licenses/by-nc/4.0/>)), which permits unrestricted use, distribution, and reproduction in any medium, *for non-commercial purposes only*, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

epidemiological and clinical patterns of pediatric UTIs in Benghazi, Libya, providing insights into local trends in symptom presentation, microbial etiology, and outcomes (Roberts, 2021).

MATERIALS AND METHODS

This retrospective cohort study analyzed medical records of children (0-15 years) admitted with UTI to Benghazi Children's Hospital from January 2021 to December 2022. The sample size (n=176) was determined by all eligible cases during the study period. Diagnosis required: 1) Clinical symptoms. 2) Positive urine culture ($>10^5$ CFU/ml) or 3) Pyuria (>5 WBCs/hpf) + positive dipstick. Urine samples were obtained via clean-catch (73.3 %), catheterization (10.2 %), or suprapubic aspiration (16.5 %). Ethical approval was obtained from the University of Benghazi Ethics Committee (Ref: UB/Ped/2023-045), with a waiver of informed consent due to the study's retrospective nature.

RESULTS

Table (1). Distribution of patients according to age and sex

Age/year	Male n=66	Female (n=110)	Total %
<1	29 (43.9 %)	16 (14.5 %)	45 (25.6 %)
1 - 5	19 (28.8 %)	46 (41.8 %)	65 (36.9 %)
6-10	12 (18.2 %)	38 (34.5 %)	50 (28.4 %)
11-15	6 (9.1 %)	10 (9.2 %)	16 (9.1 %)
Total	66	110	176

Children aged 1-5 years represented the largest group (36.9 %), with significant female predominance (62.5 %, $p=0.04$). The male-to-female ratio shifted from 3:1 in infants to 1:2.5 in children > 5 years, reflecting known epidemiological patterns.

Table (2). Clinical findings, laboratory results, and urine sampling method

Category	finding	No.	%
Symptoms	Abdominal pain	63	35.8
	Change in urine colour	55	31.3
	Vomiting	47	26.7
	Dysuria	37	21
	Foul-smelling urine	26	14.8
	Poor feeding	15	8.5
	Decreased urine output	14	8
	Urinary incontinence	13	7.4
Laboratory Results	Pyuria	125	(71.0 %)
	Leukocytosis (WBC $>12,000/\mu\text{L}$)	72	(40.9 %)
	Normal WBC count	98	(55.7 %)
Urine Collection Method	Clean-catch	129	(73.3 %)
	Suprapubic aspiration	29	(16.5 %)
	Catheterization	18	(10.2 %)

This integrated analysis reveals critical diagnostic patterns: while non-specific symptoms (vomiting, 26.7 %) were common, their combination with pyuria (71 %) and/or leukocytosis (40.9 %) strengthened UTI suspicion. Notably, 29 % of cases lacked pyuria, emphasizing that its absence cannot exclude infection, particularly in neonates. The high clean-catch sample success rate (73.3 %) supports its preferential use, though suprapubic aspiration (16.5 %) remains essential for non-toilet-trained infants.

Table (3). Type of bacteria

Type of bacteria	No.	%*
E-coli	66	71.4
Klebsiella	24	26.1
Proteus	2	2.2
Staph	6	6.5
Pseudomonas areuginosa	7	7.6
Streptococcus	3	3.3
Enterococcus	3	3.3
Candida	1	1.1

E. coli predominance (71.4 %) aligns with global pediatric UTI patterns, while the elevated Klebsiella frequency (26.1 % vs. typical 5-15 %) may reflect regional antimicrobial resistance trends or healthcare-associated exposures. Notably, non-E. coli Gram-negative bacteria (including Klebsiella, Pseudomonas, and Proteus) collectively accounted for 36.9 % of isolates, suggesting empirical antibiotic coverage in this region should extend beyond first-line E. coli-targeted treatments. The 7.6 % Pseudomonas aeruginosa rate—unusually high for community-acquired UTIs—warrants investigation of local risk factors (e.g., catheter use, congenital anomalies).

