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The Journal of Health Research is a peer-reviewed publication dedicated to advancing knowledge in medicine, dentistry, pharmacy, nursing, medical laboratory sciences, medical imaging, and anesthesiology. We provide a vital platform for disseminating high-quality research shaping the future of healthcare

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Research and all correspondence should be sent in the name of the editor-in-chief to the following addresses :

hjhr@huc.edu.iq

009647723676000

60th St., Al-Dora, 10011, Baghdad, Iraq

Editorial board members

Name	Scientific title	Specialty	Affiliation
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EMAIL	dentistry@huc.edu.iq		
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EMAIL	elshazly@uni-bonn.de		

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EMAIL	Sarah.thamer@huc.edu.iq	
Ali Abdulmunem Ahmed	Arabic language	Department of Anestheia Technology, Al-Hadi University College
EMAIL	Aliabdelemoniem1994@gmail.com	

Al-Hadi Journal for health research

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Sixth: Principles of Transparency

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   A. Deliberately using another person's ideas or original materials as if they were one's own, even if the sentences were used by the same researcher in other journals without proper citation, is considered impersonation.
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   Fabrication of data and falsification mean that the researcher did not actually conduct the study but rather fabricated data or results, recording or fabricating false information. Data falsification means that the researcher conducted the experiment but processed, altered, or deleted data or results from the research findings.

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   Unnecessary publications include inappropriately dividing study results into several articles, often done to inflate academic credentials.

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   All listed authors must have made a significant scientific contribution to the research and agreed to all its requirements. Any person who made a significant scientific contribution, including students, should be included.

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   In the case of documented violations of any of the mentioned policies in any journal, regardless of whether the violations occurred in that journal or not, the following sanctions will be applied:

   i. Immediate rejection of the offending research.

ii. Immediate rejection of any other research submitted to any journal published by any of the offending research authors.

iii. Imposition of a ban for a period of no less than 36 months on all authors for any new submissions to any journal, either individually or in collaboration with other authors for violating research.

iv. Prohibition of all authors from working on the editorial board of any journal.

Authors guides

First: Submission Requirements

1. Initial Submission: Researchers can choose to submit the research in a single file to be used in the evaluation process.
2. Corrected Submission Requirements: When the submitted research is in the correction stage after evaluation, researchers are required to adjust the research to the correct format specified by the journal for publication acceptance. Additionally, any additional elements required by the journal for publication should be provided.

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Authors' names should be assigned to the research based on:

1. Substantial contributions to study design, data collection, or analysis and interpretation.
2. Substantial contribution to drafting or critically revising the intellectual content of the research.

3. Definite approval of the final version submitted for publication.

All the above conditions must be met by all authors mentioned in the research. Contributors who do not meet these criteria can be added in the acknowledgment section. All authors must agree on the order of authors before submitting the research for publication. Additionally, consensus from all authors is required to designate one researcher to be responsible for correspondence.

Third: Research Evaluation Process

To maintain the research evaluation system, researchers are committed to participating in the evaluation of scientific research submitted by other researchers. When necessary, authors may be required to provide a reviewer or a group of reviewers for the editorial board. The journal adopts a double-blind review policy, where researchers and reviewers are unaware of each other. The evaluation process is conducted confidentially, and the research evaluation is done through the online research submission system.

Fourth: Pre-Publication Research Evaluation

In addition to the initial evaluation process, the journal evaluates research before publication in its final form by the editor-in-chief and members of the editorial board. This evaluation aims to ensure the quality of published research and adherence to scientific publishing standards. This stage includes comments and citations through the journal's website and on published papers. Researchers are required to respond to comments and observations from the scientific committee.

Fifth: Research Paper Preparation

Research should be submitted in Arabic or English, following appropriate writing and spelling rules. Research papers should be printed in Times New Roman font size 14, single-column format, and in MS-Word format. The research should be written on A4 paper, and the printed area should be 15 cm x 24 cm. Research papers should be submitted once to obtain an identifier number for the research in the journal. Sending the research multiple times may result in rejection. Research papers should include a title page with the author's name, affiliation, and the title of the research.

Sixth: Submission of New Research

Submission is done through the Al-Hadi College website and the journal's online portal. Researchers will be guided step by step in creating and uploading research files as part of the submission process. Researchers may choose to submit the research in one file for use in the evaluation process. The research file should be in .docx or .doc format to be used in the evaluation process. It is recommended to include all forms and tables in the main research file.

Seventh: Citation

The Vancouver citation method should be adopted for writing sources in the research.

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There are no strict formatting requirements, but all research should contain necessary elements, including abstract, keywords, introduction, materials and methods, results, discussion, conclusion, acknowledgments, conflicts of interest, and the list of references. Ensure that all figures and tables are included in the main research file.

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Regardless of the submission file format, especially after reviewers' corrections, researchers are requested to submit the research file according to the format used in Al-Hadi Journal of Health Research in MS-Word document to avoid unnecessary errors. Researchers are advised to use spell check at this stage. At this point, the name of the researcher (or researchers) and affiliation must be included.

Tenth: Research Document Submission

During the submission of the research to Al-Hadi Journal of Health Research, all contributing researchers must ensure that the research represents valid work, has not been published in full in another journal, and does not contain significantly similar content to the research of other authors. Other researchers must agree to choose one of them to be responsible for correspondence with the editorial board, handling reviewers' corrections, and proving the validity of the research.

Eleventh: Research Submission and Verification

Research should not have been previously published digitally or in print and should not be simultaneously submitted to Al-Hadi Journal of Health Research and another journal for evaluation. Copies of references that may be duplicated in the current research (including those containing significantly similar content or using the same data) and have been published or are under consideration in another journal must be submitted.

Twelfth: Open Access Statement

Al-Hadi Journal of Health Research is considered a fully open-access journal, meaning that all articles are available online to all users immediately upon publication. The author and journal should be correctly included in the research. Advantages of open access for authors include free access for all users worldwide, retention of copyright by authors without restrictions, and increased visibility for readers.

Thirteen: misconduct allegations

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1. mistreatment of research subjects
2. data falsification and fabrication
3. plagiarism and impersonation

The fabrication is defined as taking data from other research without collecting scientific data. Falsification is defined as manipulating research materials to achieve favorable results. Falsification and fabrication can occur at any stage of the research process (in the field) until the research is published, where citation misuse can occur (indicating a citation when it does not support the argument). The journal aims to identify any type of falsification or fabrication at all levels of research processing, from initial examination to the comprehensive evaluation of the revised research, and even after publication. Reporting any falsification or fabrication is an ethical obligation for our authors, participating authors, reviewers, editors, and readers. In

any case of falsification or fabrication, the journal reserves the right to withdraw the fabricated or falsified material. The journal follows the guidelines of its publication ethics committee in dealing with falsification and fabrication.

Scientific evaluator guide

Firstly: Preliminary Guidelines

Before accepting or declining the invitation to review the current research, read these questions as they will assist you in making the decision:

1. Does the current research align with your specific expertise? Accept the review if you believe you can conduct a rigorous scientific evaluation.
2. Do you have a potential conflict of interest with the research topic or authors? Send such concerns to the editor-in-chief when responding to the review request.
3. Do you have sufficient time to review the research? Scientifically rigorous evaluation of research requires a significant amount of time, so before committing, ensure you are aware of the deadline for submitting the review.

Secondly: How to Evaluate a Research in Al-Hadi Journal of Health Research

The scientific reviewer's evaluation should be a comprehensive critique of the research submitted for publication, presented in a full report rather than just a few brief sentences. While the journal does not require a specific template for the structure of the scientific review report, the following sections can be utilized:

1. Abstract
2. Major and significant issues
3. Minor and insignificant issues

The journal encourages scientific reviewers to assist researchers in improving the scientific content of their research papers. Therefore, the scientific review report should provide a constructive analysis with clear evidence to the researcher, especially for those parts of the research that require modifications. In cases where the scientific reviewer does not wish the researcher to be aware of their comments on the research, these comments can be sent to the journal's editor-in-chief confidentially. The evaluation process may vary from one scientific reviewer to another, but the scientific reviewer should pay attention to the following aspects as much as possible:

1. Is the current research topic well defined?
2. Has a contemporary research problem been addressed?
3. Is there a need for ethical approvals for the research, or does it need such approvals?
4. Is the study model sufficient to answer the study's questions?
5. Are the statistical tests used adequate, and are their results correctly included?
6. Are figures and tables adequately explained, and do the results accurately represent them?
7. Have previous researches conducted by the researcher, included in the current study, been discussed adequately, and have the results of studies related to the current research been compared well?
8. Is there incorrect citation of sources, such as using a source in a context contrary to where it was originally cited, or has the researcher extensively used their previous studies in the current study?
9. Do the study results support the conclusions?
10. Are there any restrictions on conducting the research mentioned?
11. Is the abstract an accurate summary of the current research and its results without repetition?
12. Is the language of the current research clear and understandable?
13. To assist researchers in making corrections promptly, the reviewer should send a copy of the evaluated research through the journal's submitted research tracking system. If the scientific reviewer cannot conduct the research evaluation within the specified time, they should contact the journal to adjust the final deadline for submitting the evaluated research. The scientific reviewer is encouraged to provide constructive criticism for the under-review research and focus on objectivity in critiquing scientific aspects of the research, which includes, for example, the soundness of research methods and methodology. At the end of the research evaluation process, the reviewer will be asked the following question regarding the current research:

- Accepted
- Needs major revisions
- Needs moderate revisions
- Rejected
- Unable to evaluate the research

Thirdly: Confidentiality in the Research Evaluation Process

Research submitted for evaluation must be treated with complete confidentiality throughout the evaluation process. The scientific reviewer should not share information about the research under evaluation or discuss its content with anyone outside the research evaluation process. The scientific reviewer may, upon request, consult with a colleague who has a relevant relationship with the research topic, and this consultation should be done confidentially while keeping the research under evaluation confidential. In such cases, the researcher should first contact the journal or its editor-in-chief and inform them of the colleague's name who wishes to communicate regarding this matter, including their information in the "Comment to the Editor" field in the evaluation report.

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The scientific reviewer should refuse to evaluate the research in one of the following cases:

1. They have a specific business interest in the research topic.
2. They have previously discussed or provided opinions and advice on the research topic with the researcher.
3. When they feel incapable of being impartial in evaluating the research for any reason.

Fifthly: Applications for Scientific Reviewer Membership

Al-Hadi Journal of Health Research values those applying for membership in the journal's committees. The journal's editorial board is responsible for selecting research reviewers based on the research itself. In each case, suitable reviewers are invited based on their expertise or previous publications. To ensure the possibility of selecting a scientific reviewer, please regularly update your contact information. For those not registered on the journal's website and wishing to be selected as a scientific reviewer, they should register on the website as a researcher.

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Al-Hadi Journal of Health Research is fully committed to safeguarding the intellectual property rights of its authors, recognizing that all literary and scientific rights remain reserved to them. Ownership of the published research rests with its authors, and no third party is permitted to republish, distribute, or exploit the work in any printed or electronic form without prior written consent from both the authors and the journal.

The journal's role is limited to granting the right of scientific publication and distribution while upholding academic integrity and ensuring that ideas and results are attributed to their rightful owners. This policy is in full alignment with international standards and the principles of publication ethics.

Issue contents

Applications and Limitations of Artificial Intelligence in Dentistry

The emergence of artificial intelligence is significantly changing many industries, and healthcare is no exception. The advent of AI creates new avenues of diagnosis, hastens therapy protocols, and enhances the outcome of patients. Dentistry, which had depended upon clinical experience, manual skills, and rapport with patients, can now deploy AI as a transformative force. Virtual transformation of all--be it diagnosis protocols or therapy planning and management of patient care--can be achieved by integrating enhanced conventional practices with huge quantum leaps forward courtesy technology with AI. But though massive opportunities are presented by AI to enhance dental care practices, its incorporation into quotidian clinical practices reveals limitations. The present discussion dwells on principal uses of AI in dentistry and challenges presented by its proper use.

Artificial intelligence, specifically through machine learning, deep learning, and neural networking, is increasingly gaining traction on all fronts of dental care. The computers examine large data points and give measurable predictors that man by hand would take much time to interpret. Amongst its greatest applications of AI on dentistry is its use on its imaging diagnosis. It is possible to add AI algorithms to examine dental radiographs--X-rays and cone beam computed tomography--with similar or superior accuracy as trained operators. It is possible to identify caries, periodontal diseases, and even primary oral cancers by caries with saving of time for diagnosis and reduction of human error. Further, with CAD/CAM technology allied with AI, accuracy of design and production of dental prosthesis significantly increased to lead to more effective and precise restorative dentistry practices.

In orthodontics, AI is understandable too particularly with orthodontic treatment design as well as outcome prediction. Given large data sets to study on, one can provide prediction of what occurs to tooth on longer time scales and recommend best therapy approach to implement by providing data on what is best with orthodontics therapy to ensure best results. The use of AI also facilitates detection of non-apparent facial asymmetries and non-obvious orthodontic malocclusions to provide more accurate plans of therapy. Preventive dentistry benefits from AI's prediction analysis to enable practitioners to foresee future problems with oral health, such as periodontal disease or loss of tooth structure, on the basis of a patient's medical history, lifestyle patterns as well as their genetics. The prediction function facilitates more individualized plans of care with preventive as well as interventionist focus.

AI is also being used in the administrative aspects of dental practice are through virtual assistants. Virtual dental assistants facilitated by AI technology can assist with scheduling patients, provide reminders for oral hygiene practices, and provide post-operative directions of care among other benefits freeing up precious time for dentists and supporting personnel to provide direct patient care. The solutions by AI provide access to increased operational efficiency and provide added enhanced patient engagement and satisfaction by individualizing and extending points of engagement with patients. Innovative uses of AI are constrained by many factors with dentistry among those at the vanguard. Primary among these are data quality and availability. The AI model requires large datasets to function at its best but data within dentistry are typically incomplete, inconsistent, or unstructured. Most matured AI models only apply to small cohorts of populations and are therefore not necessarily reflective of the whole population of need within patients with

dentistry. This lowers accuracy and generalizability of diagnosis and plans of care enabled by technology with AI. Compounding this is non-standard formatting of data within dentistry which precludes ease of incorporation of solutions with AI with normal clinical workflows.

Ethical concerns also play a significant role as well to formulate a future in AI with dentistry. Questions regarding patient confidentiality and data security are particularly important where solutions with AI are trained with very confidential data such as biometric or gene data. Another danger with AI-based algorithms is that of deciding on grounds of bias. If datasets to be utilized to train such systems are biased to highlight groups selectively, the AI might suggest items that tend to benefit or disadvantage patients by sex or race or by gradients of socioeconomic status. Those challenges will need to be resolved with adequate ethical guidelines and regulating frameworks to ensure that AI is developed safely as well as equitably.

Legal and regulatory challenges are amongst other hurdles to wide-scale adoption of AI use within dentistry practice. What if an AI system makes a wrong diagnosis or recommendation; who is responsible? The clinician who worked the AI or its manufacturers? Both? Again, getting regulatory approval to market and use AI-based systems and devices is a challenging exercise since dental regulating bodies are unable to keep pace with quick-tracking advances being implemented within AI technology. These are all challenges that require to be addressed to allow for safe and effective usage of AI within the delivery of dentistry care.

Another practical chalenges is integrating AI technology within ordinary clinical practices. Most practices are developed with normal ways of doing things, and integrating machines that are developed on AI may require enormous financial investment and training. Dentists and support may resist changes to adapt to new technology, especially if they think new technology is a chore or unnecessary. Successful implementation of AI to dentistry will depend on user-friendly systems and getting professionals in dentistry to consent to adapt to new inventions.

In conclusion, Artificial intelligence holds spectacular opportunities to reconstruct dentistry care by optimizing diagnosis performance, therapy effectiveness and management of patients. Several challenges need to be resolved to realize AI's advantage to dentistry. They are data availability and quality enhancement for dentistry, overcoming ethical and juridical challenges, and smooth integration into clinical workflows. The correct approach could enable AI to play a central role to realize personalized, efficient and high-quality future dentistry. Collaborative efforts among those who design AI technology, dentists/dental professionals and regulating bodies are needed to guarantee safe and effective utilization of AI technology with new opportunities for innovative advances for dentistry.

Mohammed A. Al-Maliky
Lecturer, MD PhD (Laser Dentistry)
Managing editor
Al-Hadi Journal for Health Research

Prevalence And Distribution of Pyogenic Granuloma in Patients Attended to Dental Clinic in Al Hadi University Collage

Maha Mohammed[1] Ghufran Majeed[1,3], Noor Musa[1], Riyam Haleem[1], Hind H. Enad[1] Mustafa Wathiq Abdul Kareem[1], Abdullah Hayder Abdulrazaq[2], Hussein Basheer Mohammed[2], Watban Hameed Mahdi[2], Ismael Haqi Ismae[2], Zine El Abidine Mohamed Abdel Reda[2]

[1]Department of dentistry, Al-Hadi University College, Baghdad-10011, Iraq
[2] Ministry of Health, Iraq
[3] Al Karkh General Hospital, Ministry of Health, Iraq

Abstract

There are a number of hyperplastic responses that may occur in the mouth since the oral mucosa is continually being exposed to many stimuli. In our study we focus on the pyogenic granuloma in cross sectional study in Al Hadi University Collage in Baghdad.

Aim of the study: to estimated prevalence and distribution of pyogenic granuloma in patients attended to dental clinic in Al Hadi University Collage

Patients and method: 300 patients have been diagnosed with oral and maxillofacial lesions in dental clinic and all the patients has been examined by two specialists with documentation in a case sheet. according to the type of the lesions the patients has been categorized.

results: from the total (300) adult patients attended to the dental collage clinic, (38) patients diagnosed with oral pyogenic granuloma and prevalence was (12.6 %) from and there was a female patient's predication by 22 (57.9%) of the patients while male patients were 16 (41.1%) there was a significant relation with the periodontal status and the location and the specific site of the lesions however the age and sex of the patients did not show any meaningful relationship.

conclusion: Pyogenic granuloma (PG) as a tumor like (non-neoplastic) soft tissue lesion had female predilection (with obvious differences found in the distribution among middle age group) and the maxillary gingiva is the most affected site specially the left premolar region a high relation detected with poor oral hygiene but there is relation with age of the patients so it could be occurred at any age.

key words: pyogenic granuloma, traumatic fibroma, reactive hyperplastic lesions, oral and maxillofacial lesions.

Corresponding author:
Maha mohammed, Department of dentistry, Al-Hadi University College, Baghdad-10011, Iraq, **maha.m@huc.edu.iq**

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Introduction

A kind of tumor-like hyperplasia, reactive hyperplastic lesions (RHLs) develop in reaction to long-term irritation or stress. These benign growths seem like hyperplastic lesions. Removal of stimulating drugs followed by appropriate dental care is the aim of treatment for these diseases (1)

Epulis fissuratum (EF), traumatic fibroma (TF), pyogenic granuloma (PG), pregnancy tumor (PT), and peripheral giant cell granuloma are the reactive hyperplastic lesions most often seen in daily clinical practice. (1)

One of them is a pyogenic granuloma, a benign vascular tumor that may appear on the mucosa, as typical reactive tumor-like nodular development. It often presented as a small, single growth in the mouth or skin that is red, pink, or purple in color. Lesion color is affected by vascularity and how the lesion is progressing clinically. (2) (3)

PG commonly affected in young patients, and pregnant women and seldom in elderly. (4) seen in the gingiva as a result of injury or localized inflammation. Some considered pyogenic granuloma as inflammatory hyperplasia and this term is misleading since the lesion is not caused by an infection but rather develops in as reactive lesions as response to stimuli like hormonal changes, low-grade local irritation, or trauma, in other hand it can't be considered as malignant. (5) (6).

It may be due to the vascular impacts of female hormones; however, it mostly affects young women in their twenties. (7)

clinically PG presented as an isolated soft mass that may presented as, smooth or lobulated, sessile or nodule-like, or even pedunculated with few millimeters up to a few centimeters in diameter **(**8) (2). The lesion's color shifts from pink to red as the tumor grows and its vascularity changes. There could be some bleeding, either spontaneously or because of trauma. **(**8) (2) (3)**.** However early or new lesions are very vascular, red in color with bleeding tendency, however mature lesions are not bleed easily and give appearance of fibromas as they develop into a fibrous mass but still the lesion could be enlarged in size. (9)

PG can occasionally cause bone resorption (1) . Marla V, et al. (10) reported pyogenic granuloma lesions in female patients with a cupping defect in the alveolar bone that occurs between the first permanent molar and the primary molar which made the radiographical imaging is mandatory in these cases

Histological PG has shown two forms. The first one, known as lobular-capillary hemangioma (LCH), has a lobular morphology and is characterized by a lack of inflammatory stromal cells as well as many tiny capillaries lined by plump endothelial cells and separated by fibrous septa. The second histopathologic kind of PG is non-lobular type (non-LCH), which is defined by heavily inflammatory stroma and highly vascular, diffusely organized capillary proliferation that resembles granulation tissue due to hyperactive tissue-repair mechanisms**. (**8). The oral PG could have a distinct look, which makes diagnosis challenge to the surgeons.

Histopathological features are the most reliable predictors of pyogenic granulomas, but neurofibromas, peripheral ossifying fibromas, peripheral giant cell granulomas, and, in extremely rare instances, squamous cell carcinoma should also be considered in a differential diagnosis, along with Kaposi sarcoma, in immunosuppressed patients. (11).

The last two diseases, peripheral giant cell granuloma and peripheral ossifying fibroma, only manifest in the alveolar mucosa in contrast to oral pyogenic granuloma which is disease of gingiva.

Alternatively, pyogenic granulomas may develop on the lips, gums, or mucosa anyplace in the oral cavity. It may be necessary to differentiate benign lesions from lobular capillary hemangiomas, such as: Lymph nodes enlargement, hemangiomas, and Angiolymphatic hyperplasia with eosinophilia (11).

Surgical excision with suturing is the method of choice for treatment of sessile or recurring lesions because it reduces postoperative bleeding and the likelihood of recurrence. (11) (2).

Patient and method

prospective cross-sectional design has been performed on adult outpatients who has been attended at the Oral Diagnostic Clinic at the Department of Dentistry / Al Hadi University College in Baghdad were the patients has been subjected to oral examination and treatment plan. From November 2022 to March 2023, a total of 300 individuals were interviewed and clinically examined for the existence of oral lesions. In order to confirm the diagnosis in certain circumstances, a comprehensive oral clinical examination was conducted, along with obtaining a patient's medical history. This was followed by a radiographic examination and a histological examination, which were submitted to a laboratory for analysis and reported by a pathologist.

Two experts reviewed every patient's medical and clinical examination records. The clinical examination was conducted in accordance with the World Health Organization's recommendations (WHO 2013), using a disposable instrument, appropriate lighting, and supplies. All participants filled out a questionnaire that personal information such as age, sex, marital status, medical history, and whether or not they had a pyogenic granuloma and for how long. The medical fact-checking committee of Al Hadi University College gave its stamp of approval to this study.

Statistical analysis: The data was analyzed using SPSS (version 22).The Chi-square test was used to find any associations between gingival pyogenic granuloma (GPG) and the factors that were being studied. Non-significant at $P \geq 0.05$; S: Significant at $P < 0.05$; and HS: Highly significant at $P < 0.01$

Results

In our study from 300 patients attended to the dental clinic 38 (12.7%) patients were diagnosed with pyogenic granuloma .As in (Table -1-) the female patients were 22(57.9%) while the male were 16(42.15%),most of the patients were from the young and middle (21-30),(31-40) years age group by (26.3%) for each , and the female patient mostly from the (31-40) years age group while the male most of them at (21-30)age group ,

Table(1):Distribution of patients with pyogenic granuloma according to sex and age

Variable		Male		Female		No.	%
		No.	%	No.	%		
Age groups	10-20	8	21.1	2	5.3	10	26.4
	21-30	6	15.8	2	5.3	8	21.1
	31-40	2	5.3	8	21.1	10	26.3
	41-50	0	0	6	15.3	6	15.8
	51-60	0	0	2	5.3	2	5.3
	61-70	0	0	2	5.3	2	5.3
	Average	22.8		38.6		30.7	

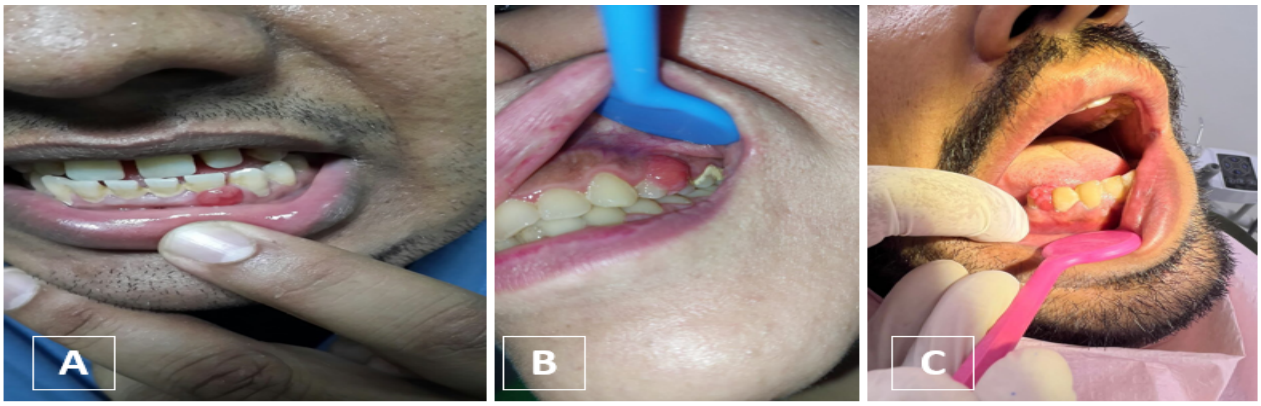

Figure -1- Oral Pyogenic granuloma **A:** at the lower anterior teeth in male30 years old with poor oral hygiene **B:** at the maxillary gingiva between two premolars in female 41 years old with poor oral hygiene **C:** at the lower premolar area in male 30 years old with moderate oral hygiene

However, the other groups (10-20), (31-40), (51-60), and (61-70) were (21.1%), (15.8%), (5.3%) for the last two groups respectively. There were no significant correlations with sex or age of the patients (p-value :0.330) (0. 864) respectively (Table-2-). According to oral hygiene and periodontal status there was a highly significant relation (p- value: 0.006**) that 20 (52.6%) of the patients presented with poor oral hygiene, however the other patients examined as moderate in 14 (36.8%) and good in 4 (10.5%) periodontal status (Table 2).

Table (2) distribution of patients with pyogenic granuloma according to age groups and total sex according to location and periodontal status

Variable		No.	%	*p- value*
Age groups	10-20	10	26.3	.864
	21-30	8	21.1	
	31-40	10	26.3	
	41-50	6	15.8	
	51-60	2	5.3	
	61-70	2	5.3	
sex	Male	16	42.1	.330
	female	22	57.9	
Periodontal status	Good	4	10.5	.006**
	Moderate	14	36.8	
	Poor	20	52.6	
Location	maxillary	30	78.9	.000**
	mandibular	4	10.5	
	check	2	5.2	
	tongue	2	5.2	
Site of the lesions	left/ between 4&5	12	31.5	.036*
	left /anterior	4	10.5	
	left / canine	6	15.8	
	right /between 4&5	10	26.3	
	right /posterior	4	10.5	
	midline	2	5.2	

Most of the lesions located in the maxillary gingiva (30 lesions) (78.9%) while in the mandible it was only 4 (10.5%) the other lesions located in tongue 2 (5.2%) and in the check 2 (5.2) and the relation is highly significant with location (p-value 0.000**) (Table-2-). for the gingival lesions there were a significant correlation with site of occurrence (p-value 0. .036*) (figure -1) most of the in the upper jaw lesions mostly at site between two premolars at the left side 12 (31.5%) the same think for the right side 10(26.3%) and it was 6(15.8%) for the canine with low frequency to the other sits ,for left anterior and right posterior as 4 (10.5%) for both while the midline was 2(5.2%) in the tongue lesion (Table-2-) (figure -1).

Discussion

pyogenic granulomas were the most frequent and common reactive lesion, among other oral reactive lesions (12). In our study showed that the mean of age of diagnosed cases was (30.7) with females' predilection and the most affected age group was in the middle age of life (31-40) showed the highest percentage (21.1%), and there was no significant relation to age of the patients, hence, pyogenic granulomas of the gingiva may appear at any age. (13) while Verma Me*t. al.* (3) reported that, 22% of young patients develop PG, with frequency peaking in the second decade. Pyogenic granuloma (PG) as a tumor like (non-neoplastic) soft tissue lesion had female predilection middle age of life (31-40) in agreement with (14)(15) and Iraqi study by (16) (17) (13) (8) but in another Iraqi study it was in 4th decay (18). In vitro studies have demonstrated that the female sex hormone may

regulate the production of various growth factors, including vascular endothelial growth factor (VEFG), basic fibroblast growth factor, and nerve growth factor; this suggests that hormonal imbalance may play a role in the development of gingival hyper-reactive inflammatory responses, which may explain the female predications. Park SH 2017 demonstrated the link between hormone imbalance and OPG pathogenesis using immunohistochemical labeling. the findings show that progesterone and estrogen have little impact on OPG pathogenesis, but VEFG does (vascular epithelial growth factor) may be associated with the pathogenesis of OPG. (19) many studies related this hypothesis with pregnancy (20)(21)(22) and in Iraqi study (16)(13) unfortunately in our study just one lady presented with pregnancy.

On other hand the cases of OPGs examined clinically the most cases of pyogenic granuloma in our study, it has a striking predilection for the gingiva, interdental papillae are the most common site in (34)(89.4%)cases (23)followed (4)(10.5%) cases in check and tongue however similar to study by (24) and about (78.9%) of cases located in the maxilla (25)(6) similar to Iraqi study by (18)(13) Gingival irritation and inflammation caused by poor oral hygiene, dental calculus and plaque, or overlying restorations are the most prevalent causes of oral pyogenic granulomas (23) .

Poor dental hygiene is the most frequent cause of this condition, with tartar deposits or other foreign materials seen in the associated gingival fissure (26) and these lesions are frequently brought on by local irritations, which can also include plaque, calculus, and the buildup of foreign elements (27)(15) and a pyogenic granuloma develops when the underlying fibro-vascular connective tissue undergoes hyperplastic transformation and granulation tissue growth. (28) or due to trauma (1).

In our study there was a highly a strong association between the state of oral hygiene and gingival pyogenic granuloma that most of the patients presented with poor oral hygiene (52.6%) in agreement with many studies (29) in Iraqi study PG was associated with poor oral hygiene in (45.3%) and (26) in 75% of cases of PG. In addition, these type of lesion exhibit ahigh recurrence rate (30) which is caused by either incomplete removal, failure to address the underlying causes, or reinjury to the afflicted gingival area. Among reactive lesions, PG had the greatest recurrence rate (17.18%); however, recurrence may be reduced via controlling inflammation in the periodontal ligament and maintaining a regular schedule of supportive periodontal care. (31)(32).

Some cases of PG may presented in aggressive clinical features (21) or non-classical presentation (31)(2)(23) which need very careful differential diagnosis that it may mimic a malignant lesions (21) it could be with bone resorption (33) or an unexpected sequela or a complication of dental extraction (24) so biopsy and histopathologic diagnosis of suspected PG lesions is required (34).

Conclusion

This study showed that the percentage of the total sample attended to Al Hadi Dental Clinic in Baghdad with gingival pyogenic granuloma was (12.7%) Although pyogenic granuloma (PG) may occurs at any age, the most of patients with PG was in young females In addition, the high percentage of gingival pyogenic granuloma was found

in maxillary buccal gingiva .and there were a significant correlation with periodontal status.

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Blind Man Accurate Locate Using Hardwrare Realizationn of Coordinate Rotational Digital Computer (CORDIC) Based on FPGA

Assist. Prof. Hussam Abdali Darweesh[1], Assist. Lecher Ayadh Al-khalidi[1], and Assist. Lecher Haider M. A. Abdulhadi[2].

[1]Al-Hadi University College
[2]University of Baghdad

Abstract: The soaring demands for using location devices exacerbate the interest in the optimization of the digital systems hardware that help to located the blind man. Typically, the optimization of digital hardware can touch various levels of abstraction targeting different aspects of the design, including operating speed, power consumption, and footprint area. In this work, an RTL design is developed to model coordinate rotation digital computer (CORDIC) as an algorithmic technique to reduce the hardware resources used by the digital computational units. This hard ware help to fasted located the position of blind with accuracy and low power consumed. The computational units that are developed in this work, includes sine and cosine function of an angle ranged between 0-90 degrees, in addition to fractional multiplications and division. These units can serve as a fundamental building block in numerous applications, such as biological-inspired computing systems, real-time signal processors, etc. The developed system is synthesized and verified in software and hardware and the experimental results show that the system is very efficient in terms of hardware resources, and it can be run on maximum clock frequency of 191.09 MHz.

Keywords: CORDIC, Coprocessor, digital arithmetic, FPGA and blind man location.

1- Introduction

The coordinate rotation digital computer (CORDIC) [1] is a hardware efficient algorithm used for computing trigonometric, hyperbolic, linear, and logarithmic functions [2]. Instead of using traditional calculus-based methods such as polynomial or rational functional approximation, it uses simple shift, add, subtract, and table look-up operations to achieve its objective. Therefore, cordic-based computational units find it is way in a myriad number of applications, such as real-time signal processing [9], visual feature extraction [12], and various cognitive tasks using biological inspired algorithms [7,10], which run on stringent resource edge devices, blind man located [11], wearable devices [13,14], and self-driving cars [15]. The CORDIC operates in two different modes of computation of different functions: rotation mode and vector mode. In the rotation mode, an angle of rotation and the co-ordinate components of a vector are known and after rotating it through a rotation angle co-ordinate component of the original vector is computed. In case of the vector mode, magnitude and angular argument are calculated when coordinate component of a vector is given. Both of these methods are step-by-step sequence of pseudo rotations which result in an overall rotation through a given angle for rotation mode and will result in a final angular argument of zero in case of vector mode.

In both of these modes, the process is based on the rotation of an angle vector by a precise preset angle in a variable direction. This preset fixed rotation angle in variable direction is implemented using an iterative process of addition-subtraction and bit shift operations [3]. The final result is obtained by scaling the result obtained after successive iterations. Angular increments of rotation are

Corresponding author:
Hussam Abdali Darweesh, Department of Dentistry , Al-Hadi University collage, Baghdad 10011, Iraq . hussamuotg@huc.edu.iq,
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computed in a decreasing order of magnitude and there are different ways to select the first step of rotation, which can be 45^0 or 90^0. The expression for a set of coordinate components X_I and Y_I when rotated through an angle of 90^0 is given below [4].

$$Y_i = \pm X_i + R_1 * \sin(\theta_1 \pm 90^0) \qquad (1)$$

$$X_i = \pm Y_i + R_1 * \cos(\theta_1 \pm 90^0) \qquad (2)$$

Here 90^0 is the first step for rotation, for rest of the iterations each step is calculated based on the obtained result of the computation of the above equations. Based on the number of iterations the values of Y and X converge to the closest values of sine and cosine of an angle θ_I[4].

The rest of this work is arranged as follows: section II discusses the principle of the algorithm. Section III explains the hardware realization of the developed model. The discussion and conclusion of the paper are provided in section IV and V, respectively.

2. CORDIC Algorithm

2.1 CORDIC Sine and Cosine

Computation of trigonometric functions based on CORDIC algorithm is one of the most hardware efficient algorithms as it only requires iterative shift-add operations [5].

The idea of CORDIC is to rotate the vector over a given angle. Each rotation is computed by using add/sub and shift operations. The vector is rotated through fixed number of steps. In the (Fig. 1), the vector U with the coordinates (x and y) is rotated over an angle θ to obtain a new vector U_i with coordinates x_i and y_i. This method is explained below.

As shown in (Fig. 1), the rotation of a two-dimensional vector $U_0 = [x_0, y_0]$ through an angle θ, vector $U_n = [x_n, y_n]$ can be obtained by rotating the original vector by performing the matrix product, $U_n = RU_0$, where R is the rotation matrix [6] and is given by:

$$R = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \qquad (3)$$

And the equations for n^{th} values of x and y are shown below:

$$X_n = X_0.\cos\theta - Y_0.\sin\theta \qquad (4)$$

$$Y_n = Y_0.\cos\theta - X_0.\sin\theta \qquad (5)$$

The above equations can be rewritten as below:

$$X_n = \cos\theta[X_0 + Y_0.\tan\theta] \qquad (6)$$

$$Y_n = \cos\theta[Y_0 + X_0.\tan\theta] \qquad (7)$$

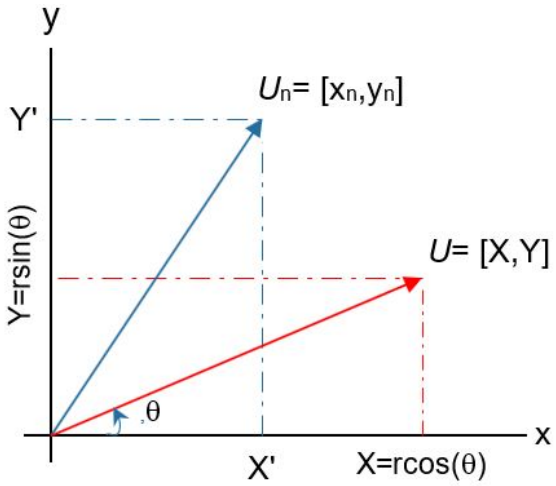

Fig. 1. Rotation of vector on a two-dimensional plane

As can be seen from the above equations, to get a single value of X, 2 multipliers and one subtractor are needed, and for Y we need 2 multipliers and one adder. But this does not eliminate the multiplier required for the computation which is nothing but the basic goal of the CORDIC algorithm to avoid the multipliers. If the rotation angles are restricted so that $\tan\Theta = \pm 2^{-i}$, the multiplication by the tangent term is avoided and that is replaced by a simple shift operation. Arbitrary angles of rotation are obtainable by performing a series of successively smaller elementary rotations. At each step of iterations, i, signifies the direction to rotate the vector U, then the $\cos(\theta)$ term becomes a constant because $\cos(\theta_i) = \cos(-\theta_i)$. The iterative rotation can now be expressed as:

$$X_{i+1} = k_i\left[X_i - Y_i \cdot d_i \cdot 2^{-i}\right] \qquad (8)$$

$$Y_{i+1} = k_i\left[Y_i - X_i \cdot d_i \cdot 2^{-i}\right] \qquad (9)$$

Where, $k_i = \cos\left(\tan^{-1} 2^{-i}\right) = \frac{1}{\sqrt{1+2^{-2i}}}$ (10)

$$d_i = \pm 1$$

The above equations give a pure shift-add algorithm for the vector rotation. In equation 10, K_i is the product that can be used as a system gain at the output of the system. This product term converges to 0.6073 as the number of iterations tend to infinity. Therefore, the rotation algorithm has a gain of approximately 1.647. The exact gain depends on the number of iterations, and obeys the relation:

$$A_n = \Pi_n \sqrt{1 + 2^{-2}} i \qquad (11)$$

The angle of the composite rotation can be computed via a chain of directions of the elementary rotations, which is described via a decision vector. However, the angler accumulator adds a third difference term to the CORDIC algorithm, which can be eliminated when the angle is useful in the arctangent base.

$$Z_{i+1} = z_i - d_i \cdot tan^{-1}\left(2^{-i}\right) \qquad (12)$$

The angle accumulator is initialized with the desired rotation angle when the CORDIC algorithm is operating in rotation mode. The rotation direction is decided based on the sign of the residual angle followed each iteration. In few scenarios, the angle accumulator may be cleared if the input angle is

already stated in the binary arctangent basis. For the rotation mode, the CORDIC equation can be described as follows:

$$X_i + 1 = X_i - Y_i \cdot d_i \cdot 2^{-i} \quad (13)$$

$$Y_{i+1} = Y_i + X_i \cdot d_i \cdot 2^{-i} \quad (14)$$

$$Z_{i+1} = Z_i - d_i \cdot \tan^{-1}(2^{-i}) \quad (15)$$

$$\text{Where, } d_i = \begin{cases} -1 , & if Z_i < 0 \\ +1 , & otherwise \end{cases}$$

At the end of the all the iterations X_i and Y_i will converge to cosine and sine of the given angle θ, respectively.

2.2 CORDIC Multiplication

CORDIC multiplication is one of the prevalent techniques that can be used to perform the multiplication of fractional numbers since it is very efficient in terms of hardware resources [7]. The CORDIC multiplication is based on the idea of series representations of the numbers [8]. For example, if two numbers *a* and *b* need to be multiplied as shown in equation (14), one of the numbers might be replaced by a series representation of 2^{-i} as shown in equation (15). By substituting equation (15) in (14), equation (16) will be obtained as a final expression for the multiplication operation.

$$y = a * b \quad (16)$$

$$\text{Let } a = \sum_1^n k * 2^{-i} \quad (17)$$

$$y = \sum_1^n b * (k * 2^{-i}) \quad (18)$$

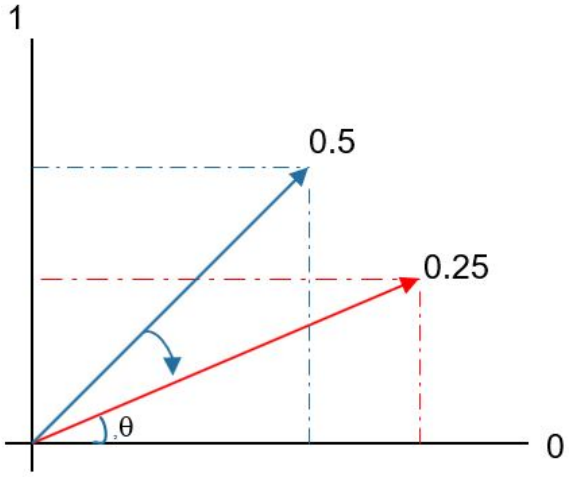

Fig.2. Multiplication and division rotational vector plane

The resultant equation, equation (18), can perform the multiplication by accumulating the results of the consecutive shift to right operations of the number b. That basically happens after computing the factor k. The factor k determines the appropriate operations need to be selected to obtain the fastest possible convergence. The k value can be either '1' or '-1'. When it is '1' an addition operation is

performed, otherwise a subtraction is carried out. The best possible approach to compute the factor k is based on the idea of using rotated test vector. The idea is demonstrated in (Fig. 2) in which the vector '0.25' represents the number a, while the rotated vector '0.5' is test vector that represents the fractions of number a.

The test vector starts with initial value of 0.5 since the result of the multiplication is assumed to be always between '0' and '1'. The test vector value is then moved around the vector a by a value of 2^{-i}, where *i* represents the number of iterations. In every iteration, the distance between the test vector and the vector a is calculated. The distance is positive if the vector a has an angle larger than the angle of the test vector, otherwise it is negative. The distance sign represents the value of the factor *k*.

(Fig. 3) and (Fig. 4) show an example of multiplication of two numbers, 0.3 and 0.3. As can be seen from (Fig. 3), the result of the multiplication is accumulated in *y* and this happens along the time with the changes of the test vector of the number a as can be seen in (Fig. 4).

2.3 CORDIC Division

CORDIC division uses the same principles of CORDIC multiplication. The division of any two numbers can be reshaped to be a multiplication of these numbers. For instance, assume y is the result of division of two number b and a, y = b / a. This equation can be re-written in the following format b – y * a = 0. Since the resulted format composes of subtraction and multiplication operations only, the result of division can be easily obtained by following the same mechanism that is used in CORDIC multiplication as shown in the equations (17, 18, 19, and 20) below:

$$y = \frac{b}{a} \qquad (17)$$

$$b - y * a = 0 \qquad (18)$$

$$\text{Let } a = \sum_1^n k * 2^{-i} \qquad (19)$$

$$b - \sum_1^n y * \left(k * 2^{-i}\right) = 0 \qquad (20)$$

(Fig. 5) and (Fig. 6) show an example of division of two numbers, 0.25 and 0.3. As can be seen from (Fig. 5) is that *y* variable starts from zero and increases over time in every iteration. This is happening along with changes of the test vector over time. The computation process is stopped once the right answer is obtained, or the number of iterations is reached.

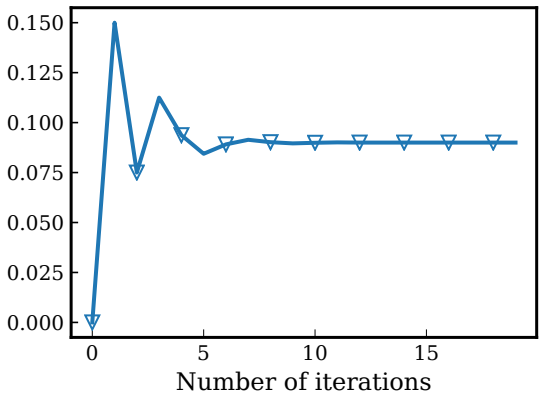

Fig. 3. Multiplication result process Vs time.

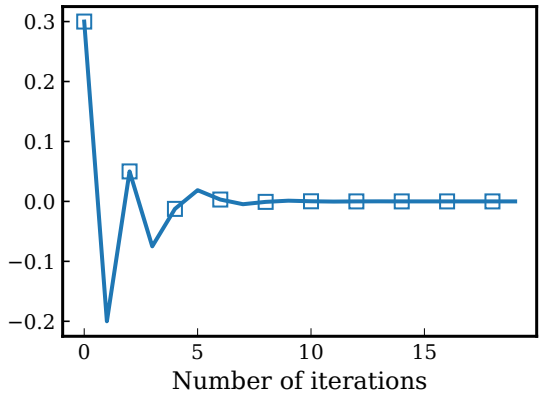

Fig. 4. The test vector values Vs. time when performing multiplication operation

3. CORDIC HARDWARE REALIZATION

The CORDIC algorithm is behaviorally modeled in VHDL and ported on field programmable gate array (FPGA). The sine, cosine, multiplication, and division models are placed together in a single block that forms the coprocessor in which all the mathematic operations are performed. The coprocessor is connected to universal asynchronous receiver transmitter (UART) that works as a bridge to move data back and forth between PC running MATLAB and the coprocessor. The entire system works as follows: the computer sends two arguments that involve in the computations along with a mathematical operation such as *s*, *c*, '+' or '-', where *s* and *c* represent the sine and cosine operations, respectively. The sent arguments are 8-bit wide. The 8-bit represents the fraction part of a number or an angle degree. For instance, 0.2 is sent as 0000_0010 binary format and 30^{o} is sent as 0001_0101_0101_0101.

The coprocessor receives these data via UART transceiver and stores them in registers. Then, the coprocessor checks the operation register to see which operation needs to be performed. After determining the required operation, the coprocessor passes the input arguments to the appropriate computational blocks to perform the necessary calculation. There are three computational blocks in the coprocessor: These blocks receive two 8-bit numbers and find the results which is either their sine or cosine, or their multiplication or division, in an iterative fashion.

The sine_cosine is implemented as 16 stages pipeline and all the iterations are performed in parallel, using the pipelined structure. It requires 16 clock pulses to generate an output for sine and

cosine functions when input angle is given at the first clock and later, one output is generated at every clock cycle of the system. Each stage has X_i, Y_i and Z_i as inputs and X_{i+1}, Y_{i+1} and Z_{i+1} as outputs. Each stage contains an arctan table for each iteration and the logic needed to manipulate X, Y and Z values.

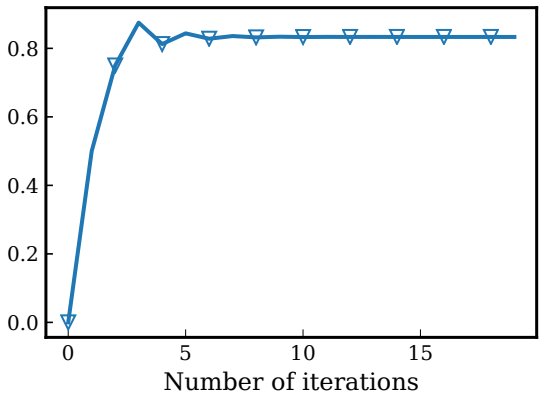

Fig. 5. Division process Vs. Time.

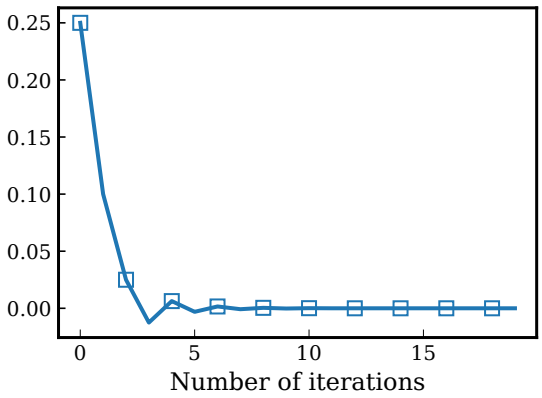

Fig. 6. The test vector values Vs Time when performing division operation.

In case of multiplication and division, the blocks are made up of state machine of four states: init, loop_start, loop_count, send_out. The state machine begins with the init state in which the 8-bit inputs are reformed to be 9-bit wide. The last added bit is to represent the decimal part of the fraction that could be either '1' or '0'. Then, the state moves to the loop_start and loop_count alternatively to get the multiplication or division process done. Once the results are ready, the state jumps to the send_out state in which the result will be sent to PC via UART transceiver.

4. Discussion

The synthesis report reflects the efficiency of using CORDIC algorithm in terms of resources. As can be noticed from the reported results (see Table 1 and Table 2), that no multipliers or dividers are used.

In case of sine and cosine computation, input angle for the trigonometric computation is a 16 bits wide number and the sine/cosine of this input angle is represented using 16 bits number. Computation

of sine/cosine of this angle is performed iteratively. The only used components in each of these iterations are adders/subtractors, registers. Sine and cosine computation involve operating 16 pipelined stages and therefore it requires 16 clock pulses to generate the single value of the output. In the case of multiplication and division the developed models are implemented in such a way that exploits the shared resources feature and optimizes the system in terms of hardware resources. However, the outputs of these models are verified by comparing with the analytical values that have been derived for the design. The results show that the system is able to perform the intended function and able to run at a maximum clock frequency of 191.1MHz.

Table 1 : Synthesis report for Multiplication and Division

HDL Synthesis Report	**Division**	**Multiplication**
Macro Statistics		
# Adders/Subtractors	3	3
10-bit addsub	1	1
4-bit adder	1	1
9-bit subtractor	1	1
# Registers	7	1
1-bit register	1	1
10-bit register	1	1
4-bit register	1	1
9-bit register	4	4
# Comparators	1	1
9-bit comparator greater	1	1
# Multiplexers	9	9
1-bit 2-to-1 multiplexer	1	1
10-bit2-to-1 multiplexer	1	1
4-bit 2-to-1 multiplexer	2	2
9-bit 2-to-1 multiplexer	5	5

Table 2: Synthesis report for Sine and Cosine

HDL Synthesis Report	**Sine and Cosine**
Macro Statistics	
# Adders/Subtractors	45
16-bit addsub	30
20-bit addsub	15
# Registers	45
16-bit register	30
20-bit register	15

5. Conclusions

The CORDIC algorithm is one of the most prevalent techniques for the calculation of elementary functions. The utility of this algorithm lies in its generality and flexibility. In this paper, an FPGA based hardware mathematical computational unit is implemented to perform trigonometric computations and basic arithmetic operations. The trigonometric functions computed are sine and cosine and arithmetic operations performed are multiplication and division functions. The CORDIC algorithm is synthesized as adders/subtractors and shift registers that reflect the simplicity and efficiency of the developed model in terms of hardware resources. In the future, design can be expanded to support other trigonometric, logarithmic, and exponential functions. The new algorithm helps to locate the blind man accurate and real time process.

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Internal and Marginal Fit of CAD/CAM Crowns Made from Digital and Conventional Impressions

Mohal Suhiel Saad[1]. Firas Abdulameer Hussain[2]. Taqwa Majid Abdul Hussain[1]

1Department of Prosthetic Dentistry, Al Baladyat Specialized Dental Center, Baghdad, Iraq
2 College of Dentistry, the Baghdad University, Baghdad, Iraq.

ABSTRACT
The significance of evaluating the accuracy and fitness of fixed dental restorations to the prepared tooth, emphasizing their impact on the clinical success and lifespan of dental prostheses. Marginal and internal fit play crucial roles in achieving a well-fitting restoration, with marginal discrepancy referring to the vertical gap between the tooth preparation and the restoration's cervical edge, and internal discrepancy denoting the horizontal gap between the axial wall of the prepared tooth and crown. Complications arising from marginal and internal discrepancies, such as plaque deposition, recurrent caries, and periodontal disease, underscore the importance of achieving precise fits in dental restorations (1).

Key words: Marginal fit, conventional impression, digital impression, CAD-CAM, die spacer, crowns.

Introduction:

The development of the transformative impact of digital impression techniques, particularly intraoral scanners (IOS), in the dental industry. These advanced workflows allow for better collaboration, faster restorations, and improved treatment planning, including same-day anterior and posterior full-coverage and partial-coverage restorations, veneer treatments, patient participation, and implant treatments. These digital workflows also positively influence removable prosthodontics, enabling better treatment planning, try-in, and delivery of final dentures, resulting in dentures with enhanced fit, comfort, durability, and esthetics (2). Moreover, the integration of CAD-CAM technology in crown and bridge fabrication is reshaping dentistry, offering more accurate milling of restorative materials compared to traditional approaches (3). Overall, this abstract underscores the growing importance of digital technologies in dentistry, particularly in fixed dental restorations and removable prosthodontics, and highlights the potential benefits they offer in terms of accuracy, convenience, and patient outcomes .

Fixed restoration

Fixed restorations play a crucial role in dental prosthodontics by restoring single teeth, groups of teeth, or filling gaps caused by missing teeth. Indirect restorations, such as inlays, onlays, veneers, crowns, and fixed partial dentures, offer numerous advantages, including increased durability, enhanced aesthetics, and improved functionality (4).

Among the fixed restorations, crowns are essential extra-coronal artificial restorations that restore the morphology, shape, and function of a natural tooth while safeguarding the remaining dental structure from future damage. Indirect restorations like crowns exhibit superior durability and aesthetics compared to chairside fillings. Dental cement is used to secure crowns in place, and they can be fabricated from various materials through an indirect method (5).

Overall, fixed restorations provide essential dental solutions that not only preserve teeth from decay but also enhance their appearance and functionality, contributing to improved oral health and patient satisfaction.

Corresponding author:
Mohal suhiel saad,Department of Prosthetic Dentistry, Al Baladyat Specialized Dental Center, Baghdad, Iraq, omalimohal92@gmail.com.
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Dental impression and impression techniques:

A dental impression is a negative mold of a tooth used to create a positive replica, record, or dental restoration or prosthesis. The precision in generating the impression is vital for the successful design and longevity of both fixed and implant-retained prostheses. Incorrect impression-taking procedures or manual methods during prosthesis creation can lead to various issues, including problems with crown retention that may affect the prosthesis's durability (6).

Dental impressions can be obtained through digital methods or traditional means. For traditional impression processes, it is crucial to use materials with suitable properties and improved attributes that allow for accurate detail replication and durability. These materials should also withstand effective cleaning processes.

Conventional impression technique

The conventional impression technique involves multiple steps in the procedure, including the fabrication of a stone cast and subsequent extra-oral digitization. However, this traditional approach raises concerns about accuracy. Documented faults in the conventional impression can lead to artifacts at the margins, compromising the restoration's marginal adaptation. To mitigate these issues, operators carefully select the appropriate tray and apply adhesive to both arches before utilizing the monophase impression technique with polyether impression material and stock trays. The interocclusal link is recorded using a polysiloxane bite registration material. The effectiveness and clinical outcomes of this traditional impression approach are then assessed (7).

Inaccurate marginal fit resulting from inadequate impression-taking techniques during prosthesis fabrication can lead to various problems, such as luting agent dissolution, caries microleakage, periodontal inflammation, and hypersensitivity (8). These issues emphasize the importance of achieving precise and accurate impressions to ensure the success and longevity of dental restorations.

Digital impression technique

The fabrication of fixed dental prosthesis traditionally involves the use of conventional impressions, which can be time-consuming for both dentists and patients. Issues may arise during the impression-making process, leading to potential errors and suboptimal prostheses. Conventional impression-making is limited by factors such as the flow and hydrophilicity of the impression material, a short working period, and patient movement during the impression-taking process (9).

However, digital impression techniques offer a more efficient and precise alternative. Intraoral scanning equipment allows for the acquisition of digital impressions, eliminating the need for tray selection, impression cleaning, and shipping. With digital impressions, the process of pouring stone models, manual die cutting, and articulation becomes unnecessary. These digital impressions are integrated into CAD/CAM systems which enable in-office milling machines to create the final prosthesis using ceramic or composite blocks (10).

Intraoral scanners have also been developed as stand-alone devices, capturing digital impressions that can be transferred to dental laboratories for prosthesis manufacturing. While some stand-alone intraoral scanners do not allow for crown design, other systems enable dentists to mark the margins before transmitting the image to the lab (2).

Overall, the digital impression technique revolutionizes fixed dental prosthesis fabrication, offering increased efficiency, accuracy, and patient comfort compared to traditional impression methods. The integration of digital technology in dentistry continues to enhance the dental restoration process, providing dentists and patients with more streamlined and precise solutions.