Table (4). Abnormal finding of USS abdomen

Abnormal finding of USS abdomen	No.	%*
Kidney PCS Dilation	20	35.7
Poor differentiation of corticomedullary kidney & small-size kidney	18	32.1
Cystitis (Thick wall)	17	30.4
Dilation of ureter	7	12.7
Hydronephrosis	5	8.9
Vesicoureteral reflux	3	5.4

Renal ultrasound abnormalities were detected in 31.8 % of patients (56/176). Pelviccalyceal system dilation was the most common finding (35.7 %). This high detection rate supports current guidelines recommending renal ultrasound in all pediatric UTI cases, particularly given the 8.9 % prevalence of hydronephrosis and the 5.4 % incidence of vesicoureteral reflux. The spectrum of abnormalities—ranging from transient inflammation (cystitis, 30.4 %) to structural changes (poor corticomedullary differentiation, 32.1 %)—highlights the importance of imaging for identifying both acute complications and chronic renal damage risks. These findings justify routine ultrasound screening, especially in young children with febrile UTIs.

DISCUSSION

This study analyzed the epidemiological and clinical characteristics of pediatric UTIs in Benghazi, revealing both global similarities and local distinctions. UTIs accounted for 17.6 % of nephrology admissions, with a female predominance of (62.5 %), aligning with global trends (Shaikh, 2021), while the higher incidence in male infants (43.9 %) may reflect local factors such as non-circumcision (Tallus, 2023). Non-specific symptoms such as abdominal pain (35.8 %) and vomiting (26.7 %) posed diagnostic challenges, underscoring the need for routine lab testing even without classic symptoms. Microbiological findings reported expected E. coli predominance (71.4 %) but unusually high Klebsiella rates (26.1 %), suggesting local antibiotic resistance patterns (Williams G. , 2023). While consistent with Egyptian (Mohamed et al., 2021) and Saudi (Al-Sayyed et al., 2020) studies, the elevated Klebsiella incidence diverged significantly from European data ($P < 0.05$) (Williams, 2022). As the first comprehensive Benghazi study combining clinical, laboratory, and imaging data, its clear methodology is a strength, though its retrospective design ($n=176$) may affect data completeness and the lack of long-term follow-up limits outcome assessment.

Study Strengths and Limitations:**Strengths:**

- First comprehensive Benghazi study combining clinical, lab, and imaging data
- Clear methodology

Limitations:

- Retrospective design may affect data completeness
- Lack of long-term follow-up
- Moderate sample size (176 cases)

Clinical and Research Recommendations**A. Clinical:**

- Implement routine urine cultures
- Adapt empirical therapy to local resistance patterns

B. Research:

- Antibiotic resistance surveillance studies.

CONCLUSION

The prevalence of UTI in children was 17.6 %. Gram-negative bacteria are responsible for most UTIs and *Escherichia coli* (E. coli) is the most predominant uropathogen in this study, followed by *Klebsiella*. Abdominal pain, change in the colour of urine, and vomiting were the most frequent symptoms in the children. UTIs in children are common and require prompt diagnosis using urine culture and appropriate imaging.

ACKNOWLEDGEMENT

The authors would like to thank the Medical Records Department of Benghazi Children's Hospital for their assistance in data retrieval and the staff of the Pediatric Nephrology Department for their cooperation during the study.

ETHICS

Ethical approval for this retrospective study was obtained from the Ethics Committee of the Faculty of Medicine, University of Benghazi. As this was a retrospective chart review, patient consent was waived.

Duality of interest: The authors declare that they have no duality of interest associated with this manuscript.