Computer aided device/computer aided manufacturing (CAD/CAM)

The CAD/CAM process starts with the dentist taking three-dimensional images of the tooth preparation, which are then loaded into computer software. The software generates a computer-

generated cast, allowing the dentist to plan the restoration digitally. This digital planning ensures a more delicate restoration, especially in the case of veneer restorations.
Preserving the enamel of the teeth is crucial for successful bonding of the restoration. CAD/CAM technology allows for precise preservation of enamel, which promotes better bonding compared to dentin bonding. The enamel covering must be protected during the tooth preparation process to ensure optimal bonding results.
While some dentists claim to offer a one-day process for chairside CAD/CAM services, the actual working time may be doubled compared to conventional restoration procedures (11). Nonetheless, CAD/CAM technology significantly reduces the overall treatment time and offers the benefit of same-day restorations, enhancing the patient's convenience and experience.

Advantage:
Fixed restorations made using CAD/CAM technology offer the advantage of being fabricated and bonded to the tooth on the same day, providing a same-day restoration process .This is in contrast to conventional restorations, such as crowns and other classic prosthetics, which often require the use of temporaries and multiple visits to the dental office while the fixed prosthesis is being made by a dental laboratory.

Disadvantages:
Digital impression systems indeed come with their own set of disadvantages, which may affect their widespread adoption in certain clinical situation.Gingival Margin Capture: To produce an accurate digital impression, the gingival margin and approximately 0.5 mm of tooth structure apical to the margin must be exposed. This requirement can be challenging in cases with subgingival margins or difficult-to-reach areas.
Initial Cost Investment and Learning Curve: Adopting digital impression systems involves a significant initial cost for acquiring the necessary equipment. Dentists and dental staff also need to undergo training to effectively use the technology, leading to a learning curve.
Equipment Repair and Updates: Like any technological system, digital impression devices may require occasional repairs or updates, which can incur additional costs.
Restricted Opening: Some patients with limited mouth opening may find it uncomfortable or challenging to accommodate the larger wand used in digital impression systems.Furthermore, certain clinical situations still favor analog impression procedures over digital impressions. Unstable soft tissue or insufficient hard tissue can pose challenges especially when taking impressions for long-span bridges or large/full arch implant restorations.Digital impression systems also have limitations related to their scanning capabilities. The scanner's size may limit its ability to capture certain areas in the oral cavity accurately. Additionally, the presence of blood, saliva, or contamination in the oral cavity can reduce the effectiveness of digital impressions,Studies have shown that intraoral scans (IOS) using digital impression systems can be more accurate than conventional impressions for short-span fixed dental prostheses (FDPs) up to a quadrant. However, when it comes to full-arch scans, conventional impression techniques have demonstrated higher transfer accuracy. While the latest software versions of IOS scanners have shown improvements in short-span distances, conventional impression techniques still provide the lowest deviation for long-span distances (12), while digital impression systems offer numerous advantages, certain limitations and clinical scenarios may still necessitate the use of traditional analog impression procedures. Dentists must carefully evaluate each case's specific requirements to determine the most appropriate impression technique for optimal results**.**

Marginal fit and integrity and internal fit

The margin of a fixed dental restoration refers to the area where the crown comes into contact with the natural tooth. It is the most coronal (highest) location of undamaged tooth structure. Achieving an accurate and precise fit at the margin is essential for the success and longevity of the restoration.

The space between the tooth margin and the restorative margin should ideally be between 40 and 100 nanometers (nm) to ensure a proper tooth-to-restoration adaptation. Achieving such a close fit between the restoration and the tooth margin helps prevent bacterial leakage and ensures a strong bond between the two ,When the margin of the preparation is positioned below the gumline (subgingival), crown lengthening therapy may be necessary to expose the margin and allow for proper impression taking and restoration placement. Crown lengthening involves removing excess gum tissue and bone to reveal more of the tooth structure and create an appropriate margin,Various types of margins can be used when fixing prepared teeth with fixed restorations. One common option is the chamfer finish line, which is popular in complete gold restorations .The chamfer finish line design removes as little tooth structure as possible while still providing adequate space for the restoration material ,resulting in a more conservative preparation ,Ensuring both the marginal fit and the internal fit of fixed restorations are crucial for achieving long-lasting and well-functioning dental restorations. A precise fit at the margin and within the restoration ensures proper adaptation, reduces the risk of complications, and enhances the overall success of the fixed restoration (2).

Measurement methods for marginal fit

The marginal gap values of partial and full coverage restorations have been measured using a variety of approaches. Each method has its own set of benefits and drawbacks.

Cement space and marginal fit

There is a correlation between more concrete space and less seating disparity (13). When luting an artificial crown with zinc phosphate cement, a minimum amount of seating discrepancy is required, as well as at least 40 um of cement gap. Crown seating is heavily influenced by the amount of cement available (14). When the cement gap was increased from 10 um to 30-50 um the marginal fit of CEREC 3 CAD/CAM all-ceramic crowns improved Creating cement gap for CAD/CAM crown manufacturing is necessary to permit accurate coping adaptation to the abutments, improve excess cement outflow, and reduce the force required to adapt the crown on the abutment tooth during cementation (15). The ideal cement space of 20–40 um for complete seating of a typical crown. The retention value of casted crowns using zinc phosphate and zinc polycarboxylate cements was higher for crowns without cement space than for crowns with cement space. A thick cement layer favors a higher concentration, which can lead to microcracks, piece maladjustment, and even marginal fractures of loose ceramic (16). Internal adaptation, on the other hand, indicates the fracture force of the prosthetic work. As a result of the thick coating of cement, a region of force concentration is created, allowing for ideal fracture circumstances. the mean marginal discrepancies produced by crowns with a cement spacing of 70 m were greater than the clinically acceptable marginal discrepancy range of 30–120 um. One probable explanation is that the resin cement is subjected to increased intracoronal hydraulic pressure in narrower areas, which may translate to higher resistive forces during cementation, perhaps impeding a more complete crown seating. Changes in other criteria, such as tooth type, taper of tooth preparations, types of 21 materials, and CAD/CAM technologies, may also result in differing outcomes (17).

Die Spacer/ Cement Film Thickness

The die spacer utilized in crown manufacture has an impact on the indirect restoration's retention and fit indirect restoration with a die spacer of 25-40 um in thickness was reported to improve seating. The use of a die spacer of less than 30 m may result in poor seating of the repair during cementation. The potential of designing and fabricating crowns with the incorporation of virtual cement space (die

spa) was established with the introduction of digital designing and fabrication of crowns. Digital designing and fabrication of crowns introduced the possibility of designing and fabricating crowns with the incorporation of virtual cement space (die spacer), consequently improving accuracy (18). Cements with varying degrees of deterioration in the oral environment will be used to fill the gap. Recommended using crown seating techniques that include perforations, internal relief and die spacer. it is safer to use die spacers because they promote internal relief close to the ideal and its application technique does not harm the restoration surface, as it is applied before casting (18). Die spacer has been shown to improve the marginal fit between the restoration and tooth preparation, decreasing the risk of cement dissolution, plaque accumulation, recurrent caries, and periodontal problems. The thickness of this die spacer affects the fracture strength of a ceramic restoration, its retention, and the marginal gap (18).

CONCLUSION

Within the limitation of this review study the following conclusion can withdraw:

i. Conventional impression artifacts at the margins could occur from documented faults, jeopardizing the restoration's marginal adaption
i. The fixed restorations that was created with digital impression techniques had a better marginal fit than those made with conventional procedures.
i. CAD/CAM allows for accurate and aesthetically acceptable same-visit indirect fixed restorations. With the creation of very precise, accurate models and restorations.
i. Furthermore, use of I.O.S. for digital impressions may be a viable alternative to analogical technique. The reliability of the workflow in term of marginal accuracy is enhanced by all the advantages lying into a full digital environment.
i. The IOS technique reduces the danger of cross-infection during fixed restoration making especially in the presence of the corona virus disease 19 (COVID-19) pandemic.

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New Acylselenourea Ligand With its Metal Complexes; Synthesis, Structure, Characterization, Thermal Analysis and Biological Activity

Talib H. Mawat[1,2], Sarah J. Alwash and Wathiq Kh. Mohammed[2]

[1]Department of chemistry, College of science, Al-Nahrain University, Baghdad, Iraq.
[2]Department of anaesthesiology techniques, Al-Hadi University College, Baghdad-10011, Iraq.

Abstract

The production of four mononuclear metal complexes using a novel ligand ((Z)-4-methoxy-N-(2-(4-methylbenzylidene)hydrazine-1-carbonoselenoyl)benzamide) (H2L). Potassium selenocyanate, hydrazine hydrate, and 4-methoxybenzoyl chloride were combined to generate the precursor of N-(hydrazinecarbonoselenoyl)-4-methoxybenzamide. The precursor that formed a new ligand (H2L) by interaction with 4-methylbenzaldehyde. New complexes with the general formula K2[ML2], (M= Iron(II), Cobalt(II), Nickel(II), and Zinc(II)), were isolated as a result of H2L's interaction with Iron(II), Cobalt(II), Nickel(II), and Zinc(II) ions. The generated acylselenourea-compounds have been described by FT-IR, UV, 1H, 13C, 77Se-NMR, mass spectra, thermal analyses, Molar conductance, and effective magnetic moments. The separation of octahedral geometry around (Iron(II), Cobalt(II), Nickel(II), and Zinc(II)) ions has been seen in the analytical and spectroscopic investigations of complexes. Furthermore, it has been discovered that some Gram (-) bacteria, such as Escherichia coli, Klebsiella pneumoniae, and Bacillus sabtuius, exhibit resistance to the H2L ligand and its metal complexes. Additionally, it appears that metal complexes may be more resistant to microbial activity than free ligand due to strains of the Gram+ bacterium Staphylococcus aureus. C. albicans, C. glabrata, C. tropicalis, and C. parapsilsis were the four fungi that were evaluated in relation to the ligand (H2L) and its complexes. with metal complexes exhibiting a higher level of resistance to microbial activity than free ligand.

Keywords: 4-methoxybenzoyl chloride; Potassium selenocyanate; Acylselenourea; Biological activity.

1. Introduction

The chemistry of molecules containing organoselenium has advanced and evolved more than a century later. Due to the toxicity and instability of many organic selenium compounds, synthetic techniques have been developed to synthesize organic selenium derivatives that are safer to handle, easier to manufacture, and less poisonous. These substances have antibacterial, antiviral, anticancer, and other therapeutic uses in addition to being employed as antioxidants. [1].

Among the compounds reported to include selenium and having applications such as antioxidant, antitumor, and anticancer are those belonging to the chemical form acylselenourea. been studied, possesses cytotoxic action, and has proven to protect against oxidative stress [2].

Acylselenoureas have been demonstrated to inhibit human carbonic anhydrase (hCA) and function as antiproliferative agents when coupled with ferrocenyl moieties. Furthermore, it has been demonstrated that acylselenourea complexes containing palladium, ruthenium, zinc, and cadmium inhibit the proliferation of leukemia cell lines. Diselenide motifs combined with acylselenourea derivatives provide potent and focused antitumoral activity. [3].

Corresponding author:
Talib H. Mawat, Department of chemistry, College of science, Al-Nahrain University, Baghdad, Iraq.talib.phd.88@gmail.com.
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Two trace metals, iron (Fe) and copper (Cu), are necessary for the proper functioning of cells. Owing to their inherent ability to engage in the redox cycle and perform dual roles as electron donors and acceptors, iron and copper are involved in a multitude of cellular processes. [4].

Research has indicated that acyselenoureas and selenosemicarbazones have anti-cancer potential. The discovery of selenium atoms in organic compounds led to an enhancement in the agents' ability to combat viruses, germs, and parasites. It was also discovered that acyl selenoureas and their Co(II), Cu(II) complexes exhibited strong anti-tumor activity in vitro. These findings showed that acylselenoureas, as new chemicals, had potential applications in cancer therapy. [4].

Selenoureas are thiourea analogues for selenium, and little research has been done on their biological activities because, until the late 1950s, selenium was regarded to be harmful to humans. The fact that elemental selenium precipitates during the complexation of acylselenourea, that ligands change with the evolution of hydrogen selenide, or that oxidation results in the formation of diselenide bridges suggests that these compounds are unstable, which is another possible explanation.[5]. However, some of the acylselenoureas that were synthesized and their complexes exhibited good biological activity. A small number of comparison studies found that acylselenoureas had biological activities that were on par with or even better than those of related thioutreas and their complexes. [5].

Seleno-compounds are Schiff bases that are produced when acylselenoureas and carbonyl compounds condense. They displayed anticancer, antifungal, antibacterial, antimalarial, and antiparasitic properties. [6,7].

We have previously synthesized and studied acylselenureas ligand-containing Mn(II), Ni(II), Cu(II), and Zn(II)-complexes. Biological activity studies were conducted on the ligand and its complexes [8].

In the process of creating heterocycles and homocycles containing selenium, acyl selenocyanates are helpful intermediaries. Acyl chloride and potassium selenocyanate reacted to produce acyl selenocyanates. In this work, we report the synthesis of a Schiff-base ligand of acylselenourea by reacting acyl selenocyanates with aldehyde in the presence of amine. Compounds' chemical structures were investigated.

2. Experimental

2.1 Chemicals and Method

All of the laboratory compounds used in this investigation were readily accessible commercially and were used without further purification. One can prepare N-(hydrazinecarbonoselenoyl)-4-methoxybenzamide by following the procedure outlined in Ref. [8]. This molecule serves as a starting point for the synthesis of ligand.

2.2 Physical Instruments

We computed the melting points using an SMP-30 Stuart electric and thermal apparatus. The KBr method was used to analyze the FTIR spectra of the Perkin-Elmer FT-IR 1725X spectrophotometer in the 400–4000cm–1 range. For 10-3M solutions in DMSO at room temperature, electronic spectrum measurements were performed using a UV-visible spectrophotometer manufactured under the Shimadzu brand. The DMSO-d6 solutions The 1H and 13CNMR spectra, respectively, were recorded using a Brucker 400MHz spectrum analyzer with tetra-methylsilane, or TMS, serving as an internal standard. The 77SeNMR spectra in the DMSO-d6 solution were obtained using a Brucker 400MHz spectrometer, and dimethylselenide (Me2Se) was one of the internal standards. The Agilent LCmssx spectrometer was used to record electrospray mass spectra, or ESMS. The EuroEA3000 was

used to examine elements Hydrogen, Carbon, and Nitrogen. The atomic absorption spectrophotometer (FAA) 680G was utilized to identify the metals. The chloride concentration was determined by potentio-meteric titration using a 686Titro (processor-665, Dosimat-Metrohm) Swiss equipment. After completing conductivity tests using DMSO, solutions, and a conductivity meter with a digital display manufactured by Eutech Instruments, model number CON510, the magnetic moments of the R.T. were determined. Evans' approach was used to do the magnetic measurements at 298 K using an MSB-MK1 balance (Sherwood Scientific DE).

2.3 Preparation of H_2L

N-(hydrazinecarbonoselenoyl) benzamide was produced by mixing a solution of 0.84gm potassium selenocyanate (6mmol) in 10ml dry acetone with a solution of 4-methoxy benzoyl chloride (12mmol). The reaction mixture was stirred at 25C for a duration of 25 minutes. The hydrazine hydrate (99.90%, 0.3 ml, 6 mmol) and 5 ml of dry acetone were added, and the mixture was then agitated for 30 minutes at room temperature. The mixture was then agitated with 6 mmol of 4-methylbenzaldehyde in EtOH for two hours at 60 oC. Following the chemical's extraction with diethyl ether and a water washing, ligand was produced. See Scheme (1). Yield: 0.13g (68%), m.p= 175-178°C. Data of FT-IR (cm^{-1}): 3351 ν(N2-H), 3313 ν(N1-H), 3029 $\nu(C\text{-}H)_{aromatic}$, 2994 $\nu(C\text{-}H)_{aliphatic}$ 1672 ν(C=O), 1633 $\nu(C{=}N)_{imine}$, 1579 $\nu(C{=}C)_{aromatic}$, 1281 for Selenone of C=Se. ^{1}HNMR spectrum of H_2L (400MHz in DMSO-d^6) displayed signals at δ_H; 8.21 (2H, d, J_{HH}= 12 Hz $C_{3,\,3'}$-*H*), 7.95 (2H, d, J_{HH}= 12 Hz $C_{9,\,9'}$-*H*), 7.48 (4H, d, J_{HH}= 8 Hz $C_{2,\,2'}$,$_{10,10'}$-*H*), 9.01 (1H, br, N1-*H*), 4.55 (1H, br, N2-*H*), 4.22 (3H, s) (CH_3O), 2.98 (1H, s, C_7-*H*), 1.69 (3H, s, C12-*H*) ppm.

H_2L's ^{13}CNMR spectrum (100 MHz in DMSO-d6) shows signs in the area. δ_C; 176.29ppm that is brought about by the (C=O) group and 169.86 ppm, which are connected to the (C=Se). 145.49 (C=N), 136.64 (C1), 135.49 (C11), 133.68 (C8), 129.82 ($C_{10,\,10'}$), 126.34 ($C_{9,\,9'}$), 123.54 (C4), 119.70 ($C_{3,\,3'}$), 114.38 ($C_{2,\,2'}$), 59.13 (C13) (OCH3), and 24.32 (C12)ppm are also included. 76MHz in DMSO-d6 ^{77}SeNMR spectra of H_2L displays signal at196.74 ppm for C=Se moiety.

H_2L's ESM(+) spectrum showed a height with m/z= 375.3 $[(M+H)]^+$ (23%) for $C_{17}H_{17}N_3O_2Se$, requires= 374.3 Peaks discovered at m/z=330.6 (50%), 262.8 (100%), 167.5 (38%) and 118.3 (74%) correlate to $[M+H\text{-}(CH_5N_2)]^+$, $[(M+H)\text{-}\{(CH_5N_2)+(C_5H_8)\}]^+$, $[(M+H)\text{-}\{(CH_5N_2)+(C_5H_8)+(CH_4Se)\}]^+$ and $[(M+H)\text{-}\{(CH_5N_2)+(C_5H_8)+(CH_4Se)+(CH_5O_2)\}]^+$ respectively.

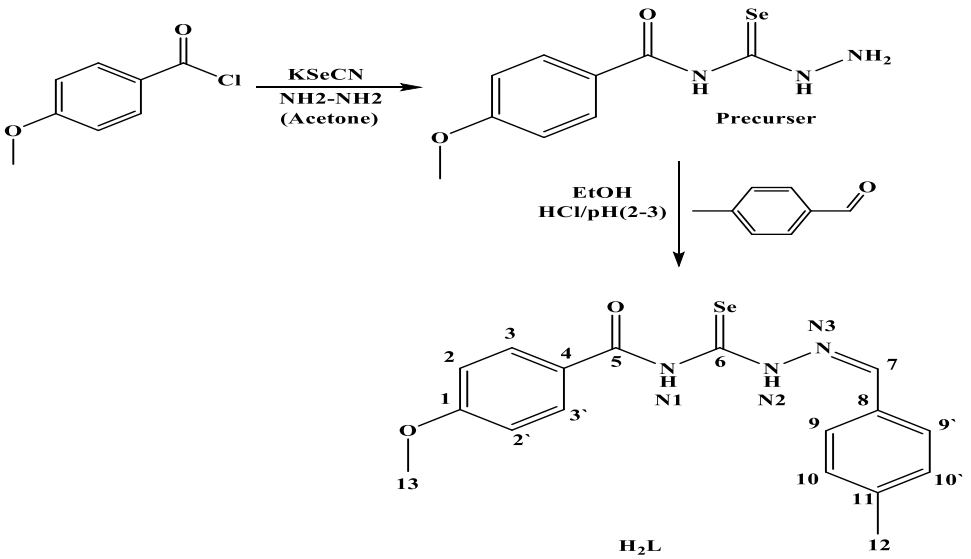
2.4 General Metal Complexes of H_2L Synthesis

A 2:1 (L:M) mole ratio of metal chloride (1.35 mmol) was added to a mixture of H2L (0.5 gm; 2.7 mmol) in methanol (10 ml). The presence of KOH was used as a base in the reaction. After refluxing for two hours, the reaction mixture was cooled to room temperature. Scheme (2) illustrates how a filter was used to extract the chemical precipitate, which was then washed with cold 100% ethanol and allowed to dry by air.

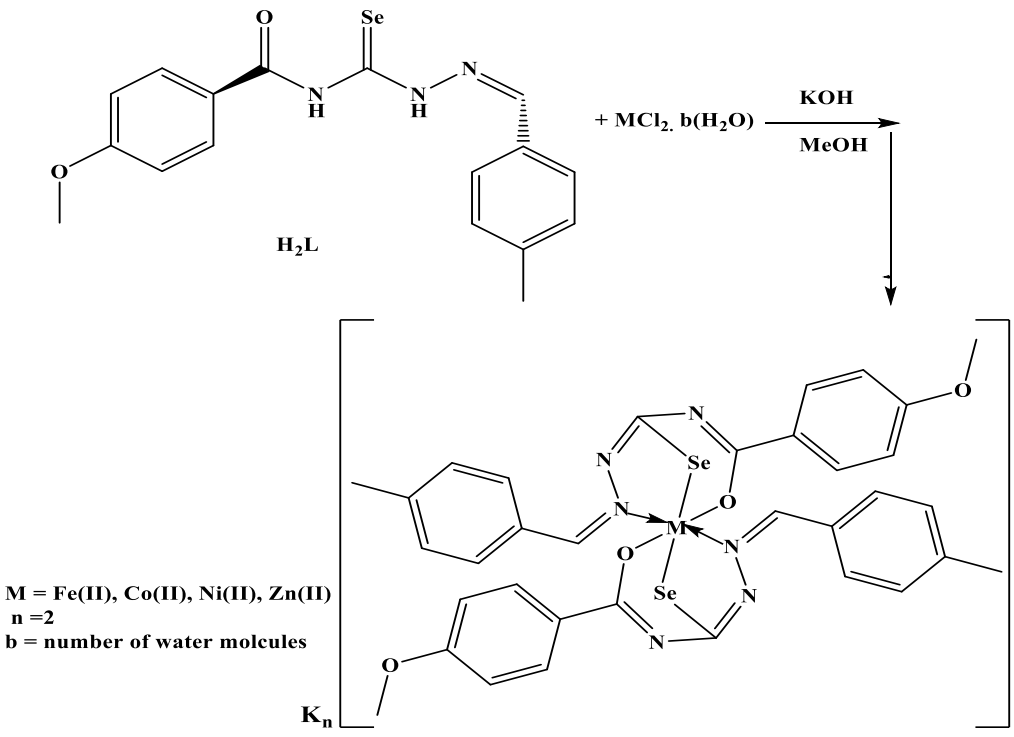
3. NMR Information.

$K_2[Zn(L)_2]$'s ^{1}HNMR spectrum (400 MHz in DMSO-d6) showed indicates at δ_H; 8.34 (2H, d, J_{HH}= 8 Hz $C_{3,\,3'}$-*H*), 8.15 (2H, d, J_{HH}= 8 Hz $C_{9,\,9'}$-*H*), 7.59 (4H, d, J_{HH}= 8 Hz $C_{2,\,2'}$,$_{10,\,10'}$-*H*), 4.30 (3H, s) (CH_3O), 3.16 (1H, s, C_7-*H*), 1.28 (3H, s, C12-*H*) ppm.

Peaks were seen in the $K_2[Zn(L)_2]$ (100MHz in DMSO-d6) ^{13}CNMR spectra with C;171.20ppm owing to the (C=O) group and 160.64ppm connected to the (C=Se) group. As well as, 147.92 (C=N), 137.09 (C1), 131.99 (C11), 128.55 (C8), 126.72 ($C_{10, 10`}$), 121.71 ($C_{9, 9`}$), 118.67 (C4), 115.75 ($C_{3, 3`}$), 112.94 ($C_{2, 2`}$), 55.70 (C13) (OCH_3), 22.81 (C12) ppm. $K_2[Zn(L)_2]$ (76MHz in DMSO-d6) ^{77}SeNMR spectrum indicates signal at Se; 377.46ppm (C-Se) group.



Scheme1: Synthesis route of ligand H_2L.



Scheme2: Synthesis route and suggested structures of H_2L complexes.

4. Result and discussion

H2L that is air stable may be dissolved in DMF, DMSO, and CHCl3, with the exception of other popular organic solvents. On the basis of their spectroscopic and analytical results, they

predicted the likely spatial configurations of compounds. H2L mononucleating complexes have a conductivity in DMSO ranging from 35.13 to 59.11 cm2/mol, which indicates a 2:1 electrolytic characteristic. [9].

4.1 FTIR Spectra

The H2L FTIR spectra revealed many distinct functional group bands at 3351, 3313, 1672, 1633, and 1281cm-1. These bands were identified as belonging to ν(N2-H), (N1-H), (C=O), imine of C=N, and selenone of C=Se, in that order. [10–12]. The spectra did not exhibit any lines at 2420cm-1 that may be associated with ν(Se-H), indicating that the ligand was also present in its selenone form. [12].

Table 1 displays the names of the most noticeable FTIR bands for H2L and its compounds. Due to complexation, bands of ligand with appropriate shifts were seen in the FT-IR spectra of H2L and its complexes. The carbonyl C=O and the imine group's ν(C=N), which were discovered in free ligand at wavenumbers of 1672 and 1633cm-1, respectively, were moved to wavenumbers.

A similar shift to a smaller wavenumber happens when the metal electron density delocalizes into the system of ligands. Such shifting facilitated the coordination of nitrogen and oxygen toward metal ions by revealing the nature of the strong interaction between the imine and carbonyl groups and metal ions [12,13]. While the free ligand H2L was detected at 782 cm-1, the ν(C-Se) groups found 721–739 cm-1 in both complexes [11]. It is evident from the complexes' spectra that the ligand underwent deprotonation during complexation since the (N2-H) and (N1-H) bands are absent at 3351 and 3313 cm-1. [13, 14]. The complexes' spectra showed that the formation of (N=C-Se) and (N=C-O), respectively, was associated with absorption bands at (1608-1614) and (1645-1652)cm-1. In the FTIR spectra of the complexes, those lines at 510-525, 410-445, and 320-342 cm-1 were attributed to Metal-O, Metal-N, and Metal-Se, respectively [15,16]. To (M-Cl), bands no round 255-274cm^{-1} are attributed [16].

Table1: FTIR frequency values in (cm^{-1}) of compounds.

Compounds	**ν(N2-H)**	**ν(N1-H)**	**ν(C-H)** aliphatic	**N-C=O N=C-O**	**N-C=Se N=C-Se**	**H-C=N**	**C=C**	**C-Se**	**M-O**	**M-N**	**M-Se**
H_2L	3351	3313	2994	1672	1589	1633	1579	1281 782	–	–	–
$K_2[Fe(L)_2]$	_	–	3005	1650	_ 1608	1630	1570	1240 739	510	410 431	320
$K_2[Co(L)_2]$	_	–	3007	1645	_ 1612	1626	1575	1234 721	521	421 441	329
$K_2[Ni(L)_2]$	_	–	3010	1652	_ 1614	1627	1574	1249 735	525	420 445	342
$K_2[Zn(L)_2]$	_	–	3009	1651	1610	1629	1571	1249 735	514	415 444	340

4.2 NMR Spectra

The 1HNMR spectra of the se-ligand (H2L), which were obtained using DMSO-d6 as the solvent, show the carbonyl and selenone forms of the ligand (Figure 1a). The spectra revealed peaks at H= 9.01 and 4.55 ppm (1H, br), corresponding to one proton each for the groups (N1-H) and (N2-H). At 8.21 ppm, protons at (C3, 3'-H) were linked to the doublet signal. The peak at 7.95 ppm, or two protons, are attributed to (C9, 9'-H) protons. Peaks at 7.48, 4.22, 2.98, and 1.69 ppm,

respectively, indicate proton resonance and are ascribed to protons at (C2, 2', 10'-H), (CH3O), (C7-H), and (C12-H) ppm.

Figure 2a shows the ^{13}CNMR spectra of H_2L in DMSO-d^6 solvent, which exhibits peaks at C= 176.29 and 169.86 ppm, respectively, attributed to (C=O) and selenone of the C=Se group [15, 17]. The signal at 196.74ppm in the ^{77}SeNMR spectra of H_2L in DMSO-d^6 solvent is attributed to selenone of the C=Se group [15], (See Figure 3a).

There were no peaks at 9.00 ppm or 4.00 ppm that might be attributed to the (N1-H) or (N2-H), respectively., were seen in the complex of $K_2[Zn(L)_2]$ in DMSO-d^6's ^{1}HNMR spectrum, suggesting that the complex formed when the N-H group was deprotonated [15,17]. The doublet of peaks at 8.34 and 8.15 ppm is correlated with the two protons of the complex, which have been identified as the aromatic protons (C3, 3'-H) and (C9, 9'-H), respectively. In contrast to the upfield chemical shift observed in the free ligand H2L, these protons appeared to be looking downfield due to the stiffness that evolved during the complex's formation., (see Figure 1b).

The dissolved K2[Zn(L)2] complex 13CNMR spectra of the DMSO-d6-solvent assigns peaks to the (C-O) and (C-Se) moieties at 171.20 and 160.64 ppm, respectively (see Figure 2b). Which C-O and C-Se groups are involved in the coordination may be determined by comparing the upfield shift of the complexations with the free ligand. As a result of the metal center's ability to de-localize electron density to the ligand-system, C-O and C-Se exhibit less order of bond and more selenide character than C-Se (especially the selenium d-system). An imine-related signal first appeared at 147.92 ppm, and it did so with more chemical shifting than the unbound ligand. This is due to the fact that complexation is imine group dependent. The (C-Se) group is represented by a signal at 377.46 ppm in the ^{77}SeNMR spectra of $K_2[Zn(L)_2]$ in DMSO-d^6 solvent. When compared to a free ligand, the chemical shift of the signals indicated a complex's formation and selenide-like types of ligand coordination to the metal's core. [15,17]. (See Figure 3b).

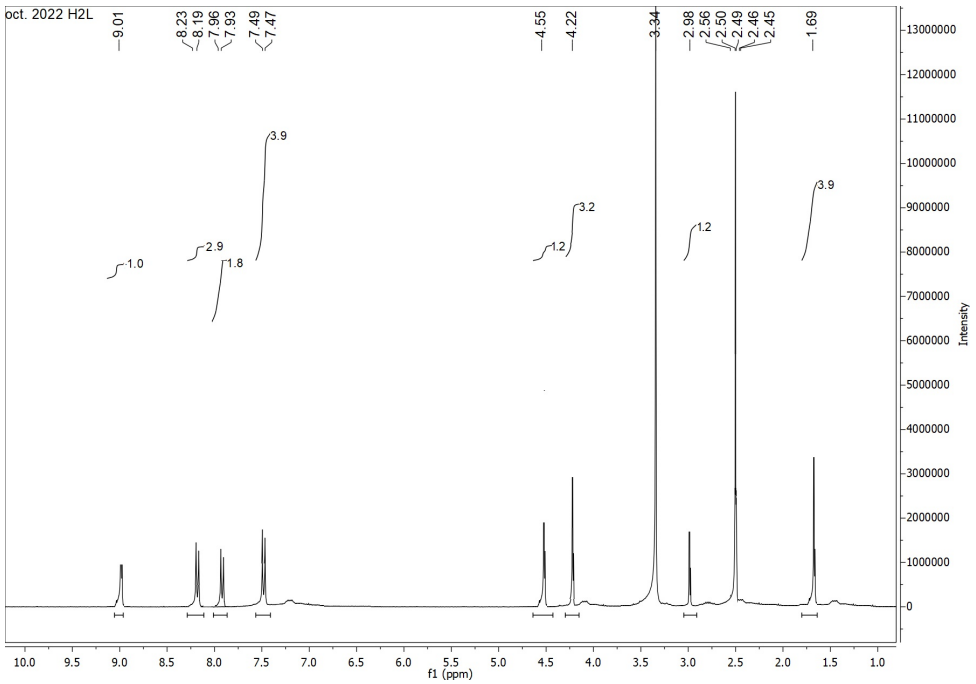


Figure (1a): ^{1}HNMR spectrum of H_2L.

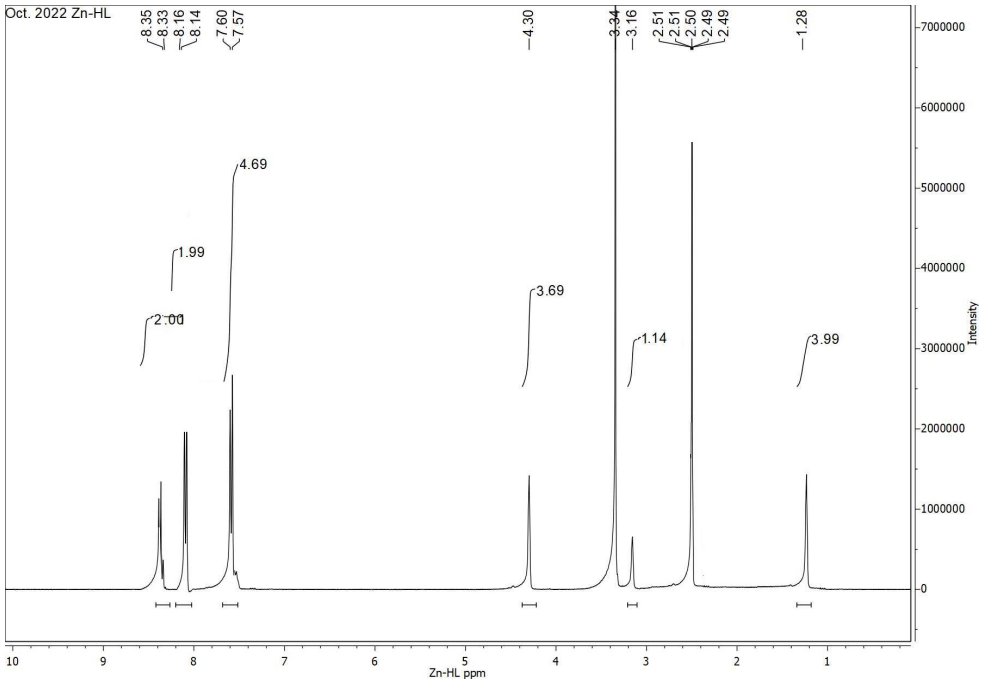


Figure (1b): ^{1}HNMR spectrum of Zn-Complex.

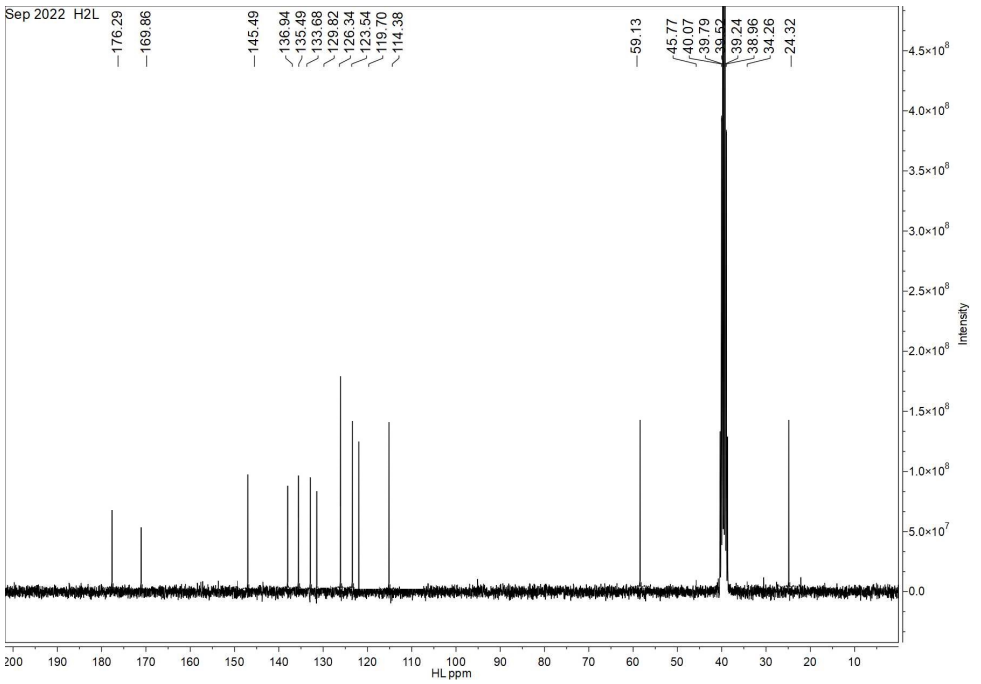


Figure (2a): ^{13}CNMR spectra for H_2L.

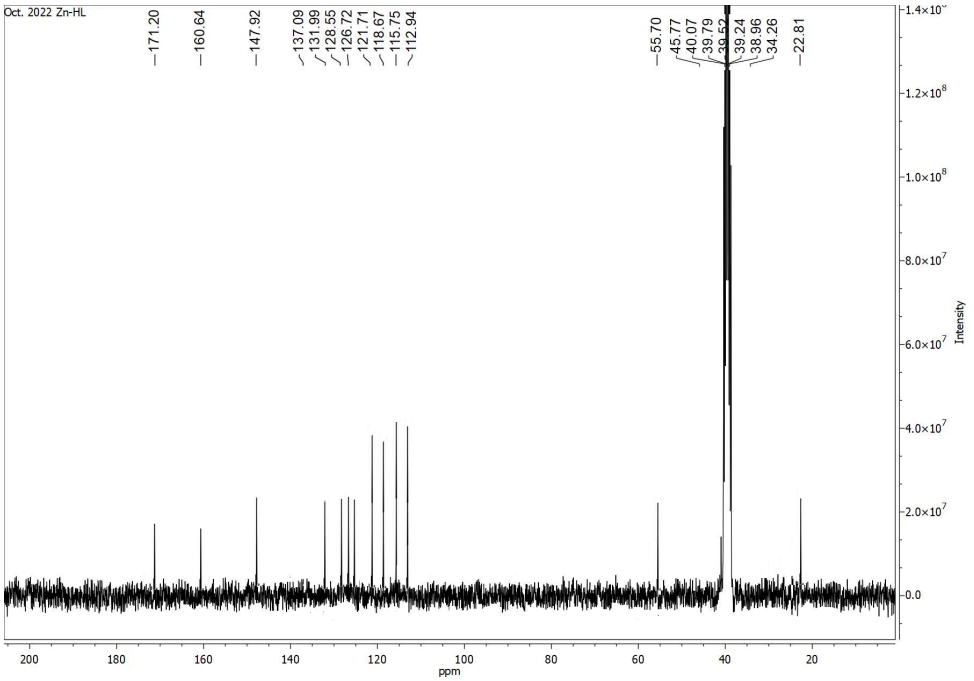


Figure (2b): ^{13}CNMR spectra for $K_2[Zn(L)_2]$.

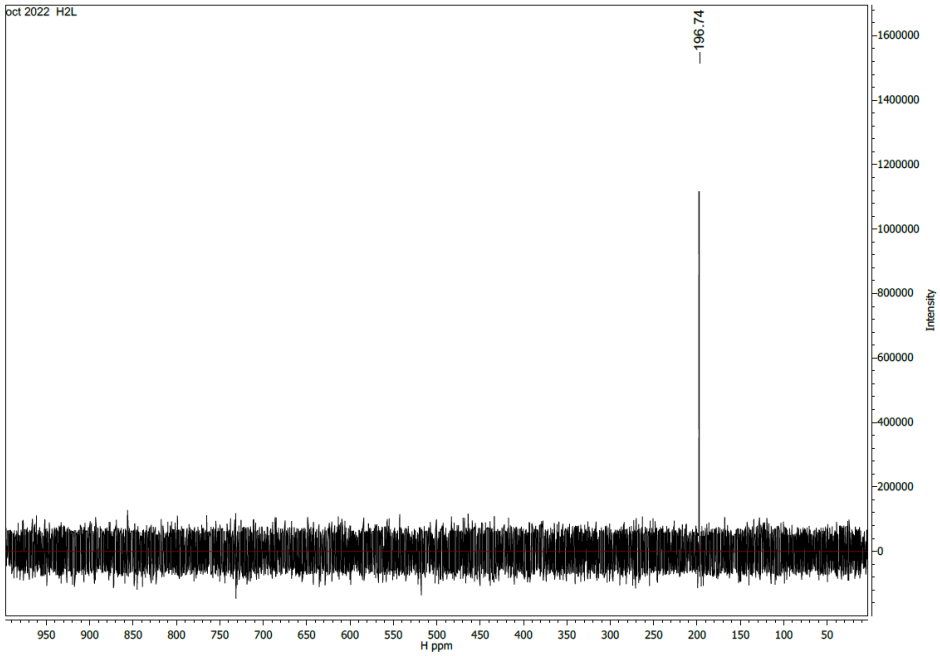


Figure (3a): ^{77}SeNMR spectra of H_2L.

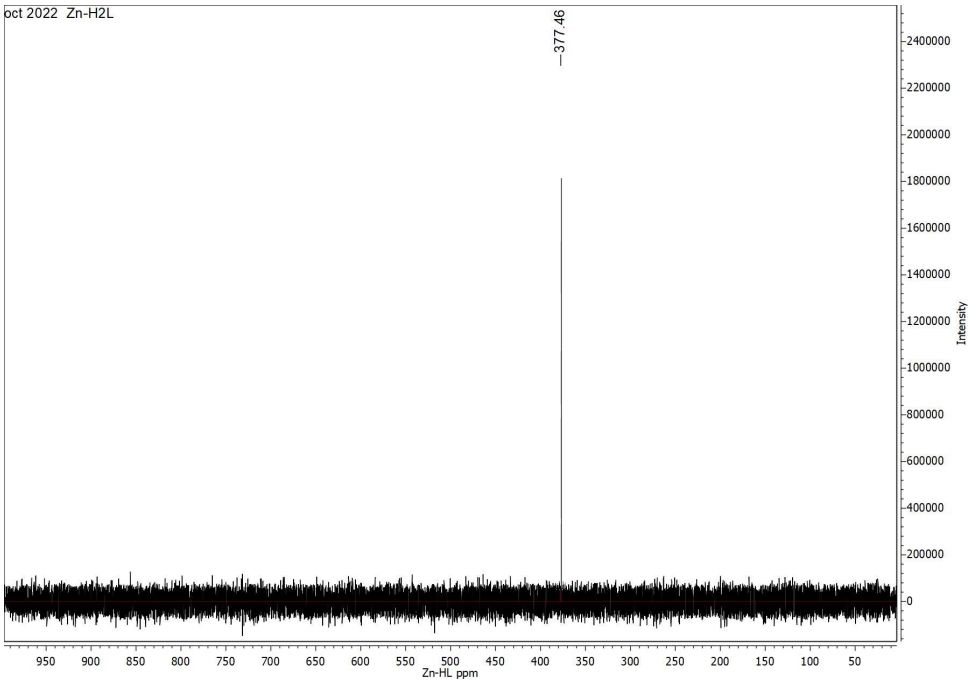


Figure (3b): ^{77}SeNMR spectra of $K_2[Zn(L)_2]$.

4.3 Mass Spectra

H_2L's positive ESM spectra showed a peak with m/z= 375.3 $[(M+H)]^+$ (23%) for $C_{17}H_{17}N_3O_2Se$, requires= 374.3 Peaks found at m/z=330.6 (50%), 262.8 (100%), 167.5 (38%) and 118.3 (74%) correlate to $[M+H-(CH_5N_2)]^+$, $[(M+H)-\{(CH_5N_2)+(C_5H_8)\}]^+$, $[(M+H)-\{(CH_5N_2)+(C_5H_8)+(CH_4Se)\}]^+$ and $[(M+H)-\{(CH_5N_2)+(C_5H_8)+(CH_4Se)+(CH_5O_2)\}]^+$ respectively, (see Figure 4a).

Peak in the mass spectrum of the $K_2[Fe(L)_2]$ electrospray, atm/z= 878.6 $[M]^+$ (19%) for $C_{34}H_{30}FeN_6O_4Se_2K_2$ requires= 878.6amu. Peaks noticed at m/z= 684.3 (21%), 624.2 (100%), 158.4 (71%) and 104.1 (63%) related to $[M-(C_6H_6+C_9H_8)]^+$, $[M-(C_6H_6+C_9H_8)+(CH_4N_2O)]^+$, $[M-(C_6H_6+C_9H_8)+(CH_4N_2O)+(C_7H_4+C_6H_6+2SeH_2+2K+N_2+O_2)]^+$ and $[M-(C_6H_6+C_9H_8)+(CH_4N_2O)+(C_7H_4+C_6H_6+2SeH_2+2K+N_2+O_2)+(C_4H_6)]^+$ respectively, (see Figure 4b).

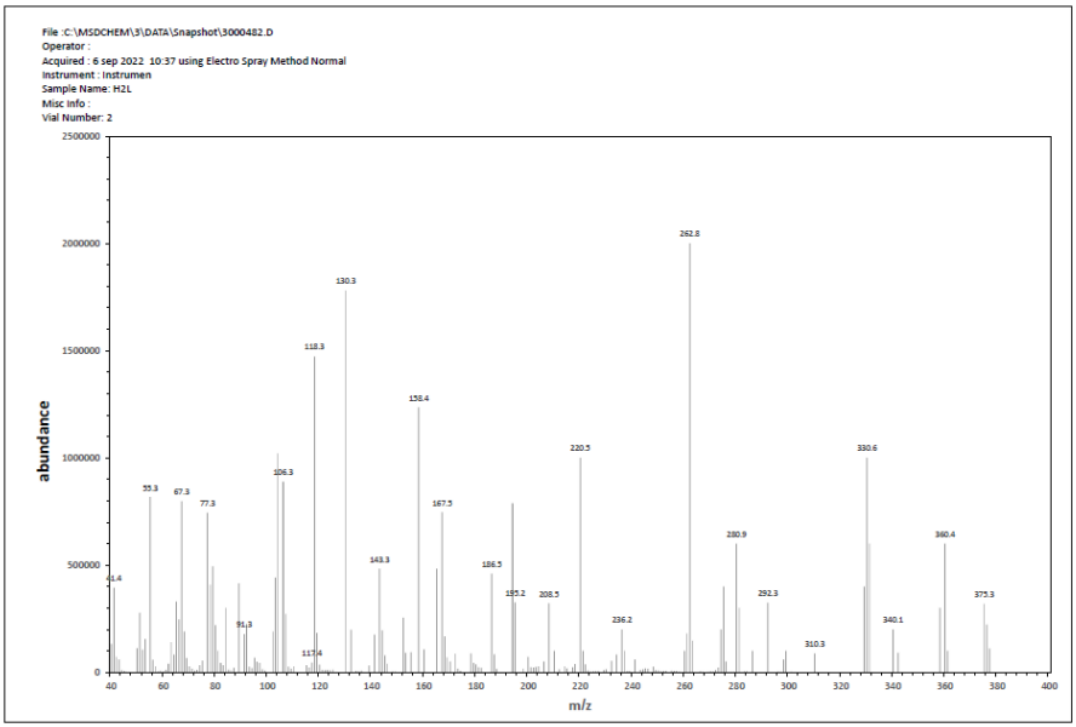


Figure (4a): The ESMS spectrum for H_2L.

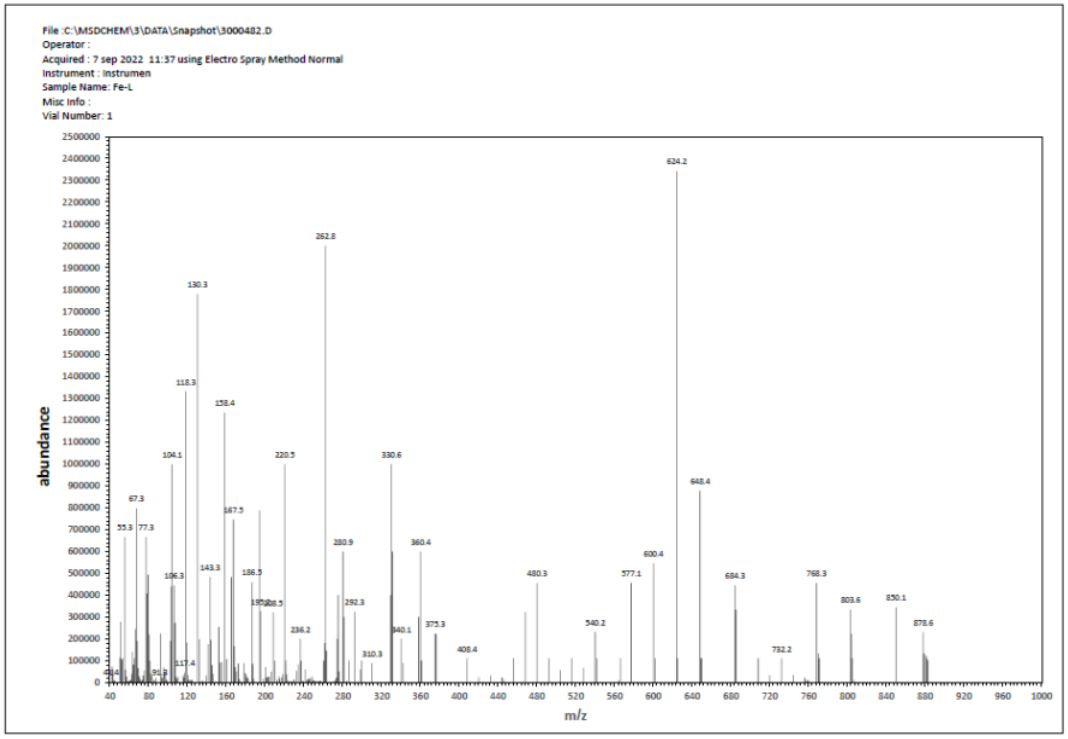


Figure (4b): The ESMS spectrum for $K_2[Fe(L)_2]$ complex.

4.4 Measurement of the magnetic moment and UV-visible data

Table (2) provides information on the UV-vis spectral properties of H_2L and its complexes. The free ligand H_2L and its complexes both displayed two intra-ligands at 265 and 315nm, due to ($\pi \rightarrow \pi*$, and $n \rightarrow \pi*$); respectively [15].

Electronic spectra for H_2L complexes have shown additional bands in the 279–379 nm range that have been attributed to charge transfer and ($\pi \rightarrow \pi*$, $n \rightarrow \pi*$) [19]. Electronic Iron(II) complex The transition from d to d, types $^4T_1g^{(F)} \rightarrow {}^4T_1g^{(P)}$, causes a peak in the d-d region at 580 nm [19–21]. It was found that the Fe atom has a distorted octahedral geometry [22]. Iron(II) complex was finished in accordance with the designated geometry. Additionally, a distorted octahedral structure surrounding the Iron atom was indicated by the magnetic moment value. [23]. The Cobalt(II) complex recorded peaks at 588 and 754nm due to $^4T_1g^{(F)} \rightarrow {}^4A_2g^{(F)}$ and $^4T_1g^{(F)} \rightarrow {}^4T_1g^{(P)}$, respectively. With deformed octahedral geometries around the cobalt atom, this spectrum is typical of the Cobalt(II) complex. 650 and 815nm were the highest wavelengths for the Nickel(II) complex, correlated to $^3A_2g \rightarrow {}^3T_2g^{(F)}$ and $^3A_2g \rightarrow {}^3T_1g^{(F)}$ transitions, each of which denotes a warped octahedral geometry around the Ni atom. Additionally, a distorted octahedral arrangement was indicated by the magnetic moment value surrounding the Cobalt and Nickel atoms.

The Zinc(II) complex's spectra revealed peaks that were attributed to the charge transfer and ligand field [24]. For the Zinc(II) centers, tetrahedral form of the structure was expected [25].

Table2: Magnetic moments and UVvis spectral data in the solutions of the DMSO.

Compounds	**μeff (BM)**	**λnm**	**ε_{max} $dm^3\ mol^{-1}\ cm^{-1}$**	**Assignment**
H_2L	-	265 315	756 1432	π → π* n→ π*
$K_2[Fe(L)_2]$	4.89	291 371 580	2111 1444 55	π→π* n→π* $^4T_1g^{(F)} \rightarrow {}^4T_1g^{(P)}$
$K_2[Co(L)_2]$	3.79	288 345 588 754	1211 1289 49 34	π→π* n→π* $^4T_1g^{(F)} \rightarrow {}^4A_2g^{(F)}$ $^4T_1g^{(F)} \rightarrow {}^4T_1g^{(P)}$
$K_2[Ni(L)_2]$	2.57	280 340 650 815	644 732 66 34	π→π* n→π* $^3A_2g \rightarrow {}^3T_2g^{(F)}$ $^3A_2g \rightarrow {}^3T_1g^{(F)}$
$K_2[Zn(L)_2]$	Diamagnetic	279 329 379	944 991 1320	π→π* n→π* C.T.

4.5 Thermal Analyses

The H2L ligand and its metal complexes were subjected to TGA and DSC studies, Table (3). Reaching 600°C from room temperature,

The H2O and its metal complexes stabilized in argon atmosphere, as well as their TGA curves. H2L's thermal research showed that the ligand is stable at temperatures as high as 100.3oC. There are peaks at 111.4, 130.3, 255.1, and 430.3°C in the DSC curves. The temperature varied from 100.3 to

250.7 degrees Celsius at its maximum point. a lack of (C6H6) fragments that was caused by (calc.= 4.0220mg, 20.8%; obs.= 4.3680mg).

Following the loss of the (N2H4+C6H6+H2Se) fragment (10.6960 mg; computed as 10.6990 mg), 50.93% was determined at 311.4ºC in the second step.

Up to around 95.2oC, the K2[Co(L)2] complex thermal degradation data appeared steady. Exo- and endo-thermic phase maxima were discovered by the DSC research at 180.1, 241.9, and 433.8 oC. The TGA curve for the first step, which was seen at about 95.2-209.4oC, demonstrated the removal of (N2H2+C3H6) fragments, with objectives of 1.7888 mg and calculations of 1.7988 mg, or 8.94%. Point identified at 422.3ºC due to lack of (H2Se+C6H6+ C7H8O) (calc.= 6.5400mg, 32.67%; obs.= 6.5342mg).

The Ni(I) metal complex remains stable at 102.2oC. The DSC study's peak temperatures of 201.6, 235.4, 350.6, and 499.1oC were used to indicate exo- and endo-thermic temperatures for temperatures above sea level. Circular peaks 102.2–173.8ºC, as shown by TGA analysis, indicated the elimination of (N2+C6H6+H2Se) molecules (obs.= 4.8783mg; calc.= 4.8790mg, 23.23%). The loss of (C6H6+2H2Se+H2) (obs.= 6.3130mg; calc.= 6.3140mg, 30.06%) led to the peak's recognition at 307.3oC.

Table (3): TGA and DSC analyses of ligand and its complexes.

Compound	Stable up to ˚C	Stage	Decomposition temperature initial-final ˚C	Nature of transformation/intermediate formed% mass found (calc.)	Nature of DSC peak and temp. ˚C	DTG peak temp. ˚C
H_2L	100.3	1	100.3-250.7	4.3680 (4.0220)	111.4 Exo 130.3 Exo 255.1Endo	179.4 290.4
		2	311.4-445.3	10.6960 (10.6990)	430.3 Exo	366.2
$K_2[Co(L)_2]$	95.2	1	95.2-209.4	1.7888 (1.7988)	180.1Exo 241.9Endo	193.9 276.8
		2	422.3-495.2	6.5342 (6.5400)	433.8 Endo	441.2
$K_2[Ni(L)_2]$	102.2	1	102.2-173.8	4.8783 (4.8790)	201.6Exo 235.4Exo	194.5
		2	307.3-433.5	6.3130 (6.3140)	350.6Exo 499.1 Endo	275.7 475.3

4.6 Biological Activity

The Mueller Hinton medium of agar method was used to study the bacterial activity of H2L and its metal complexes against four different types of bacteria: Escherichia coli, Bacillus sabtuius, Staphylococcus aureus, and Klebsiella pneumoniae. [26,27]. The concentration of the sample in the DMSO used in the test is 100 ppm. The plates were kept at 37°C for a full day in an adjacent incubator.

DMSO solution served as a control in a test that revealed no impact on any type of bacterium. The inhibitory zone thickness in millimeters was used to test the models. Acylselenourea complexes that are coordinated with metal ions are reported to exhibit increased bacterial activity compared to the free acylselenourea ligand. It has been shown that metal complexes have bacterial activities that free H2L does not have and are more active than free H2L ligand. Using the free acylselenourea H2L ligand and the disc diffusion approach, Iron(II), Cobalt(II), Nickel(II), and Zinc(II) ions were partitioned against Gram negative E. coli, Bacillus sabtuius, and Klebsiella pneumoniae bacterial strains as well as Gram positive S. aureus bacterial strains.

Ligand had less efficacy against other bacterial activities but shown antibacterial action against Bacillus sabtuius. In general, H2L complexes had greater action against all bacterial species. (See Figure 5).

Overtone's model and the chelation hypothesis both account for the rise in complex activity [28, 29]. The formation of the complex may serve as a supportive complex for the microorganism's cellular membrane to pass through, depending on the chelation process. Chelation reduces the polarity of metal ions, allowing them to swap part of their positive charge with the donor groups. Delocalizing metal charge over the whole chelate system and into the ligand system might accomplish this. That is, the enhanced lipophilic metal chelates system's characteristics facilitate its passage through the lipid layer that lines microorganisms' cell membranes. (See Figure 6).