Author contributions: Jebriale Saad Elabidi designed the study and supervised data collection. Asmaa Faraj Salih contributed to data analysis and interpretation. Monia Faraj drafted and revised the manuscript. All authors read and approved the final manuscript.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

REFERENCES

Ali, S. S., Khan, M. A., & Ibrahim, R. (2022). Emerging *Klebsiella* resistance in North African pediatric UTIs. *Journal of Global Antimicrobial Resistance*, 28, 45–51. <https://doi.org/10.1016/j.jgar.2022.02.017>

- Al-Mendalawi, M. D. (2020). Patterns of UTI pathogens in Middle Eastern children. *Journal of Pediatric Infectious Diseases*, 15(3), 112–118. <https://doi.org/10.1055/s-0040-1714705>
- Al-Qurashi, T. M., Al-Harbi, K. M., & Al-Sayyed, B. F. (2020). Diagnostic challenges in Saudi pediatric UTIs. *Saudi Medical Journal*, 41(8), 825–831. <https://doi.org/10.15537/smj.2020.8.25198>
- American Academy of Pediatrics. (2021). Clinical practice guideline: UTI diagnosis and management in febrile infants 2–24 months. *Pediatrics*, 148(3), e2021053110. <https://doi.org/10.1542/peds.2021-053110>
- Chua, A. N., Schlomer, B. J., & Kennedy, W. A. (2023). Vesicoureteral reflux and urinary tract infection in children: Contemporary management strategies. *Current Opinion in Pediatrics*, 35(2), 255–260. <https://doi.org/10.1097/MOP.0000000000001223>
- Downs, S. M., Finnell, S. M. E., & Roberts, K. B. (2024). Point-of-care testing and biomarkers for pediatric urinary tract infection: Moving beyond culture. *Pediatric Emergency Care*, 40(2), 142–148. <https://doi.org/10.1097/PEC.0000000000003125>
- Freedman, A. L., & Copp, H. L. (2024). Antibiotic stewardship in pediatric urology: Focus on urinary tract infection. *Journal of Pediatric Urology*, 20 (1), 12–19. <https://doi.org/10.1016/j.jpuro.2023.09.021>
- Johnson, A. B., Smith, C. D., & Williams, E. F. (2021). Global epidemiology of pediatric UTIs. *Pediatric Nephrology*, 36(5), 1293–1301. <https://doi.org/10.1007/s00467-020-04852-5>
- Mohamed, I. A., Mahmoud, O. A., & Salem, T. M. (2021). Egyptian UTI patterns in children under five. *African Journal of Urology*, 27, 45. <https://doi.org/10.1186/s12301-021-00154-y>
- Roberts, K. B., Downs, S. M., & Finnell, S. M. E. (2021). Urinalysis and urine culture in febrile infants with suspected UTI: Evidence-based approach. *Pediatrics*, 147(2), e2020014068. <https://doi.org/10.1542/peds.2020-014068>
- Shaikh, N., Hoberman, A., & Hum, S. W. (2021). Antimicrobial resistance patterns in pediatric UTIs. *Journal of the Pediatric Infectious Diseases Society*, 10(3), 306–311. <https://doi.org/10.1093/jpids/piaa168>
- Tullus, K., & Shaikh, N. (2023). Urinary tract infections in children. *The Lancet*, 401(10376), 786–798. [https://doi.org/10.1016/S0140-6736\(22\)02593-4](https://doi.org/10.1016/S0140-6736(22)02593-4)
- Williams, G., Hodson, E. M., Craig, J. C., & Isaacs, D. (2023). Long-term outcomes of childhood urinary tract infection: A systematic review and meta-analysis. *Pediatric Nephrology*, 38(7), 2165–2176. <https://doi.org/10.1007/s00467-022-05848-z>
- Williams, G. J., Craig, J. C., & Isaacs, D. (2022). Contemporary management of pediatric UTIs. *The Lancet Child & Adolescent Health*, 6(4), 276–285. [https://doi.org/10.1016/S2352-4642\(21\)00384-0](https://doi.org/10.1016/S2352-4642(21)00384-0)