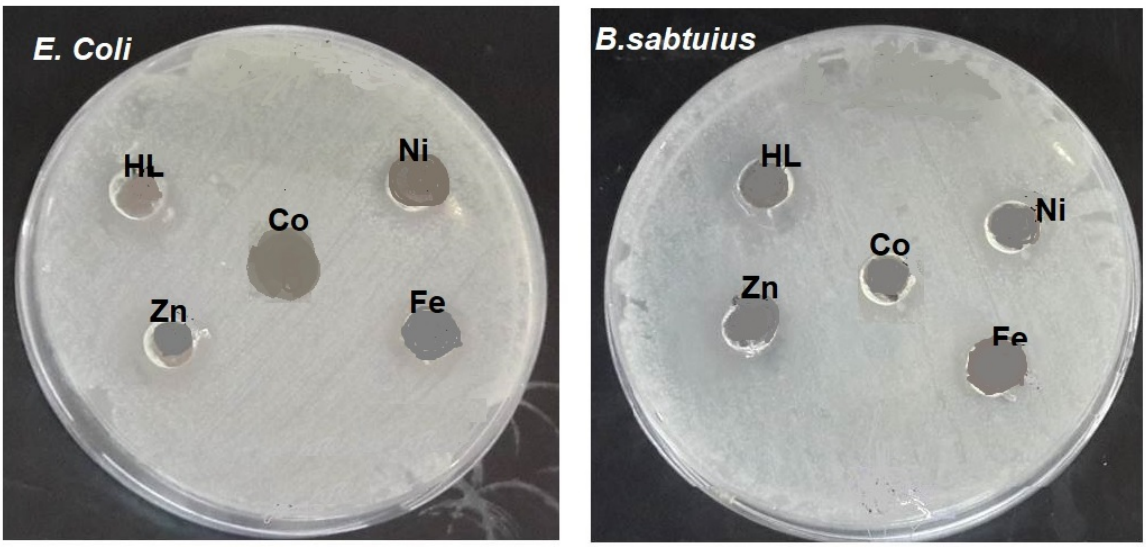


Figure (5): Inhibition diameter of H_2L and also its complexes against *E. coli and Bacillus sabtuius.*

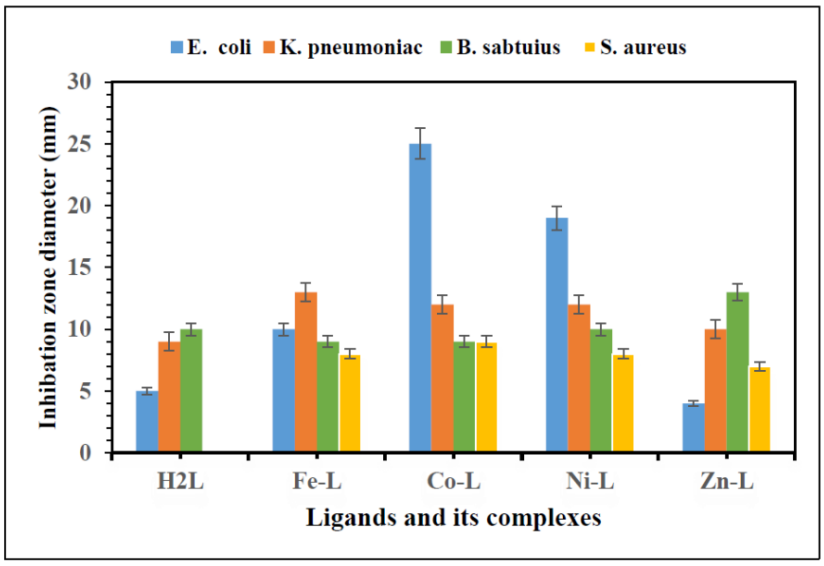


Figure (6): Evolution of diameter zone (mm) of inhibition of H_2L and its complexes against the growth of various microorganisms. Error bars represent SD between repeated tests.

4.7 Fungi activity

The ligand H2L and its metal complexes were used to investigate four distinct fungal species (C. albicans, C. glabrata, C. tropicalis, and C. parapsilsis). All tested compounds were subjected to a final DMSO concentration of 100 ppm. Figures 7 and 8 demonstrate how the ligand and its metal complexes inhibit the types of fungi under investigation. From the collected data, the following observations are noted:

Both ligand H2L and its metal complexes have demonstrated efficacy against Candida glabrata.

With the exception of the Co(II)-complex, ligand H2L demonstrated action whereas its metal complexes had no effect against Candida parapsilsis.

In contrast to ligands, complexes exhibited greater action against Candida albicans.

When it came to fighting Candida tropicalis, complexes Co(II), Ni(II), and Zn(II) were more active than the Fe(II) complex.

Complexes were often more resistant to fungi than free ligands, indicating that complexation enhanced ligand resistance. This can be explained by the redistribution of the title ligand's -electrons across the chelate ring, as per chelation theory [30]. This makes the polarity of the chelation system less polar, which increases the ligand's activity. The complex will therefore be able to cross the lipid layer of fungal cell membranes thanks to the lipophilic characteristic of the chelate system..

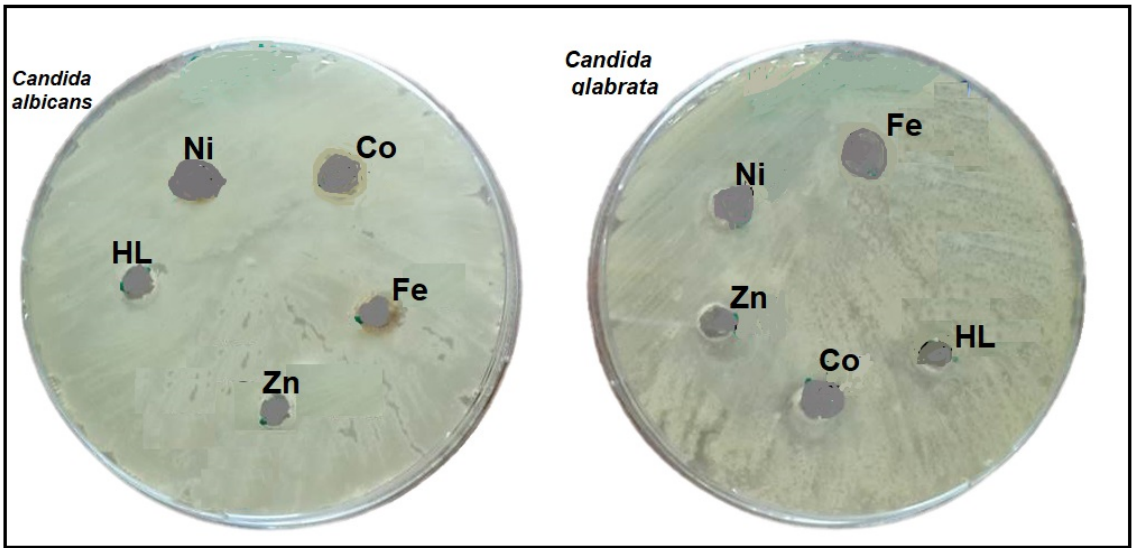


Figure (7): Inhibition diameter of H_2L and also its complexes against *Candide albicans and Candida glabrata*.

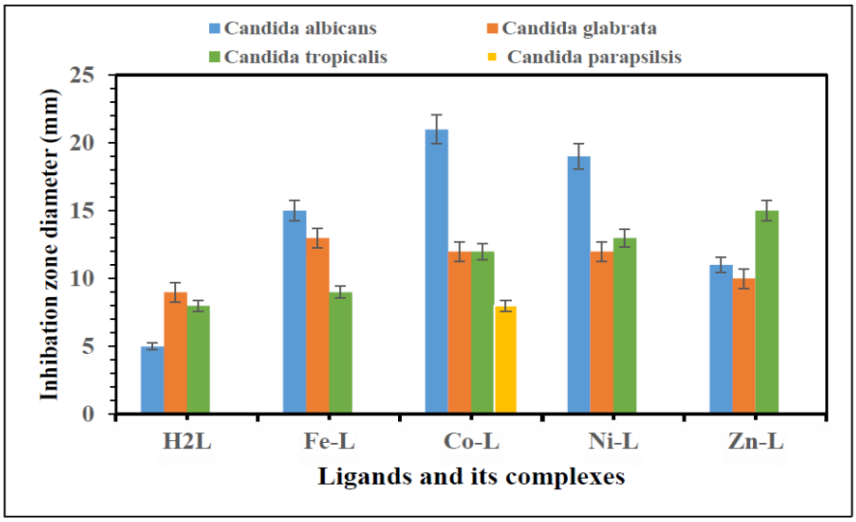


Figure (8): Evolution of diameter zone (mm) of inhibition of H_2L and its complexes against the growth of various Fungi. Error bars represent SD between repeated tests.

5. Conclusions

Known as "M" in total, the coordination metal complexes of Iron, Cobalt, Nickel, and Zinc are produced and characterized along with a new acylselenourea of Shiff-base ligand. H2L was created by combining the precursor with 4-methylbenzaldehyde. During complexation, the main ligand functioned as a di basic species, coordinated to the metal's center by the atoms of nitrogen, oxygen, and selenium. Using a range of physicochemical studies, including thermal properties, the H2L and its metal complexes have been fully discovered. Spectroscopic and analytical investigations revealed that the reaction of H2L with Iron(II), Cobalt(II), Nickel(II), and Zinc(II) metal ions resulted in the formation of six coordinate complexes. Numerous bacterial species as well as four distinct types of fungi have been researched for the biological effects of the compounds listed in the title. Acylselenourea complexes have been demonstrated to exhibit higher levels of antibacterial activity in comparison to free ligand.

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Novel Acylselenourea Ligand and its Complexes; Synthesis, Structure, and Characterization; Antibacterial Activity and Thermal Analysis

Talib H. Mawat[1], Nabil I. Abbas[2], Sami S. Al-shamary[2], Abdulkareem J. Abuelheni[2]

[1]Department of chemistry, College of science, Al-Nahrain University, Baghdad, Iraq.
[2]Department of anaesthesiology techniques, Al-Hadi University College, Baghdad-10011,Iraq.

ABSTRACT

Three mononuclear metal complexes are used to synthesize the new ligand (E)-N-(2-benzyl-1-carbon.)benz. A novel ligand was produced via the reaction of precursor N-(hydrazinecarbonoselenoyl)benzamide with benzaldehyde, which was created by the combination of potassium selenocyanate, hydrazine hydrate, and acyl chloride. The H2L reaction with Cu(II), Zn(II), and Cd(II) ions necessitated the isolation of new complexes with the general formula K[MLCl], where M = Cu(II), Zn(II), and Cd(II). Effective magnetic moments; mass spectra; molar conductance; TG-DSC; and C, H, and N analysis; FT-IR; UV-Visible; 1H and 13C; and Se-NMR have all been used to study the generated Acylselenourea-compounds Analytical and spectroscopic studies of complexes have shown that geometry of square planers surrounding Cu(II) differs from tetrahedral shape around the ions Cd(II) and Zn(II).

Additionally, it appears that metal complexes may be more resistant to bacteriological action than allowed ligand due to rinsings of the Gram (+) bacteria Staph. aureus. It has been discovered that The H2L ligand and its metal complexes have antibacterial properties against Gram (-) bacterial species, including Bacillus subtilis, Escherichia coli, and Klebsiella pneumoniae.

Keywords: Acyl chloride; Potassium selenocyanate; Acylselenourea; Antibacterial activity; Thermal analysis.

1. Introduction:

In 1817, selenium was discovered. Moreover, a wide range of materials are used as organoselenium [1]. Unlike the far more advanced chemistry of organic molecules including sulfur and oxygen, the chemistry of compounds containing selenium is often similar to that of their corresponding S counterparts [1].

The instability and toxicity of many Se-compounds have hindered the development of Se heterocycle synthesis. Despite the considerable toxicity of many selenium compounds, derivatives of organic selenium were created as anticancer medicines. [1].

The current curiosity with chemical compounds containing selenium stems from their remarkable biological and biosynthetic properties. In the last several decades, aryl and alkyl derivatives have been synthesized, while the existence of isoselenocyanates has long been contested. A significant building block to synthesize linear and cyclic selenoorganic molecules. is acyl isoselenocyanates. [2].

The synthesis of heterocycles based on selenium requires the use of acyl isoselenocyanates as crucial intermediates [3]. Acryl isoselenocyanates were created by an acyl chloride reaction. A series of chemical compounds known as potassium selenocyanate contains selenium, nitrogen, and oxygen as heteroatoms of the imine moiety [3].

Corresponding author:

Talib H. Mawat, Department of chemistry, College of science, Al-Nahrain University, Baghdad, Iraq.
talib.phd.88@gmail.com

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Numerous chemical and biological applications for these molecules have been discovered [4]. They mix "soft" elements like S, Se, or Te with "hard" elements like N and O to create new atoms that can interact with a variety among metal ions. (5). Because they can consistently form metal complexes, organic molecules having groups of oxygen, nitrogen, and selenium on their backbones are useful. Selenium compounds with ligands and complexes are called schiff-bases.. with a range of pharmacological and biological characteristics, such as antibacterial and anticancer effects [6]. These substances can also be used as biological agents and antioxidants with anti-inflammatory, antibacterial, antiviral, and anticancer effects. [7].

With a few notable exceptions, the characteristics of compounds containing selenium are similar to those of their equivalents containing sulfur. For instance, organic Se-compounds are less stable overall than their S counterparts and might be vulnerable to photosensitivity and oxidation in certain situations. They are also highly toxic and often smell bad.
Therefore, new methods for creating organic Se,compounds that start with less dangerous and more stable elements are ideal. These chemicals seem to be aryl isoselenocyanates, which have the potential to be employed in the production of Se, chemical compounds. [8].
Elements can be chelated by compounds containing selenium, forming stable complexes [9]. Selenochemicals are used as reagents in analytical, organic, and biological chemistry. Researchers examined incorporating the selenium atom into both heterocyclic and homocyclic structures in an effort to produce substances with high stability, rapid reactivity, and little toxic. [4]. their importance Because in biological and medicinal applications, additionally to their employment as steps in the synthesis of organic materials, the creation of heterocyclic selenium and its compounds has grown increasingly complex, making it one of the most critical issues in modern chemistry. This study involved the synthesis and structural characterization of N-(2-benz.-1-carbon.)benzamide ligand and metal complexes. The ligand was formed via the reaction of Precursor: benzaldehyde; N-(hydrazinecarbon.)benz. A set of three complexes was produced by The acyl-compound (H2L) interacts alongside its metal complexes, Cu(II), Zn(II), and Cd(II). The generated compounds' antimicrobial activity was also investigated.

2. EXPERIMENTAL

2.1 Chemicals and Method

Without any additional purification, every laboratory chemical utilized in this study was obtained through commerce and consumed. You may find the recipe for making N-(hydrazinecarbonoselenoyl) benzamide in Ref. [10]. This molecule is used as a precursor in the production of ligand.

2.2 Physical Instruments

Using an electric and thermal Stuart equipment (model SMP-30), the melting points were ascertained. FTIR spectra taken using a Within the 410–4000 range is the Perkin-Elmer FT-IR 1725X spectrophotometer. cm-1 series. Series 260–4000cm-1 CsI discs. were evaluated using the KBr method on a Shimadzu FTIR-8400-S spectrometer. Using a Shimadzu UV-visible spectrophotometer, electronic spectrum values 10-3M at normal temperature mixtures in DMSO recorded, ranging from 200 to 1100 nm. Using tetra-methylsilane (TMS) as an internal standard, the spectra of1H and DMSO-d6 solutions containing 13CNMR were obtained with a 400MHz Brucker spectrum analyzer, individually. 77SeNMR spectra in the DMSO-d6 solution were acquired employing a Brucker 400MHz spectrometer using dimethylselenide (Me2Se) as internal standards. ESMS, or electrospray mass spectra, were recorded

using the Agilent LCmssx spectrometer. Elements (H, C, and N) were analyzed using the EuroEA3000. The metals were identified using the (FAA) 680Gatomic absorption spectro-photometer. The Potentiometeric titration technique, which uses a 686Titro (processor-665,Dosimat-Metrohm) Swiss, was utilized to measure the chloride concentration. The magnetic moments of the R.T. were computed and the conductivity tests were performed with D-M-S-O-solutions and a CON510 conductivity meter (Eutech Instruments) Featuring a digital display. An MSB-MK1 balance (Sherwood Scientific DE) was utilized To conduct magnetic experiments at 298 K using Evans' approach. Thermal experiments, including differential scanning calorimetry (DSC) and thermogravimetry (TG), were carried out using the TG-DSC for the SDT Q600 V20.9 Build 20.

2.3 H2L preparation

N-(hydrazine,ecarbono,selenoyl)benzamide compound was created by mixing a 4.mmol solution of acyl chloride with a 2.mmol solution of potassium selenocyanate (0.29gm) in 10ml of dry acetone. The reaction mixture was agitated for twenty minutes at a temperature of twenty-five degrees Celsius. 5 mL of dry acetone and the hydrate of the hydrazine (99.90%, 0.1 ml, 2 mmol) were added to the mixture, which was then stirred for 30 minutes at room temperature. After that, benzaldehyde (4 mmol) in ether was added to the mixture and stirred for two hours at 60 oC. After the chemical was extracted using diethyl ether and cleaned with water, ligand was formed. Consider Scheme (1). Yield: 0.17g (59%), with a melting point of 176–177 °C. The FT-IR data (cm-1) for selenium of C=Se are 3346 ν(N2-H), 3311 ν(N1-H), 3029 ν(C-H) aromatic, 1676 ν(C=O), 1636 ν(C=N)imine, 1580 ν(C=C)aromatic, and 1284 for this compound. 1.58 (1H, t, JHH= 12 Hz C1-H), 7.41 (1H, t, JHH= 8 Hz C13-H), 7.31 (4H, t, JHH= 8 Hz C2, 2',12,12'-H), 9.18 (1H, br, N1-H), and 4.30 (1H) were among the signals at δH in the 1HNMR spectrum of H2L (400MHz in DMSO-d6).

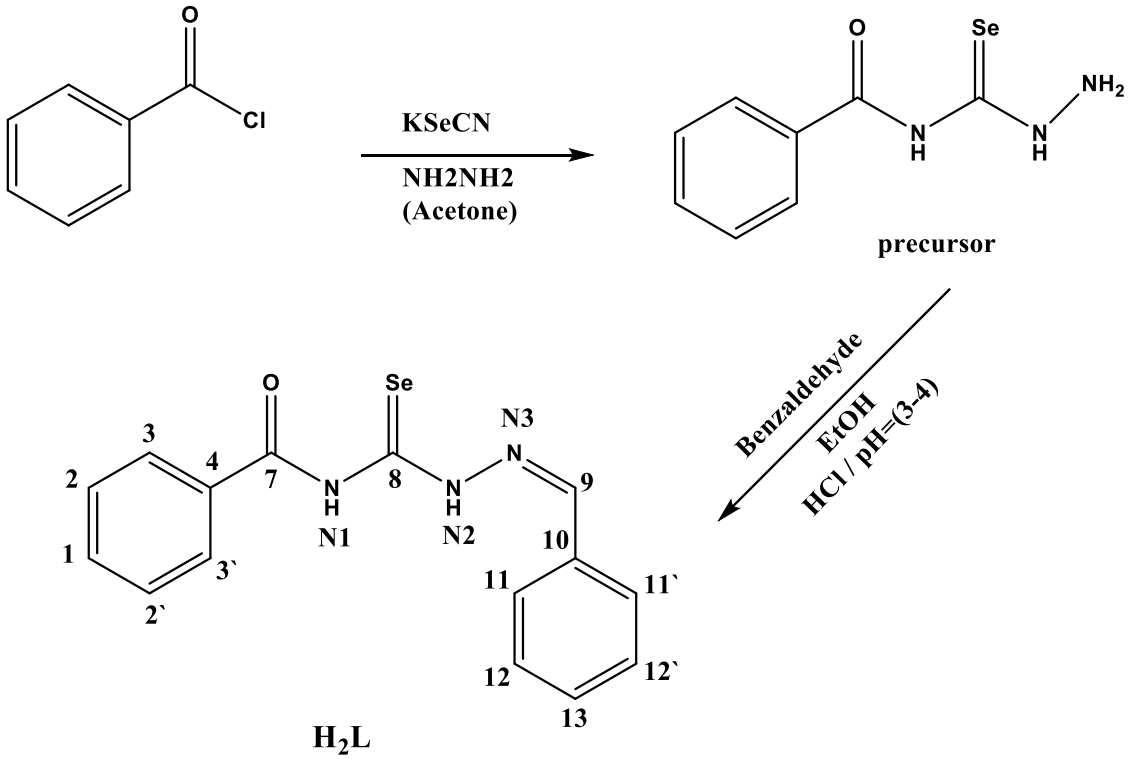
H2L exhibits signals at around δC in its 13CNMR spectrum (100 MHz in DMSO-d6); 178.98 ppm are linked to the (C=O) group, while 170.44 ppm are related to the (C=Se) group. Moreover, 128.21 (C11,11~), 126.69 (C2,2~, 12,12~), 125.49 (C3,3~), 136.40 (C4), 134.76 (C10), 132.40 (C1), and 130.87 (C13) ppm, and 146.23 (C=N) are also included.
A signal at δSe, or 179.27 ppm for the C=Se moiety, is shown in the hydrogen gas's 77SeNMR band (76MHz in DMSO-d6).
For C15H13N3OSe, the ESM(+) bands of H2L showed a peak at m/z= 330.3 [(M+H)]+ (11%) requires= 329.3 Peaks detected at m/z= 305.2 (10%), 221.5 (53%), 131.3 (100%) and 66.3 (10%) correspond to [M+H-(C2H3)]+, [(M+H)-{(C2H2)+(N2+C3NH7)}]+, [(M+H)-{(C2H3)+(N2+C3NH7)+(C7H6)}]+, and [(M+H)-{(C2H3)+(N2+C3NH7)+(C7H6)+(C3H7O+2H2)}], individually.
2.5 Creation of Common Metallic Compounds Using H2L

(1.91 mmol) H2L was dissolved in 10 ml of MEOH in a 1:1 (L:M) mole ratio. The mixture was mixed with a metal chloride (1.91 mmol) solution and 10 ml of methanol. The reaction was conducted using KOH present as a foundation. The response mixture was allowed in order to reflux for two hours before being cooled to room temperature. The chemical precipitate was removed by filtering, washed in cooled 100% EOH, and allowed to air dry, see Structure (2).

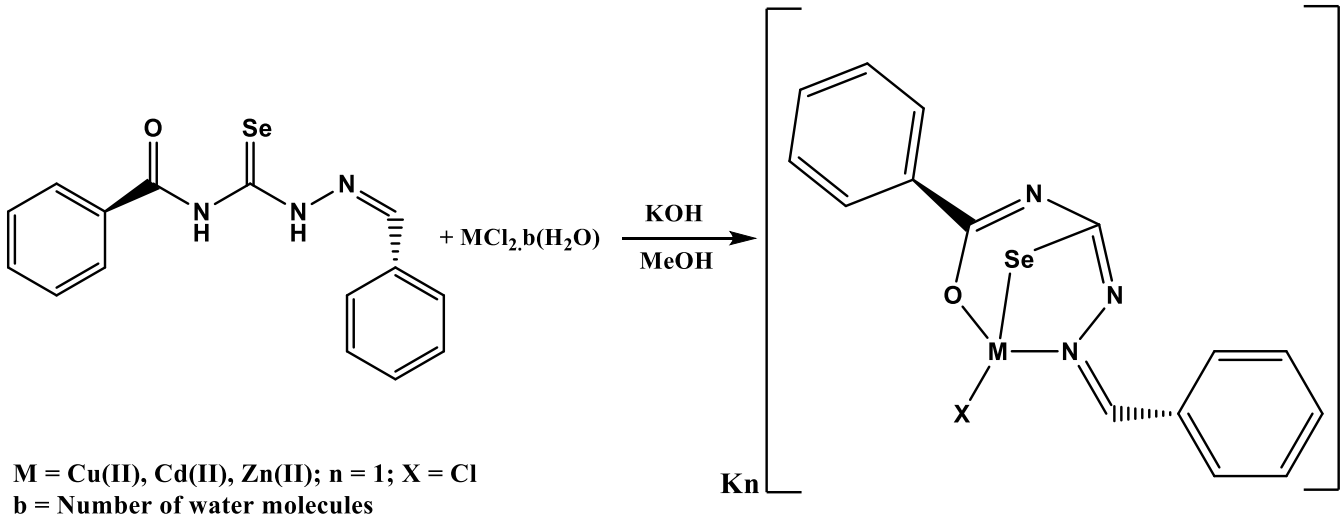
NMR Data:

K[Zn(L)Cl]'s 1HNMR; spectrum (400MHz in DMSO-d6); showed 8.44 (2H, d; JHH= 8 Hz C3, 3}-H), 8.23 (2H, d; JHH= 8 Hz C11, 11}-H), 7.93 (1H, t, C1-H), 7.56 (1H, t, C13-H), 7.37 (4H, t, C2, 2},12,12}-H), 2.31 (1H, s, C9-H); ppm are the signals at *δ*H.

The (C-O) group is responsible for 174.75 ppm of the peaks in the 13CNMR bands of Zn-Complex(100MHz in DMSO-d6), whereas (C-Se) group is linked to 167.15 ppm. 130.56 (C13), 137.06 (C4), 134.75 (C10), 132.91 (C1), 128.21 (C11,11~), 126.84 (C2,2~, 12,12~), and 124.54 (C3,3~) ppm are also included. 150.13 (C=N). Zn-complex (76MHz in DMSO-d6) has a indication at δSe; 254.15 ppm (C-Se) collection in its 77SeNMR band.



Scheme 1: Synthesis route of ligand H_2L.



Scheme 2: Synthesis route and suggested structures of H_2L complexes.

3. Results

Except for other common organic solvents, the air stable form of H2L and its complexes may be solved in DMSO, DMF, and CHCl3. They anticipated the probable spatial arrangements of chemicals based on their spectroscopic and analytical findings. H2L mononucleating complexes in DMSO have a conductivity ranging between 30.13 to 48.16 cm2/Ωmol, demonstrating that they take a 1:1 electrolytic property.. [11].

3.1. FTIR Bands

Several unique functional group bands were found in the H2L FTIR spectrum at 3345, 3310, 1675, 1635, and 1280 cm-1. These bands were assigned to, in that order, ν(C=O), ν(N2-H), ν(N1-H), imine of C=N, and selenone of C=Se [12–14]. The spectrums; did not show any bands at 2400 cm-1 that may be associated with ν(Se-H), suggesting that the ligand was also present in selenone form. [12].

The largest visible bands in the FTIR for H2L and related compounds are listed in Table 1, along with their corresponding names. The hydrogen-containing compounds' FT-IR spectra revealed groups of ligand with the proper shifts as a result of complexation. The ν(C=N) of the imine and carbonyl groups, that were discovered at 1635 and 1675 cm-1, individually, in the free-compound of H2L, were moved in the complexes, to a wavenumber of lower of H2L and seemed to be about 1630–1631 cm-1 for the imine group and 1645–1650 cm-1 for the carbonyl group. The transition to a lower wavenumber coincides with the delocalization of density of metal electrons in the ligand-system. Such shifting proved that oxygen and nitrogen were coordinated. toward metal ions and revealed the nature of the strong bond between metal ions and the groupings of imines and carbonyls [14, 15]. The ν(C-Se) collections observed about 724-736cm-1 in both complexes, while the free ligand H2L was discovered at 772cm-1 [13]. The absence of It is suggested During complexation, the ligand is deprotonated by the (N2-H) and (N1-H) bands in the complex spectra, which are situated at 3345 and 3310 cm-1 in H2L [15,16]. The compounds exhibited absorption peaks at 1645–1650 and 1610–1615 cm-1 in their spectra., which were

linked to the synthesis of (N=C-Se) and (N=C-O), individually. The lines in the FTIR spectra of complexes at 410–441 and 323–340 cm-1 were assigned to Metal-N and Metal-Se, respectively [17,18]. Rings centered at 255-274 cm-1 are assigned to (M-Cl) [18].

Table 1 lists the compounds' FTIR frequency values in centimeters.

Complexes	ν(N2-H)	ν(N1-H)	(N-C=O) (N=C-O)	(N-C=Se) (N=C-Se)	(H-C=N)	C=C	C-Se	M-N	M-Se	M-Cl
ligand	3344	3311	1676	1591	1636	1581	1280 772	–	–	–
Cu-complex		–	1651	1611	1631	1570	1241 739	410 433	323	257
Zn-complex		–	1646	1613	1632	1575	1234 724	422 441	324	255
Cd-complex		–	1648	1616	1631	1572	1249 735	420 419	340	274

3.2 NMR Measurements

The spectra of 1H-N-MR of the selenium solvent DMSO-d6 and ligand (H2L) showed points at δH= 9.18 and 4.30 ppm (1H, br), corresponding up to a single proton assigned to the groups (N1-H) and (N2-H), correspondingly. These peaks suggest that the ligand contains carbonyl and selenium forms (Figure 1a). When the doublet signal appeared, it associated with (C3, 3'-H) photons at 8.01 ppm. A peak at 7.79 ppm is indicative of two protons that are assigned to the (C11, 11'-H) protons. Resonance is shown by peaks at 7.57, 7.41, and 7.30 ppm, correspondingly, which are attributed to protons (C1-H), (C13-H), and (C2, 2',12,12'-H).

The H2L in solvent of DMSO-d6 has a 13CNMR spectrum that peaks at δc= 178.98 and 170.44 ppm, respectively, attributed to the (C=O) and selenone of the C=Se group [17]. Figure 2a shows the 77SeNMR bands of H2L in DMSO-d6 solvent, which contain a indicator at δSe= 179.27ppm, which is attributed to selenone of the C=Se group [17]..

The complex in DMSO-d6's K[Zn(L)Cl] 1HNMR spectra did not show any peaks at 9.00 and 4.00 ppm that could be assigned to the (N1-H) or (N2-H) groups, correspondingly. This suggests that the N-H group was de-protonated during the complex creation process [17]. The two protons in the complex that are represented by the doublet of peaks at 8.45 and 8.24 ppm have been identified as the aromatic protons in the order of (C3, 3'-H) and (C11, 11'-H). Because of the stiffness that developed during the complex's formation, these protons looked to be staring downfield in contrast to the H2L free ligand's upfield chemical shift. (see Figure 1b).

K[Zn(L)Cl] complexes in DMSO-d6 solvent were examined in their 13CNMR spectrum., the (C-O) and (C-Se) moiety are assigned peaks at 174.75 and 167.15 ppm, respectively (see Figure 2b). In contrast with the free ligand, the complexations significantly push C-O and C-Se upfield, identifying the C-O and C-Se collections that are coordinating. Because d-system for selenium, C-O, and C-Se, in particular, may delocalize electron density to the ligand-system, the metal center show more selenide character and less order of bonding than C-Se. Stronger chemical shifting than the free ligand caused a

signal associated with the imine moiety to appear at 150.13 ppm. This is because of the complexation function of the imine group. The (C-Se) group is represented by a signal at 254.15 ppm in the 77SeNMR bands of Zn-complex in DMSO-d6 solvent. When compared to free-compound, Complexity is shown by the chemical shift of signals displayed downfield. development and ligand synchronization with the metal center in selenide systems. [17]. (See Figure 3)

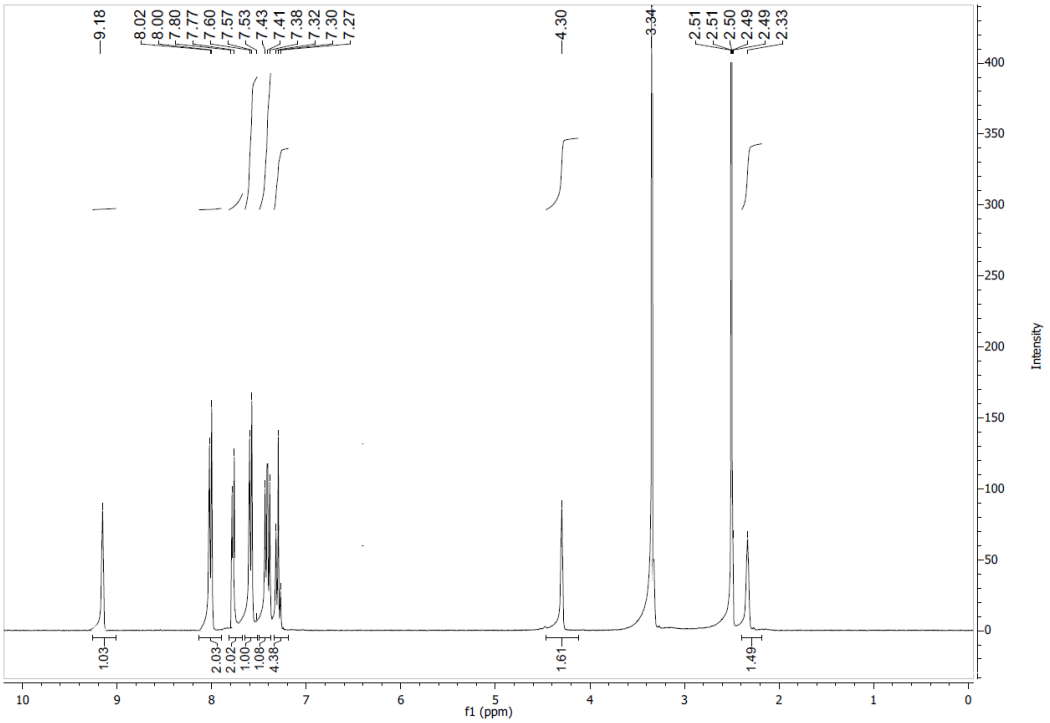


Figure (1a): ^{1}HNMR spectrum of H_2L.

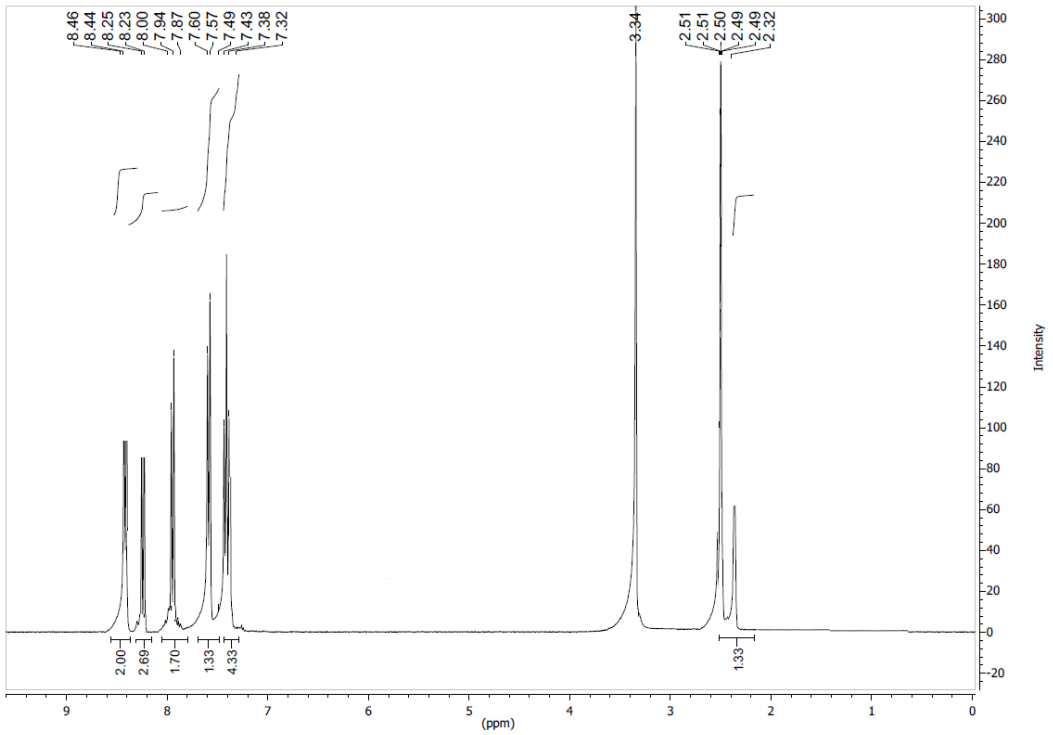


Figure (1b): ^{1}HNMR spectrum of Zn-Complex.

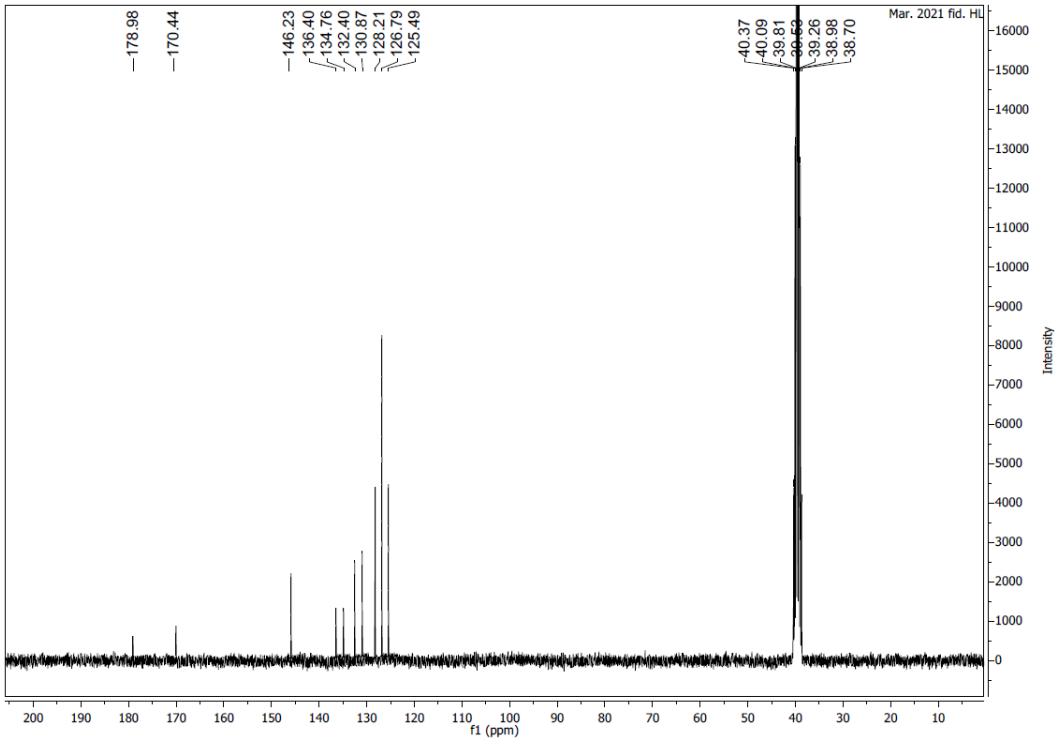


Figure (2a): ^{13}CNMR spectra for H_2L.

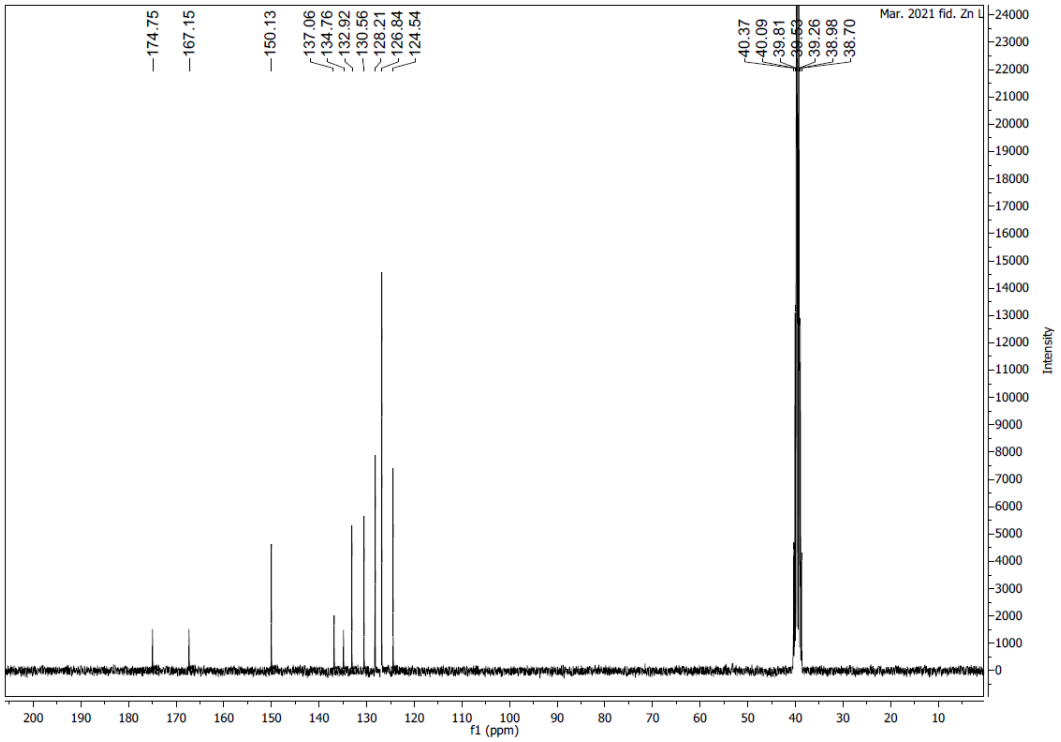


Figure (2b): ^{13}CNMR spectra for K[Zn(L)Cl].

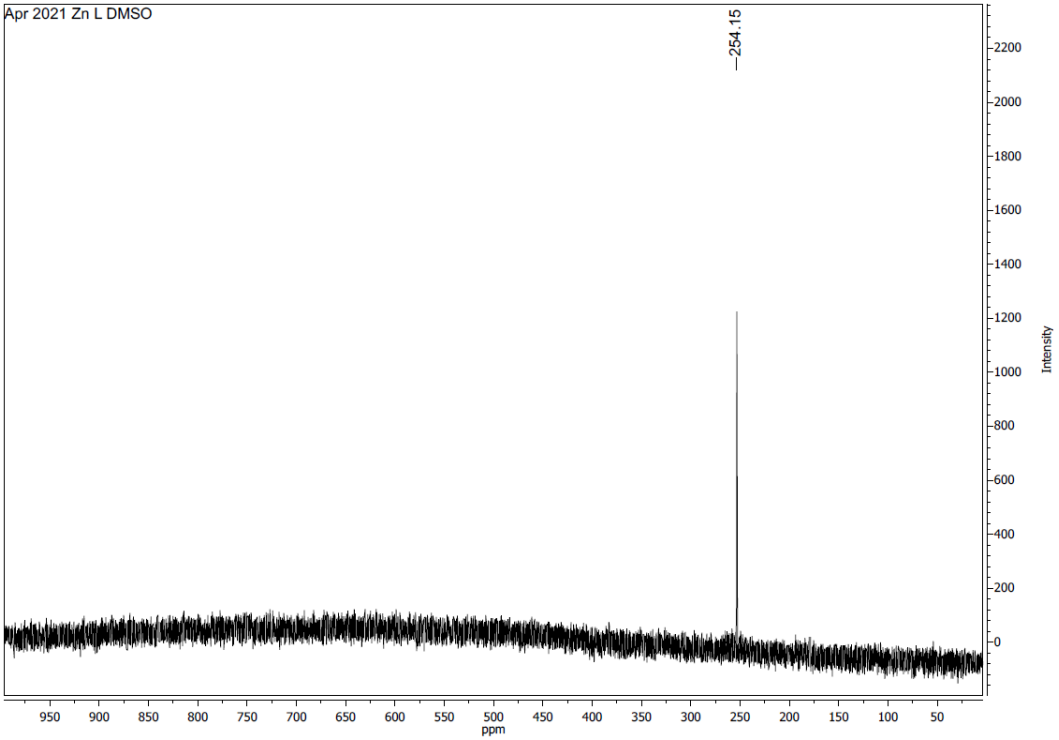


Figure (3): ^{77}SeNMR spectra of K[Zn(L)Cl].

3.3. Mass Spectra

The H2L spectrum's positive ESM showed a peak at m/z= 330.3 [(M+H)]+(11%) to C15H13N3OSe, requiring= 329.3 Peaks detected at m/z= 304.2 (10%), 221.5 (53%), 131.3 (100%) and 67.3 (10%) correspond to [M+H-(C2H3)]+, [(M+H)-{(C2H3)+(N2+C3NH7)}]+, [(M+H)-{(C2H3)+(N2+C3NH7)+(C7H6)}]+, and [(M+H)-{(C2H3)+(N2+C3NH7)+(C7H6)+(C3H7O+2H2}], individually (see Figure 4a).

Peak atm/z= 428.2[(M+H)]+ (23%) for Complex-Se requires= 428.2amu is seen in the Cu-complex electrospray (+) mass band. The following peak positions were seen at m/z= 371.1 (21%), 306.2 (95%), 131.3 (100%) and 56.3 (20%): they correspond to [(M+H)-(C4H11)]+, [(M+H)-{(C4H10)+(N2H4+C2H5+2H2)}]+, [(M+H)-{(C4H11)+(N2H4+C2H5+2H2)+(CO+C3H7N+CSe)}]+, [(M+H)-{(C4H11)+(C3H2N2)+(CO+C3H7N+CSe) +(C3H3Cl)}]+, individually (see Figure 4b).

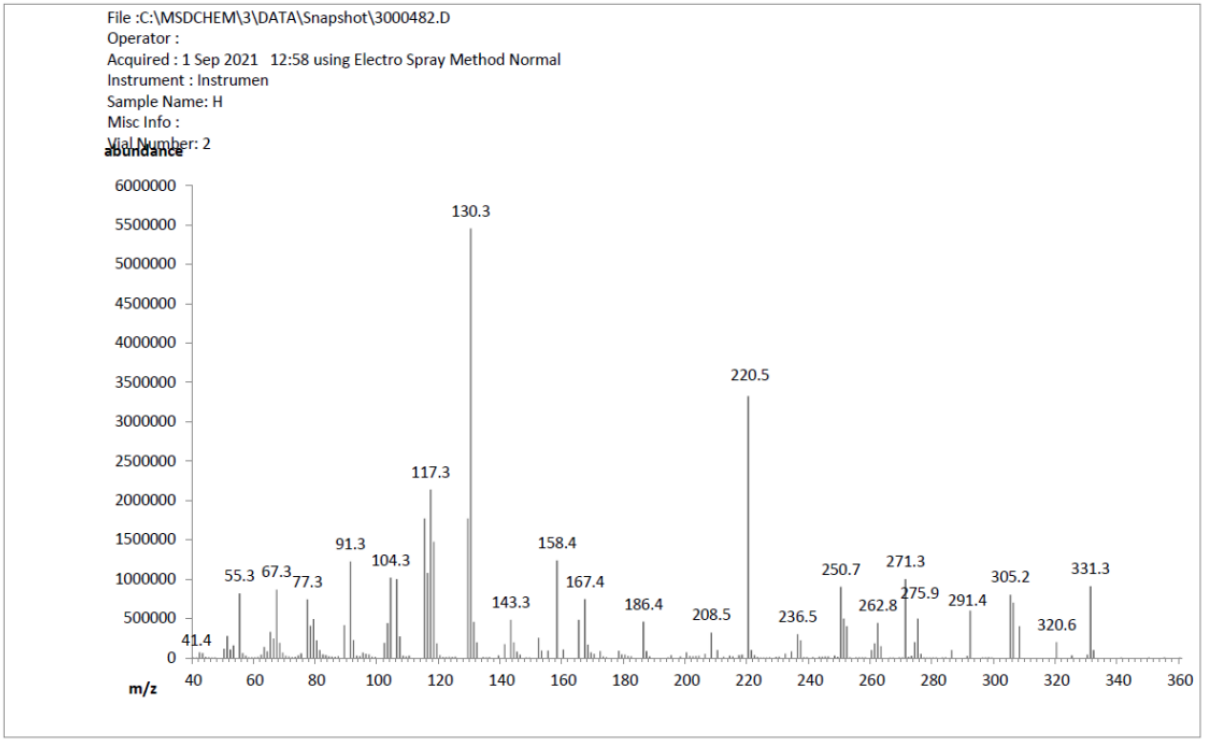


Figure (4a): The ESMS spectrum for H_2L.

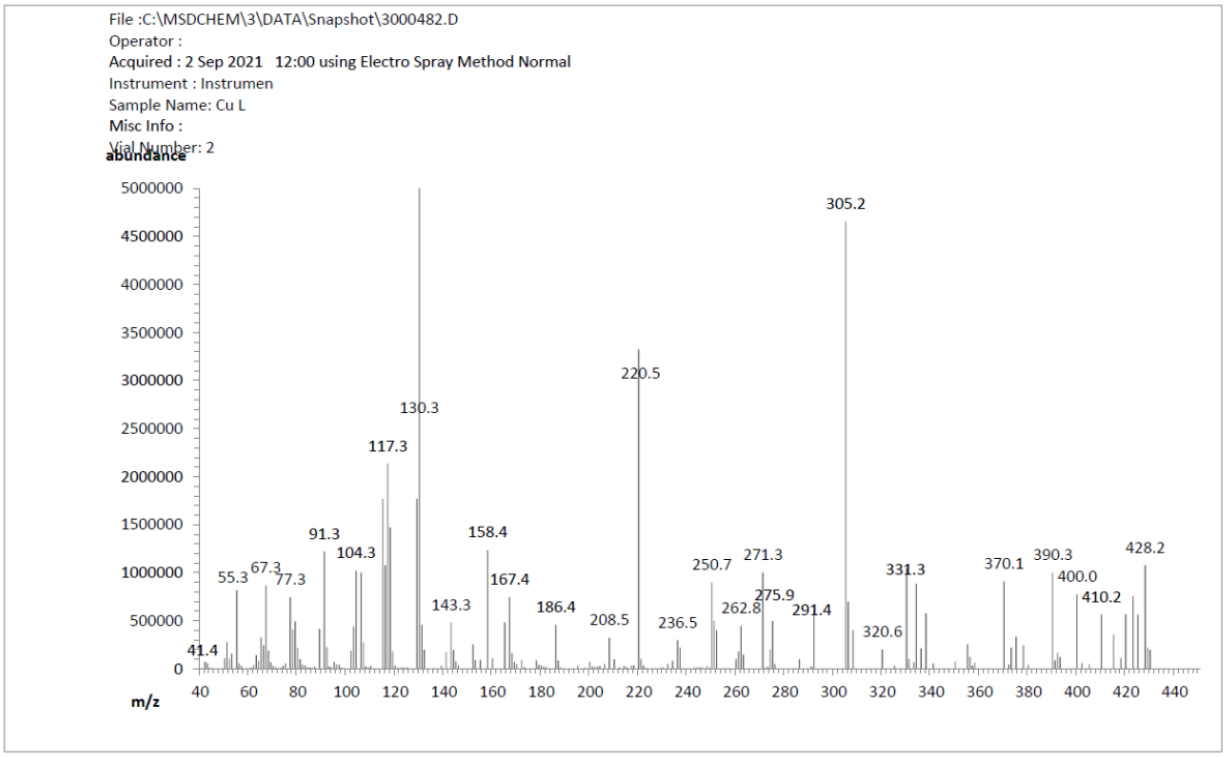


Figure (4b): The ESMS spectrum for K[Cu(L)Cl]complex.

3.4. Measurements of magnetic moment and UV visible information

The UVV spectrum data for H2L and its compounds are displayed in Table 2. Due to ($\pi \rightarrow \pi*$ and $n \rightarrow \pi*$); in that order the free ligand H2L and its complexes displayed two for the intra-ligand at 267 and 318 nm [17].

In electronic spectra of H2L complexesfurther bands between 278 and 390 nm have been attributed to charge transfer and ($\pi \rightarrow \pi*$, $n \rightarrow \kappa*$) [19]. Electronic Cu(II) complex There are peaks in the d-d region at 757 and 856 nm, which are related to a transition from d to d, types 2B1g→2B2g and 2B1g→2A2g, respectively. [20-22]. The Cu atom's Planar geometry with distortions in squares was determined [23]. Cu(II) complex was completed in accordance with the given geometry. Moreover, a skewed square planar configuration around the Cu atom was indicated by the magnetic moment value [24]. The exposed peaks in the Zn(II) and Cd(II) complex spectra were attributed to the charge transfer and ligand field [25]. The tetrahedral shape of the structure was anticipated for the centers of Cd(II) and Zn(II). [26].

Table 2: DMSO solutions' magnetic moments and UVvis spectral data.

Complexes	μeff (BM)	λnm	ε_{max} $dm^3\ mol^{-1}\ cm^{-1}$	Assignment
Ligand	-	268 319	661 1322	π → π* n→ π*
Cu-complex	1.70	296 371 758 857	2333 1357 46 48	π→π* n→π* $^2B_1g \rightarrow {}^2B_2g$ $^2B_1g \rightarrow {}^2A_2g$
Zn-complex	Diamagnetic	279	944	π→π*

		321 376	832 1245	n→π* C.T.
Cd-complex	Diamagnetic	281 341 391	644 732 1145	π→π* n→π* C.T.

3.5. Analysis of Heat

TGA and DSC investigations were performed on the H2L ligand and its metal complexes. The metal complexes of H2L TGA curves been restored in an argon atmosphere at temperatures ranging from room temperature to 600 ºC. H2L's thermal analysis revealed that the ligand is stable at temperatures as high as 97.2 ºC. The DSC curves show peaks at 110.4, 180.3, 255.1, and 470.3 °C in temperature. The highest recorded temperature ranged from 97.2 to 260.2 in Celsius. pieces of C5H6 lost, which were ascribed to (calc.= 4.0220mg, 20.11%) and (obs.= 4.0110mg). The fragment of (N2H4+C5H12) (calculated as 5.6300 mg, 28.15%); objects equal 5.6255 mg. was lost at 381.4 ºC in the second stage.

Up to 98.1 ºC, The data on thermal degradation of the K[Cu(L)Cl] complex appeared to remain durable. Exo- and endo-thermic phases were implicated in the peaks that the DSC investigation recorded at 190.1, 248.9, and 465.8 ºC (see Figure 4). The TGA first stage curve, which showed a range of 88.1–213.4 ºC, was linked to the elimination with objects equal to 2.7144 mg and (N2H2+C2H2) fragments calculated to be 2.7411 mg, 13.05%). As a result of the loss of (of (N2H4+C5H12); items add up to 5.6255 mg (5.6300 mg, 28.15%). respectively, points were found at 351.3 and 495.4 □C.

The Cd(I²) metal complex is stable at temperatures up to 110.2 oC. The DSC investigation showed Temperature maxima for exo- and endo-thermia above of 234.6, 255.4, 326.6, and 499.8 ºC.
The TGA analysis revealed that (N2+C6H5) molecules were eliminated, with peaks around 110.2–193.8 ºC ((calculated = 4.4460 mg, 22.23%; obs. = 4.4460 mg). The distinct peaks at 306.3 and 448.8 ºC, respectively, are ascribed to a loss of (C7H6), with an objective of 3.8680 mg and a calculated value of 3.8020 mg (19.01%), and (C3H2NCl, with an objective of 3.6240 mg and a calculated value of 3.6640 mg (18.32%) (Figure 5).

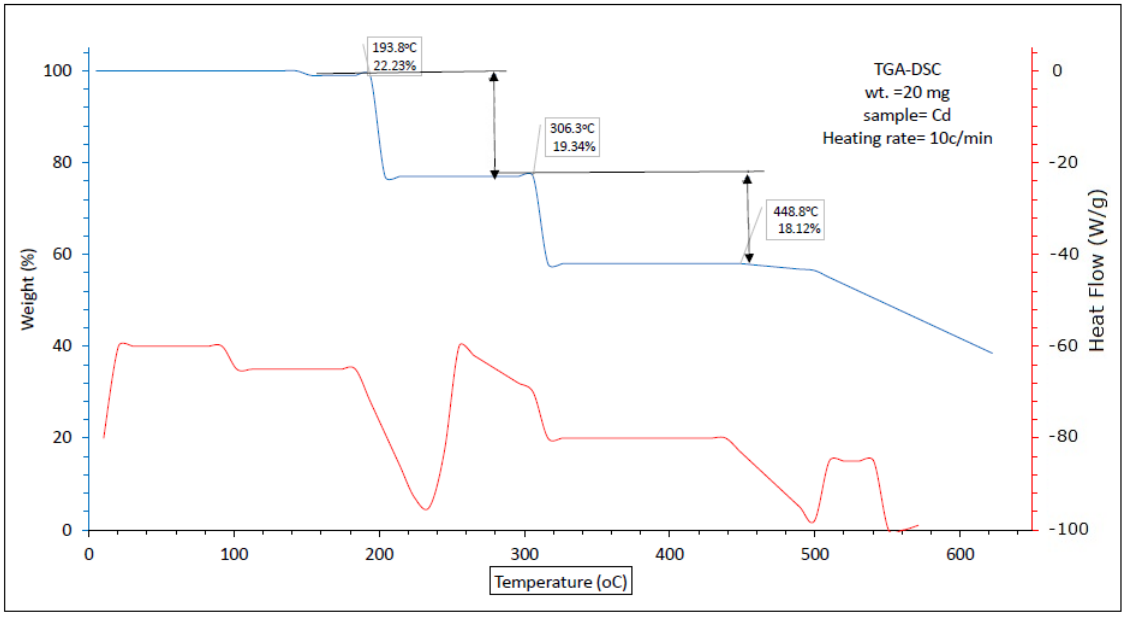


Figure (5): TGA and DSC analyses of Cd(II)-complex.

3.6. Bacterial Activity

Using Mueller Hinton's medium of agar approach, research on H2L's bacterial activity and, correspondingly, its metal complexes were examined against four categories of bacterial strains: Bacillus subtilis, E. coli, St. aureus, and Kl. pneumoniae [27]. The concentration of the sample utilized in the test is 100 ppm in DMSO. The plates were incubated at about 37°C for a duration of 24 hours.

The millimeter scale was used to quantify the thickness of the inhibitory zones. to evaluate the models. In an experiment where no action was seen against any bacterial strains, DMSO solution was utilized as a control. In comparison to the free-compound acylselenourea complexes containing metal ions are often reported to have higher bacterial activity. It was demonstrated that metal complexes exhibited bacterial activities not present in free H2L ligand, in addition to being more active than the latter.

Both strains of Gram-negative E. coli and cultures of Gram-positive S. aureus bacteria were exposed to the free-compound as well as Composite ions of Cu(II), Zn(II), and Cd(II). Bacillus sabtuius, and Klebsiella pneumoniac bacteria using the disc diffusion technique. Ligand-mediated antibacterial action was limited to Escherichia coli strains that were Gram negative. The ligands-complexes had antiseptic action in contradiction of all types of germs when compared to the free ligand; however, the The activity of the Cu(II)-complex was lower than that of the other complexes. Furthermore, the Zinc-complex demonstrated enhanced efficacy in contradiction of all varieties of germs in contrast to other complexes and the unbound H2L ligand. Overtone's model and the chelation hypothesis may be able to explain the rise in complex activity. [28, 29]. Depending on the chelation process, the complex's formation may serve as a supporting structure for the microbe's cell membrane crossing. Metal ions become less polarized by chelation, which allows the metal to share some of its positive charge with the donor groups. This might be achieved by delocalizing metal charge into the ligand system over the whole chelate system. In other words, the improved lipophilic metal chelate system's properties make it easier for it to pass via the lipid layer of microorganisms' membranes of cells. Refer to Figures 6 and 7.

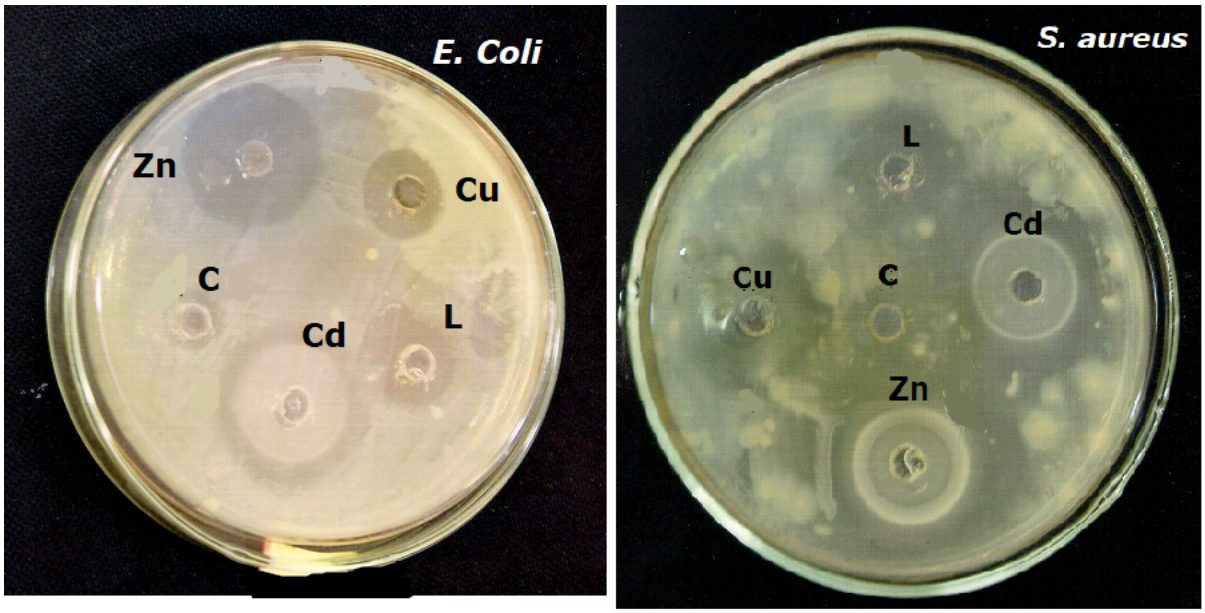


Figure (6): H2L's inhibition diameter in relation to its complexes with S. aureus and E. coli.

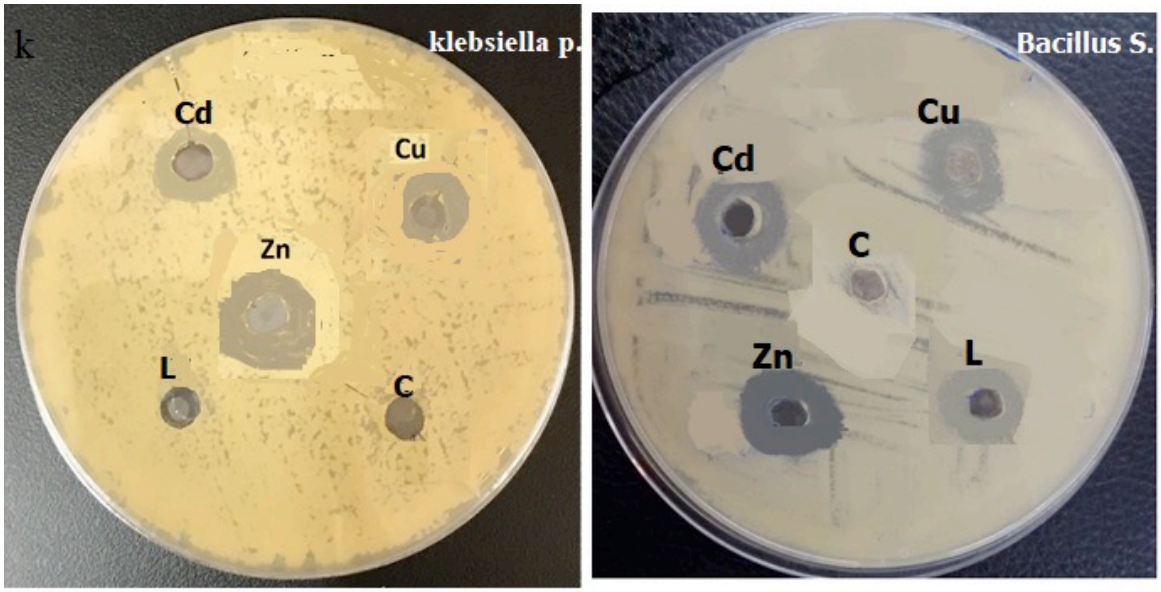


Figure (7): Inhibition diameter of H_2L and also its complexes against *Klebsiella P. and Bacillus S.*

4. Conclusions

Coordinating metal complexes are composed of Zn(II), Cd(II), and Cu(II). that M indicates. produced and described along with a new acylselenourea ligand. Acryl chloride and KSeCN were

reacted with NH2NH2 as a precursor to produce H2L. Selenium, oxygen, and nitrogen atoms coordinated the primary ligand, which was, at its heart, a monobasic species of metal. during complexation. The complete identification of H2L and its metal complexes has been accomplished using a variety of physicochemical studies, including thermal characteristics. Three coordinate complexes were produced when H2L containing Zinc(II), copper(II), and silver ions was subjected to spectroscopic and analytical analyses. Research has also been done on the biological effects of the chemicals listed above on different types of bacteria. Acylselenourea complexes have been shown to have greater antibacterial activity when compared to free ligand.

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Parents' Knowledge about Care of Child with Glucose 6 Phosphate Dehydrogenase Deficiency in Baghdad City

Ali Turki Shnaishil[1], Fatima Hatim Abbas[2]

[1]Al-Hadi University College, Baghdad-10011, Iraq.
[1]High Health Institute, Baghdad health directory.

Abstract

Background: Glucose-6-phosphate dehydrogenase deficiency, the most common enzyme deficiency worldwide, causes a spectrum of disease including neonatal hyperbilirubinemia, acute hemolysis, and chronic hemolysis. **Aim:** Assess the parents' Knowledge about Care of Child with Glucose 6 Phosphate Dehydrogenase Deficiency in Baghdad City. **Methodology**: A descriptive case study starts from 25th October, 2022 until 24th May 2023. In Baghdad city like: Ibn al-Baladi for pediatric and maternity, Fatima Al-Zahraa teaching Hospital for maternity. Purposive sample comprised of (40) parents. The questionnaire of the study consists from two parts: part 1 A demographic data sheet, consist of (5) items, which included (gender, age, resources of information, educational status, economic status) part 2: parents' knowledge from and second part of questionnaire items. **Results:** The results of the study show that most parents have good knowledge of aspects of questionnaire, and results of demographic data the age of the study sample (20-29) year, secondary education levels and from sufficient socio-economic status, most of the study sample have the knowledge from experience. **Conclusion:** The study concluded That the majority of Participants have good Knowledge about Care of Child with Glucose 6 Phosphate Dehydrogenase Deficiency.

Keywords: Parents' Knowledge, child care, Glucose 6 Phosphate Dehydrogenase Deficiency**.**

INTRODUCTION

Glucose 6 phosphate dehydrogenase deficiency (G6PD) classified as allergic response to fava beans. G6PD deficiency is a genetic defect is located in an X-linked recessive fashion. This reveal male is more likely to be affected by this disease than are females. Genetic test is accurate method to detect a G6PD deficiency in males and females in same times (1).

Favism was discovered and biochemically characterized in 1932 by "Otto Warburg and Walter Christian1" in yeast and in red cells as an enzyme with a redox function. It was one of the first enzymes of glucose metabolism to be identified, but, although Warburg did not know that, the clinical manifestations of what later became known as G6PD deficiency scientifically defined. In the 9th century, paediatricians in Greece, Portugal, and Italy noticed an gross anaemia and haemoglobinuria in children who had eaten beans/ hence (2).

Glucose-6-phosphate dehydrogenase (G6PD) deficiency is most likely red cell enzyme disorder in blood stream of human beings. The G6PD enzyme catalyses the first step in the pentose phosphate pathway, activate antioxidants to protects cells against oxidative blood cell damage (3).

A G6PD-deficient patient lacks the ability to protect red blood cells against oxidation triggers stimulating by certain drugs, metabolic conditions, infections, and ingestion of some foods This disorder affects about half billion people around the world but seldom identified in populations where malaria is rare but may exceed 10% in prevalence where malaria is endemic, since

Corresponding author:
Dr. Ali Turki, Al-Hadi University collage, Baghdad 10011, Iraq. dr.ali.turki@huc.edu.iq.
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individuals with G6PD deficiency have been related to greater levels of resistance to infection by Plasmodium falciparum. Therefore, the highest rate of G6PD deficiency prevalence's is reported in Africa, Southeast Asia, the Middle East, Southern Europe, and the central and southern Pacific islands. However, due to migration, deficient alleles are now quite prevalent in North and South America (4).

Education the parent about child with G6PD at home

1- limitation of exposure to causes that triggers symptom.

2-Desplination with your doctor for instructions, and a list of medicines and other things that could be a problem for a child with (G6PD) deficiency.

3- (G6PD) deficiency should not keep a child from living a healthy, active life

4- Monitoring (G6PD) signs and symptoms appear on child at home such as. Fatigue, weakness, pallor, drowsiness (5) .

MATERIAL AND METHODS:

Design of the study

A descriptive case study was carried in order to achieve the early stated objectives. The study was initiated from 25th October, 2022 until 24th May ,2023

Setting of the study

The study has been conducted on the parent admitted to medical ward and emergency unit at hospitals in Ibn Al Baladi, Fatimah Al Zahra, and Al Allwyia pediatric teaching hospitals

The sample of the study:

A purposive (non-probability) sample of (40) parents who have been attending at pediatric teaching hospitals. The samples have been selected based on the following criteria all parents of child with glucose 6 Phosphate Dehydrogenase Deficiency.

The study Instrument:

A questionnaire was designed and constructed by the researchers to measure the variables underlying the present study. A construction was employed through review of literature and related studies.

The questionnaire consisted of two parts

Part 1: Demographic data form:

A demographic data sheet, consisted of (5) items, which included gender, age, sources of knowledge, educational status, Economic status.

Part 2: Parents Knowledge form:

The second part of questionnaire designed to measure the parents' knowledge consists of (27) items that concerned with knowledge of their children with (G6PD) according two Likert scale know - do not know.

Pilot study:

A pilot study was carried out on (10) parents, which was selected from (Central Child Hospital - Medical City Directory) prior to the original study. The pilot study was conducted from august 10th ,2022 until September 15th ,2022. The purposes of pilot study were to:

a- Estimate the time required for data collection.

b- Obtaining study tool clarity and content adequacy.

Data collection:

The data have been collected through the use of a questionnaire and by means of an interview technique with the parent about their children with G6PD The data collection process has been performed from 25th October, 2022 until 24th May ,2023.

Statistical data analysis:

Data were analyzed through the use of statistical package of social sciences (SPSS), The statistical procedures, which were applied for the data analysis and assessment of the results.

STUDY RESULTS:

The figure (1) reflects that most of the study sample have good knowledge

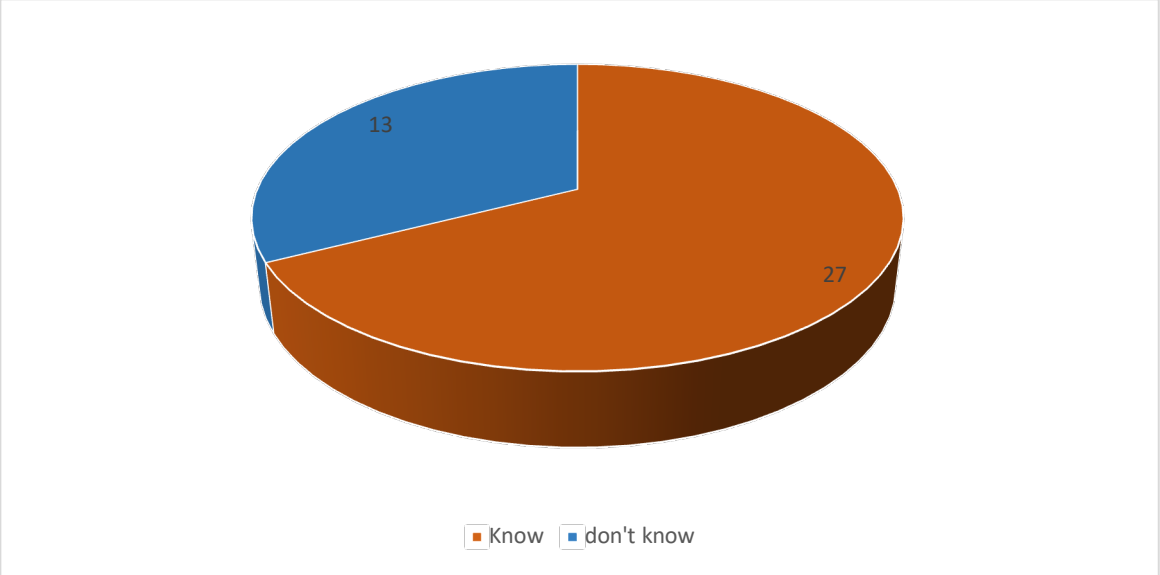

Figure (1) Distribution of parent knowledge about care of their child with (G6PD)

Table (1) Distribution of the parents' knowledge about care of their child with G6PD

No.	Items	Know	%	Don't know	%
1	Focal anemia (Bean allergy) is consider a genetic disease	31	77.5	9	22.5
2	Focal anemia is considered a non-communicable disease	36	90.0	4	10.0
3	Focal anemia results primarily from the breakdown or distrucion of red blood cells	39	97.5	1	2.5
4	The incidence of the disease in male more than females	27	67.5	13	32.5
5	G6PD is an enzyme necessary to protect red blood cells	35	87.5	5	12.5
6	G6PD enzyme deficiency or lack lead to the breakage of red blood	34	85.0	6	15.0
7	Focal (bean disease) is a heredity or genetic disease transfer in the family	31	77.5	9	22.5
8	Your child is always tired	27	67.5	13	32.5
9	Sometime the whites of the eyes are yellow	33	82.5	7	17.5
10	Your child's heart rate increases when the red blood cells are broken	28	70.0	12	30.0
11	Sometimes the color of urine is yellow	31	77.5	9	22.5
12	The color of stool is dark, almost like tea	12	30.0	28	70.0
13	Do a screening test for your baby after birth	31	77.5	9	22.5
14	Do a complete blood count for the child	32	80.0	8	20.0
15	Examination of the G6PD percentage for the child every 6 month	9	22.5	31	77.5
16	The normal range of G6PD enzyme is between 5.5 – 20.5 unit per gram of hemoglobin	19	47.5	21	52.5
17	Use of alternative antibiotics in the event of infection	32	80.0	8	20.0
18	Not taking medications that stimulate and help dissolve the child's red blood cells	34	85.0	6	15.0

19	The child needs to take medicines that help prevent anemia	29	72.5	11	27.5
20	Your child is affected by taking some medicines such as Aspirin	32	80.0	8	20.0
21	Avoid eating legumes such as beans, lentils, chickpeas and beans	36	90.0	4	10.0
22	Avoid eating nuts of all kinds	14	35.0	26	65.0
23	It is preferable to reduce intake of citrus fruits such as orange and lemon	8	20.0	32	80.0
24	Refrain from smelling odors that are irritate the patient such as a henna	28	70.0	12	30.0
25	Fainting is one of complication resulting from the exacerbation of the child's acute focal anemia	18	45.0	22	55.0
26	An enlarged spleen is one of the complications of acute focal anemia	27	67.5	13	32.5
27	Low oxygen levels for the child are one of complication of focal anemia	25	62.5	15	37.5

This table show that the parent have poor knowledge in some aspect of this items (15, 16, 22, 23, 25).

DISCUSSION:

Throughout this chapter, interpretation and discussion of the findings are presented with supportive evidence which was available in the literature.

Discussion Parent' Demographic Characteristics

A- Gender

Throughout the course of the present study indicated that most of the study sample female .The researcher noted that most of the caregivers for children are mother because mother is consider a first person for care provider of the children and most of mother house wife and the father most time out of the home for job, this result agree with Thabit, (2019) his study " Knowledge regarding neonatal jaundice among a sample of mothers attending some Primary Health Care centers Baghdad" his found 76% of the study sample female.

B- Age

Related the age of the study sample are most of the study sample were (20-29) year's This result agree with Norah , et al.,(2018) their study "Assessment of Knowledge, Attitude and Practice of Saudi Parents towards Neonatal Jaundice " they found 89.6% of the study sample 20-30 year (7), this study agree Allia Vaez, (2018) her study "Knowledge and Attitudes of Mothers on Neonatal Jaundice in Saravan, Iran"(8).

C- Level of Education

Related of level education of the study sample were thirty-two of the study sample were high school level this result agrees with Thabit (2019) his found 34.7% of the study sample were secondary school. And this study result disagrees with Suleman (2014) Assessment of Knowledge and Practices of Caregivers Toward their Neonates with Jaundice at Rapiran Pediatric Teaching Hospital/Erbil City that shows most of the study sample were able to read and write

D- Source of information

Related of source of information of the study sample they were most of the study sample have knowledge from the staff in the ward this result reflect that the staff have a good knowledge about the problem and the staff able to teaching of the mother about care of their child at home. this study agree with Norah, et al.,(2018) their found 29.8 of the study sample have knowledge from doctor treatment

E - Socio economic status

Related of socio-economic status most of the study sample were moderate socio-economic status

Discussion the Caregivers' Knowledge

According to the results most of the study sample have a good knowledge about care of the child with G6PD but some of the study sample have poor knowledge in some aspect of care. the knowledge result from experience of the disease these results agree with Suleman (9).

CONCLUSION:

1- most of the study sample were female age from (20-29) & moderate economic status.

2-Therty two of the study sample high school level of education.

3-Most of the study sample have knowledge from the staff

4- most of the study sample have good knowledge about care of child with (G6PD).

RECOMMENDATIONS:

1- Media programs to educate the families & community about early detection of the children with (G6PD) and encouraged them to attend to special centers or clinics.
2- Distribution of pamphlet about all aspect of the management of the children with (G6PD).

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A Review for Treatment Options in Class II Division 1 in Growing Patient

Shadha Alqaysi , Jehan Yawez Al-Demirchi

Department of Dentistry Al-Hadi University Collage, Baghdad -10011, Iraq
https://orcid.org/0000-0003-1888-2614

Abstract: face soft tissue must be included in orthodontic diagnosis and treatment planning in order to enhance both face aesthetics and dental occlusion.

Keywords: Class II Division 1; Dentistry; Malocclusion; Orthodontic

Introduction

Class II malocclusion, which affects about 35.5% of Iraqis, is one of the most prevalent orthodontic issues, according to Nouri and Sheakhli [1]. The primary cause is an inaccuracy in the antroposterior connection, which could be caused by an especially big overjet or the distal step molar relation. A disparity in tooth sizes, whether or not the mandible and maxilla are malformed, can also provide an initial indication of a true skeletal Class II malocclusion.

Skeletal Class II malocclusions are found to have alterations in one or more of the following locations: maxillo-mandibular-relationship (midface protrusion, mandibular retrognathism or both); vertical dysplasia (anterior upper face height often greater than normal); a high occlusal plane reflecting vertical skeletal dysplasia [2].

The most often observed diagnostic feature in cases of Class II malocclusion is mandibular skeletal retrusion. Therefore, trying to improve mandibular development by moving the jaw forward and realigning the chin is a reasonable initial step in treating individuals with mandibular retrusion. Together with concurrent alterations in the0vertical and transverse0dimensions [3].

Treatment time is better in pubertal growth which is earlier in female due to the greater mandibular response during this period [3-4] in addition , Two characteristics of the use of removable functional appliances during puberty, followed right away by fixed appliances or clear aligner therapy, may contribute to the long-term stability of the treatment outcome: the second phase of comprehensive treatment occurs during the late postpubertal phase of development, when there is little to no residual active mandibular growth.l[5- 6] . In addition, creating a stable Class I intercuspation at the end of comprehensive treatment also favors long-term stability.[7]

Corresponding author:
Shadha Alqaysi, Department of Dentistry Al-Hadi University Collage, Baghdad -10011, Iraq,
shathaabdulwahid@huc.edu.iq
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Treatment appliances

Functional appliance

The device was designed in a similar manner to Wilhelm Balters' Bionator, a removable functional orthopaedic activator that functions on the main anterior displacement of the mandible as well as the positioning of orofacial muscles. The Bionator was created in the 1950s [8].
The Twin Block appliance is the preferred appliance in most Class II division I instances. When the second deciduous molars are ready to exfoliate and, in most cases, when the whole permanent dentition is developed, which is about 11–12 years old for girls and 12–13 years old for boys [9-11].

Clear aligner

The introduction of clear aligner therapy (CAT) [12] has expanded the options available to orthodontists, offering another option of treatment. each aligner in the series exerts a specific force on the target teeth, gradually retracting them. The application of continuous, gentle force stimulates bone remodelling, allowing the teeth to migrate into a more favourable position specially the incisors. in relation to anchorage control, it helps in distributing the force evenly, minimizing the risk of mesialization of molars or unwanted changes in the posterior dentition.

While the Interarch Relationship correction often requires adjustments to the interarch relationship, particularly the overbite. Clear aligners can be designed to incorporate features like precision cuts, elastics, or other auxiliaries to facilitate changes in the vertical dimension and encourage a more favourable bite relationship.

Figure 1: clear aligner with class 2 elastic. [12]

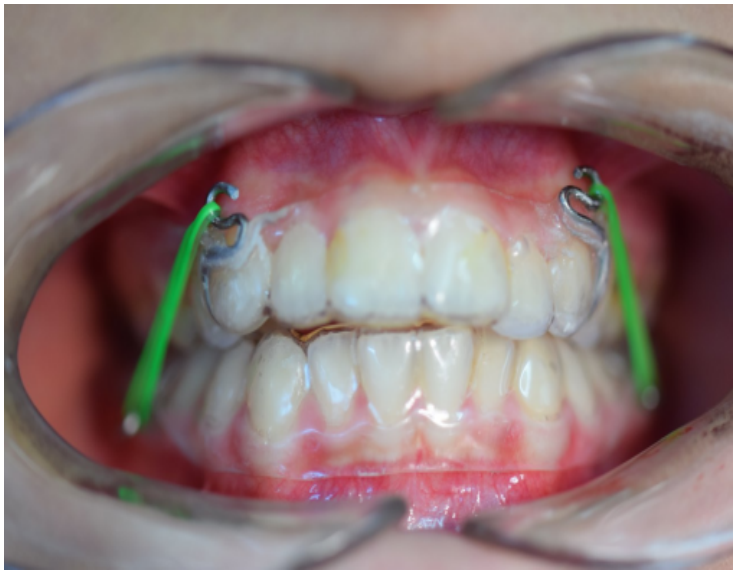

Figure 2: clear aligner with class 2 elastic incorporated with appliance

◆ Marple appliance

This orthodontic device works by moving the patient's lower jaw forward, bringing the upper and lower teeth together [13-14]. When MARA is properly working, the patient can only bite down by sliding their lower jaw forward. With time, jaw correction will occur, and the lower jaw will shift forward to correspond with the top. MARA typically takes 9-12 months to fully straighten the jaw.

The basic MARA design has a horizontal "arm" in the lower arch that extends horizontally from a stainless-steel crown on the lower first molar. The vertical "elbow" on the crown of the upper first molar directs the lower jaw forward into the proper position. The patient can only bite down when the lower jaw is moved forward, allowing the lower arms to glide in front of the elbows. Like every orthodontic instrument, there are benefits and drawbacks to the MARA.

Advantages include the fact that it is fully invisible from the outside of the mouth, that it can be used before or during the braces phase of treatment, that it is permanently attached to the teeth and cannot be removed by the patient, and that there is no connection between the upper and lower jaws, allowing the patient to open their mouth as wide as they like. The drawbacks are that it can irritate some patients' cheeks, that it doesn't work for patients with significant overbites (if they can bite behind their elbows instead of in front of them), and that it doesn't work for patients with open bites.

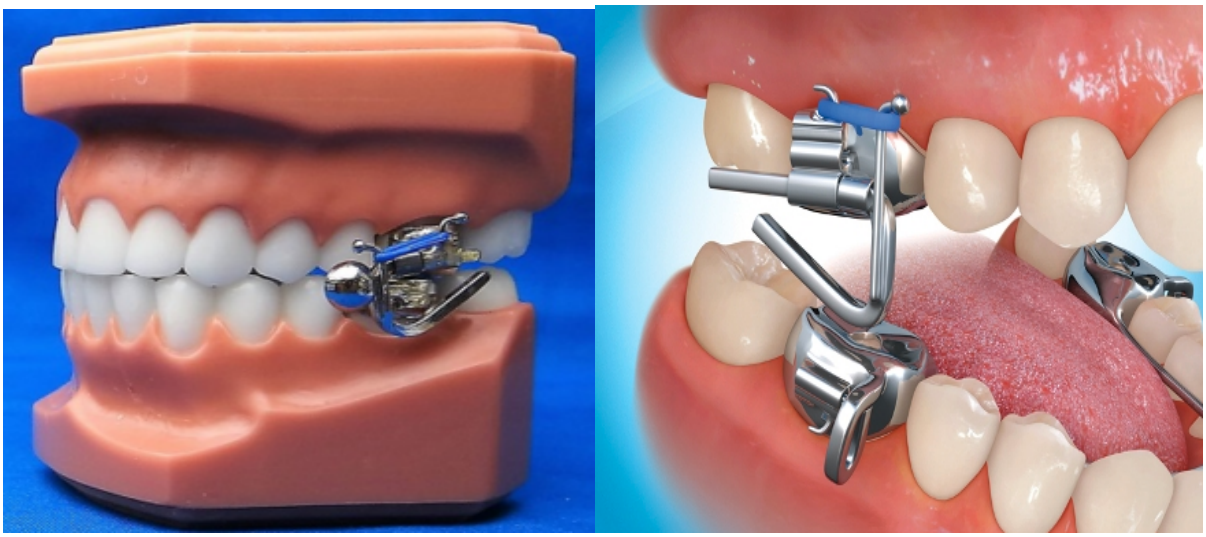

Figure 3: marple appliance [13]

◆ The Herbst appliance

Between the mandible and maxilla, the Herbst device serves as an artificial joint [11- 15.] A bilateral telescoping mechanism was part of the original design, which kept the jaw continuously protruding. It was connected to orthodontic bands on the maxillary first permanent molars and on mandibular first premolars (or canines); this maintained the mandible in a-continuous protruded position .

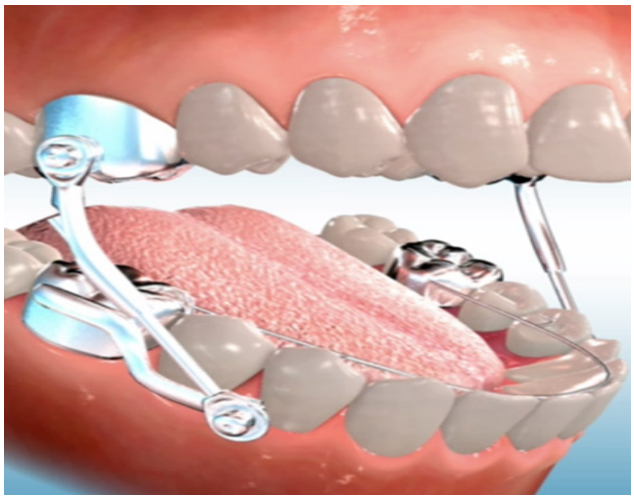

Figure 4: herbst appliance [15]

◆ Treatment with miniplate [16-17-18]

The Forsus resistant device (FRD) appliance with miniplate anchoring is put into the mandibular symphysis to strengthen the anchorage of the mandibular dentition, reduce tilting of the

mandibular incisors, and prevent maxillary incisor retrusion. The anchoring units are more secure than other functional devices because the miniplateanchored Class II elastics have reduced anchorage loss, which might be attributed to stresses being delivered directly from the maxillary to the mandibular bones rather than through the teeth.

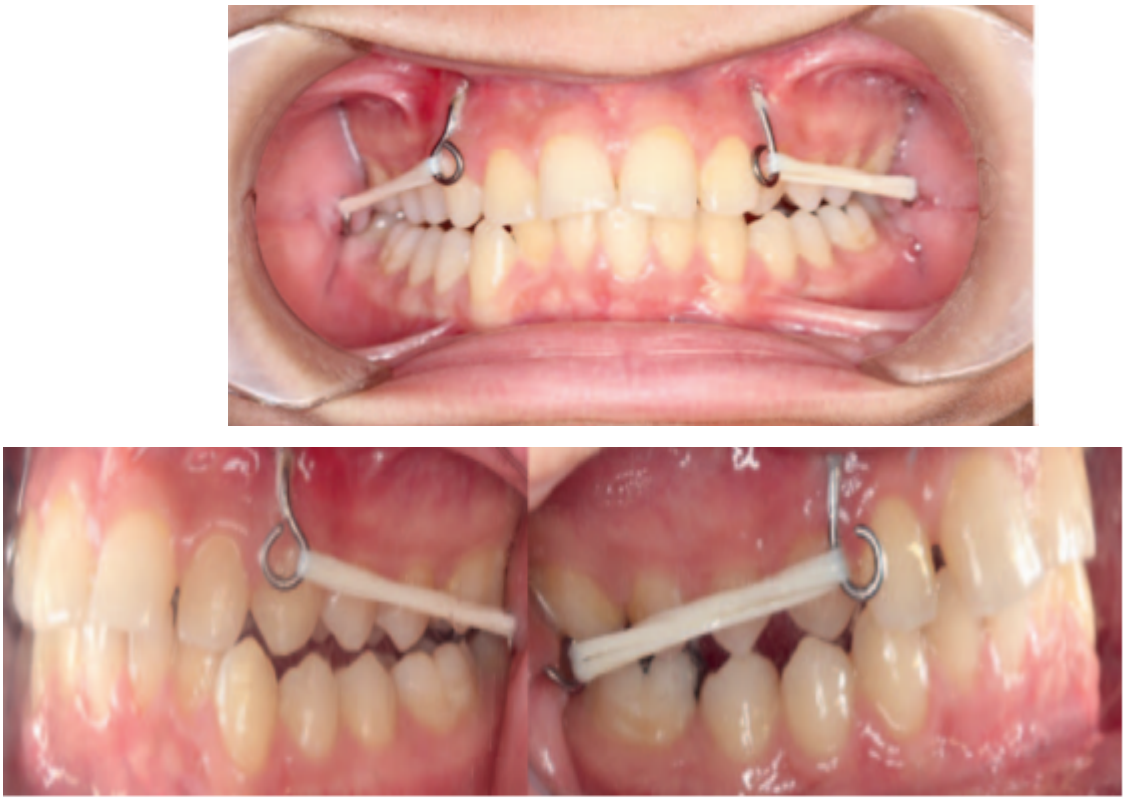

Figure 5: retraction with miniplate [16]

Retention consideration in class II cases [18]

Skeletal Class II malocclusions are found to have alterations in one or more of the following locations: maxillo-mandibular relationship (midface protrusion, Treatment options for skeletal Class II malocclusions include using functional appliances like Herbst or Twin Blocks, or limiting maxillary development using headgear appliances. Although they can cause proclination and flaring of the lower incisors, class II elastics are also utilized. When retention is eliminated, if the lower incisor is proclined, lip pressure will cause it to upright and crowd. Stop using Class II elastics at least two months prior to debonding to prevent these relapses. Because of the unequal growth of the jaw, overcorrection of the Class II treatment is advised to prevent long-term recurrence.
This relapse propensity can be minimised by continuing to wear headgear at night or using a functional appliance, such as a Bionator, to maintain the occlusal connection. Obviously, this type of retention is intended for patients who have more severe bone abnormalities at their initial visit.

Conclusion:

Soft tissue, bone, and oral tissue features must all be considered when planning orthodontic therapy. Orthodontic therapy combined with lip myofunctional training is an excellent method for achieving ideal facial aesthetics and long-term dentoalveolar stability in growing patients with Class II division1 malocclusion.

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The Effect of Impacted Mandibular Third Molar Angulation on Surgical Difficulty

Mohammed T. Albayati[1], Rand M. Aljazaairi[1], Yasser Abdulrahman[1], Ali Radi[1]

[1]Al-Hadi University College, Baghdad-10011, Iraq.

Abstract

Background: Impacted mandibular third molars (IMTM) are a common challenge in oral and maxillofacial surgery, often requiring extraction due to complications such as pericoronitis or orthodontic issues. The difficulty of these extractions can vary significantly, influenced by factors like tooth angulation. This study aims to evaluate the impact of IMTM angulation on surgical difficulty, focusing on extraction technique and duration. **Methods:** In this prospective observational cohort research, 83 individuals who underwent surgical extraction of IMTMs at Al-baladiate Specialist Center from December 2019 to September 2020. Patients were excluded if they were medically compromised, pregnant, had acute infections or associated cysts/tumors, or were missing the lower second molar. Preoperative panoramic radiographs were used to classify tooth angulation according to Winter's classification. All extractions were conducted by a single operator with fifth years' expertise. Surgical difficulty was assessed based on the technique (elevators, bone removal, or tooth sectioning) and the duration of surgery (classified as low, moderate, or high). **Results:** The majority of IMTMs were classified as mesioangular (39.7%) and vertical (27.7%). Horizontal impactions were associated with the highest difficulty in both technique (80%) and duration (26.7%). Vertical impactions typically presented lower difficulty (56.5% for technique and 66.7% for duration).
Distoangular impactions also showed high matching in low difficulty levels. Statistical analysis revealed significant correlations between tooth angulation and both the surgical technique and duration ($p < 0.05$). **Conclusion:** The angulation of impacted mandibular third molars significantly affect surgical difficulty. Vertical impactions generally present less difficulty compared to horizontal impactions. These findings underscore the importance of considering tooth angulation in preoperative planning to optimize surgical outcomes and minimize complications.

Keywords: Impacted mandibular third molars, surgical difficulty, tooth angulation, extraction technique, surgical duration

Corresponding author:
Mohammed T. Albayat, Al-Hadi University collage, Baghdad 10011, Iraq.mohammed.talal@huc.edu.iq
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INTRODUCTION

Impaction is the state in which bone, soft tissue, or neighboring teeth obstruct a tooth from moving into its ideal functional position in the dental arch within the anticipated amount of time. In clinical dentistry practice, impacted mandibular third molars (IMTM) are frequently observed [1]. One of the most common procedures in the field of oral and maxillofacial surgery is the surgical removal of impacted molars, which have an IMTM of 16.7% and 68.6% [2, 3]. It may be indicated for caries, orthodontic purposes, external resorption of the adjacent teeth, pericoronitis, or the presence of odontogenic tumors or cysts [4,5].

The extraction of IMTM may be accompanied by post-operative complications, such as pain, swelling, dry socket, mouth opening limitation and IAN damage, impairing the quality of the life of patients [6,7]. Hence, adequate treatment planning, preoperative analysis and evaluation of extraction difficulty are crucial for determining the right treatment planning. [8,9].

Several authors argue that it is difficult to determine difficulty using radiologic approaches alone, and that genuine difficulty can only be estimated intra-operatively [10]. New surgical procedures, as well as substantial training, expertise, and experience, have contributed to the advancement of dental surgery, allowing this treatment to be performed in a less stressful approach [11]. Nevertheless, complications are prevalent in all surgeries [12]. A surgical complication is an unanticipated incident in a specific surgical condition that necessitates further therapy beyond what was initially planned [13]. The injury caused by a surgical complication may lead to the loss of days at work, loss of production, multiple postoperative sessions, and a prospective lawsuit [14,15].

A number of research used radiologic examination to determine the surgical difficulties of extracting impacted wisdom teeth [16,19]. Some authors believe that clinical characteristics such as the patient's gender, age, and weight are also essential [20, 21].
Limited surgical skills can occasionally have detrimental effects on the patient and may be associated with a number of observable post-operative complications in the surgeon's experience [22]. For example, where the surgeon did his or her fellowship, how many procedures he or she conducted while training, and the degree of expertise of the student surgeon's tutor [23].

On other hand there was no weight attributed to the year of training; junior experts are expected to do better surgery with less complications when they become senior experts. The same approach is used for junior trainees in their first year, as well as their fourth year of study. "Surgical specialist" refers to a specialist in oral surgery or a specialized registrar in oral and maxillofacial surgery; surgical experience with third molar surgery is predicted to range between 5 and 15

years. The term "surgical resident" applies to a clinical assistant in dental surgery or a senior house officer in oral and maxillo-facial surgery; surgical experience in third molar surgery is assumed to be fewer than 5 years. [24].

The objective of this study was to measure the effect of impacted wisdom tooth angulation on surgical removal done by 2year expert surgeon.

METHODS

This prospective observational cohort research comprised consecutive patients who underwent surgical extraction in the Department of Oral and Maxillofacial Surgery at Al-Baladiate Specialist Center from December 2019 to September 2020. This study excluded patients who were medically impaired, pregnant women, cysts, patients with impacted teeth linked with tumors or acute infections, and individuals with missing lower second molars on the surgical side.

The Research Ethics-Committee of the College of Dentistry, University of Baghdad approved the protocol of this study (protocol # 024328 in 09-01-2019) Each patient provided informed consent to participate in the clinical study.

In addition, with the clinical evaluation, all patients received a preoperative panoramic radiograph. To calculate the angle of the IMTMs. This was established by the angle created by the intersecting longitudinal axis of the second and lower wisdom tooth.

All surgical extractions were carried out by only one operator with five years of expertise. With the use of local anesthetic, a two-sided flap was created, and elevators were used to remove the teeth until bone removal or tooth sectioning was required. The time of surgery was measured in minutes from the initial incision to the last stitch. The technique and duration of extraction affect the level of difficulty in the operation. In regard to surgical technique, the difficulty level considered low when the extraction was accomplished just with elevators, moderate in case ostectomy was necessary, and high when bone removal plus tooth sectioning were required for tooth removal. The difficulty of surgery was classified as low when the surgical extraction lasted less than fifteen minutes, moderate when the total duration was 15-30 minutes, and high when the procedure continued more than 30 minutes.

The independent variables in this study were the pre-operative classification of the IMTD angle using the Winters classification criteria. Depending on the panoramic x-ray (OPG), the level of surgical difficulty is defined by the surgical extraction technique and the duration of the procedure. The outcome (dependent) variable was the surgical difficulty according to the technique of extraction as well as to the duration of operation, the effect of each angle of IMTM on the technique of surgery and the timing of operation.

Other factors included the patients' gender, age, weight and height, as well as the reasons for extraction, and the placements and classes of impacted wisdom teeth according to the Pell and Gregory classification.

The statistical analysis carried out using GraphPad Prism version 6 for Windows P values of <0.05 were considered statistically significant.

RESULTS

Demographic Characteristics of the study sample

This research included eighty-three patients. There were 56 women (67.5%) and 27 men (32.5%). The age range was16-39 years, with a mean±SD of24.4±4.8 years. The patients ranged in height from150-196 cm (mean±SD=165.8±10.4) and weight from 40-102 kg (mean±SD=69.7±13.7).

The indication of extraction of the impacted mandibular third molars

Data in table 1 show the indications for extracting the impacted mandibular third molars, pericoronitis was the most frequent reason for this treatment.

Table 1: Indications of extraction

Indications	Number	%
Pericoronitis	63	75.8
Dental caries	10	12.1
Orthodontic treatment	10	12.1
Total	**83**	**100**

Classification of the impacted mandibular third molars

According to the Winter's classification, the impacted mandibular third molars were mesioangular in33(39.7%) patients, vertical in 23 (27.7%) patients, horizontal in 15 (18.1%) patients and distoangular in 12 (14.5%) patients, according to Quek et al. (2003) [25]. As seen in figure (1).

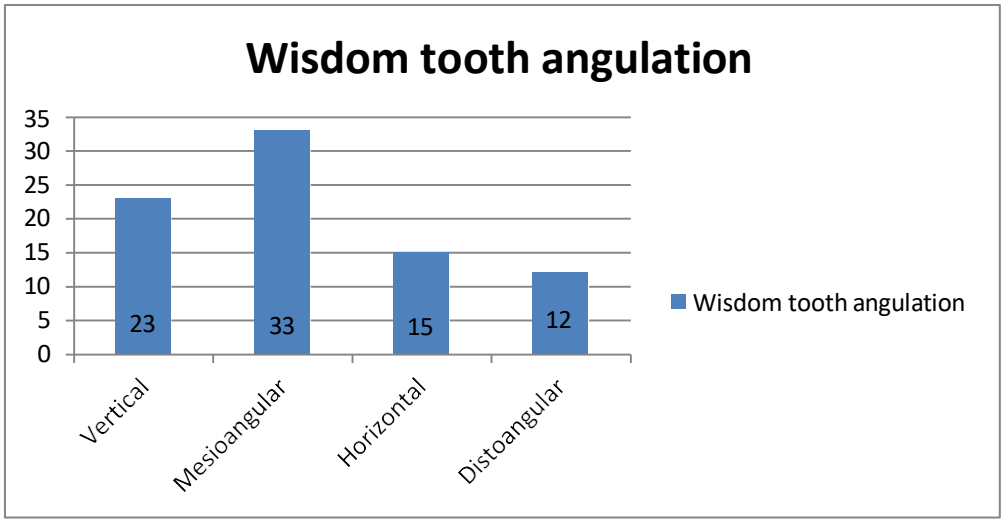

Figure 1: Distribution of impacted mandibular third molars according to Winter's classification

- **The intraoperative surgical difficulty**

According to duration of surgery

The mean± SD duration of extraction was 18.61± 15.45 minutes with a range of 3 to 103 minutes. The distribution of the surgical difficulty according to duration is shown in figure (2). Most cases were classified as being of low difficulty (less than 15 minutes).

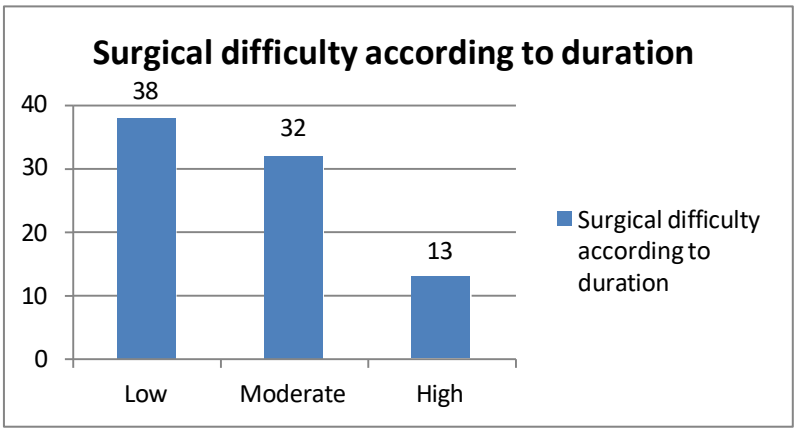

Figure 2: The distribution of the surgical difficulty according to duration

According to technique

Regarding the surgical technique, the distribution of the surgical difficulty is shown in figure (3). Most of the cases were categorized as being of high difficulty.

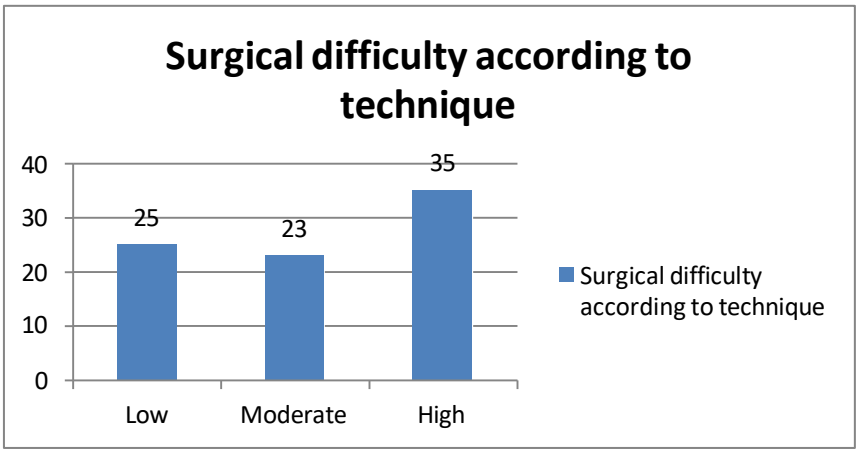

Figure 3: The distribution of the surgical difficulty according to technique

The correlation between tooth angulation and intraoperative difficulty measured by duration and technique

Table 2: The correlation between tooth angulation and intraoperative difficulty measured by technique

Variable	Intraoperative Difficulty measured by technique			Total (%) n= 83	P – Value *
	High (%) n= 34	Moderate (%) n= 24	Low (%) n= 25		
Vertical	1 (4.3)	9 (39.1)	13 (56.5)	23 (27.7)	**0.001**
Mesioangular	20 (60.6)	7 (21.2)	6 (18.2)	33 (39.8)	
Horizontal	12 (80.0)	3 (20.0)	0 (0)	15 (18.1)	
Distoangular	1 (8.3)	5 (41.7)	6 (50.0)	12 (14.4)	

Table 3: The correlation between tooth angulation and intraoperative difficulty measured by duration.

Variable	Intraoperative Difficulty measured by duration			Total (%) n= 83	P – Value *
	High (%) n= 13	Moderate (%) n= 32	Low (%) n= 38		
Vertical	0 (0)	6 (26.1)	17 (73.9)	23 (27.7)	**0.003**
Mesioangular	8 (24.2)	14 (42.4)	11 (33.3)	33 (39.8)	
Horizontal	4 (26.7)	9 (60.0)	2 (13.3)	15 (18.1)	
Distoangular	1 (8.3)	3 (25.0)	8 (66.7)	12 (14.4)	

Table 4: shows the matching of level of difficulty of surgical technique and duration in relation to the angulation of impacted mandibular wisdom tooth

	Surgical technique & duration matching for High difficulty N(%)	Surgical technique & duration matching for Moderate difficulty N(%)	Surgical technique & duration matching for Low difficulty N(%)	Surgical technique& duration Total Match N(%)
Vertical 23	0(0%)	5(21%)	13(56%)	18(78%)
Mesioangular 33	7(21%)	5(15%)	6(18%)	18(54%)
Horizental 15	4(26%)	2(13%)	0(0%)	6(40%)
Distoangular 12	1(8%)	3(25%)	6(50%)	10(83%)

According to table 4 most cases with vertical impaction show 56% matching in low difficulty according to technique and duration, while, mesioangular impactions show less percentage of matching according to different level of difficulty.

Furthermore, the horizontal impactions showed matching at high level of difficulty for technique and duration. finally, the distoangular impactions showed high level of matching at low level of difficulty as seen in vertical impactions.

DISCUSSION

Predicting surgical difficulties prior to IMTM extraction enables for treatment planning that reduces the potential of complications [25, 26, 27], but it remains a persistent challenge for oral surgeons. [12]. This study aimed to evaluate the effect of impacted wisdom tooth angulation on surgical difficulty measured by technique and duration.

Many studies base surgical difficulties on the time and technique used for surgical extraction of impacted teeth [12,28,29], while others use the operator's perspective as an additional indication of difficulty [30]. Most studies utilize the duration of operation to estimate surgical difficulty. [31] Scoring difficulty for impacted wisdom tooth angulation; vertical score one, mesioangular score two, horizontal score three, distoangualr score four, similar difficulty scores of angulations described by Carvalho and Pederson [26, 20].

Tooth angulation affect significantly on surgical difficulty measured by techniques, regarding technique of surgery the high difficult cases were horizontal impacted teeth (80%). On other hand, regarding surgical technique the cases with low degree of difficulty were vertical impacted teeth (56.5%), that’s agree with Carvalho and Roy et al [26, 32]

Furthered more, impacted wisdom tooth angulation affect significantly on surgical duration, regarding to duration of surgery the high difficult cases were horizontal impacted teeth (26.7%). On other hand, regarding surgical duration the low degree of difficulty cases were vertical impacted teeth (66.7%), that’s agree with Carvalho and Roy et al [26, 32]

While, distoangular impacted wisdom teeth 91.7 % of cases were low and moderate score in surgical technique similar percentage 91.7% low and moderate difficulty score regarding surgical duration, the limited number of distoangular cases included in the study sample may not explain the real effects on surgical technique and duration.

According to the table 3.4. the matching in level of difficulty between duration and technique in relation of the impacted mandibular third molar angulation of teeth mostly resulted in distoangular

(83%) and vertical (78%) impactions, and most vertical cases with low level difficulty that agree with roy2014 Perderson 2007 [27, 32], horizontal impaction showed no cases with low level of difficulty of surgical technique and no matching at low level difficulty. The distoangualr impactions showed most of cases with high level of difficulty in technique and duration, that disagree with Pernambuco 2018 and roy et al 2014 [26, 32]

One drawback of this study is its limited sample size, which was taken from consecutive patients who visited our facility during a specified period of time. Another restriction is the operator's degree of expertise, which may have an impact on the study's results. Sánchez-Torres et al. related the difficulty of extraction to the skills of surgeon, although they noticed that there is no scale for classifying the operator's experience, believing that about ten years or more would signify a high degree of experience. [31].

CONCLUSION

Within the study's limitations, it showed that. Both surgical difficulties measured by technique and duration was significantly affected by wisdom tooth angulation. With exception of distoangular impaction a two-dimension radiograph (orthopantomograph) showed tooth angulation without respecting to ascending ramus relation, that why, the result of surgical difficulty measured by technique and duration in a vertical and distoangular impacted teeth were similar.

Conflict of interest

The authors have declared that they have no conflicts of interest.

Informed consent

The participants signed an informed consent to participate in the clinical study.

Source of funding

None.

Ethical approval

The protocol of this study approved by the Research Ethics-Committee of the College of Dentistry, University of Baghdad (protocol # 024328 on 09-01-2019).

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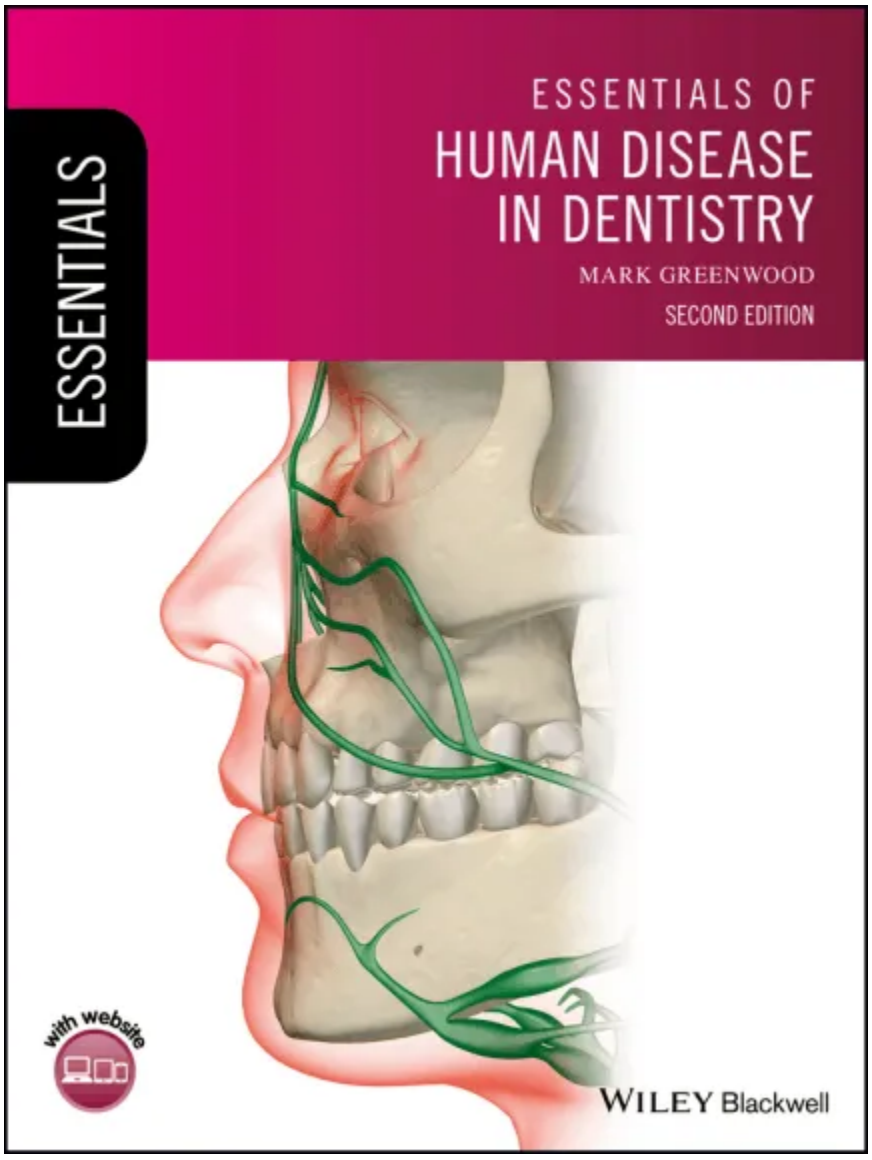
Book Review: Essentials of Disease in Dentistry, Second Edition - Mark Greenwood

Book reviewed by Dr. Mohammed Abbood Kanbar Al-Maliky
Department of Dentistry, Al-Hadi University Collage, Baghdad -10011, Iraq



Essentials of Disease in Dentistry-Second Edition by Mark Greenwood provides a broad review of medical conditions in relation to dental practice. Fully revised and updated in light of very recent developments, this textbook remains essential for dental students and a useful reference for dental practitioners. Over the years, Greenwood has established himself as an authority in oral and maxillofacial surgery. He carefully bridges the gap in dentistry from general medicine to ensure that dental practitioners are abreast of all systemic diseases that may have an impact on oral health care.

Content Overview

This is also supported by the fact that different main sections are put together in one book in order to discuss the various types of diseases and conditions the dental practitioner may deal or come across. Greenwood begins with general medical states relevant to dental care, starting from systems, such as cardiovascular diseases including diabetes up to respiratory disorders. Remaining chapters deal with infectious diseases, oral cancer, and immunological conditions, with practical guidance about how these should influence treatment planning.

The design of each section is done well to start with an overview of the medical condition itself, further into its oral manifestations then into its implications for dental treatment and its management. This is a strong point in the book, given the orderliness; hence, it is easy to navigate and refer to with ease, especially for clinicians seeking quick consultation in practice.

Critical Evaluation

Clinical relevance and accessibility are the features of Greenwood's work. He managed to introduce the most complicated medical information and not to overload the reader, which is just right for not only the specialists but also for general practitioners and students; the use of clinical cases and illustrations should be appreciated as giving a real-world context to theoretical information. Yet, the only drawback in the book could be that updates of some sections, especially about newer diseases or treatment modalities, could be more exhaustive. While the textbook covers common infections well, less space is devoted to more recent global health issues, such as the impact of COVID-19 on dental practice. This, however, can be excused due to the publication date and is perhaps an area for development in the next edition.

Relevance to the state-of-the-art in modern dental practice

In today's health care environment, integration of medical and dental knowledge has become increasingly important. According to Greenwood, systemic diseases have to be understood not only from a medical but also from a dental perspective. It means that dentists should be watchful while probing the oral cavity to uncover symptoms of various systemic health problems. While this focus is important in and of itself, it becomes even more so within the frame of an aging population with increased chronic conditions and a growing body of evidence linking oral health to health conditions.

Academic Strengths

The Essentials of Disease in Dentistry is an excellent teaching text for educational purposes. Coupled with comprehensive yet succinct language, it is one of those books that make learning easy and a pleasure for dental students. The addition of review questions at the end of each chapter covers critical thinking and helps students judge for themselves how much they have learned. Finally, the theoretical versus practical balance allows readers to immediately apply their knowledge in the clinical setting.

Conclusion

Essentials of Disease in Dentistry, by Mark Greenwood, is an important primer for dental professionals who seek to develop their knowledge of the interrelationship between oral health and general medicine. Admittedly, there is some scope for minor revisions that might be incorporated into future editions, but overall, this book has its strengths outweighing any limitations. Its practical orientation, clarity of presentation, and clinical relevance make it indeed a welcome addition to any dental practitioner's library. Most of the material in this new edition is taken from the success of its forerunner; thus, it will continue to establish this text as a cornerstone in dental education and practice. It is not only a recommendation but a must for the Greenwood work to those professionals in dentistry who would like to expand their knowledge concerning medical conditions affecting dental care. The following reviews strike an excellent balance between summary and critique regarding the book's relevance for contemporary dental practice.