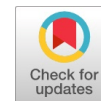


Assessment of use and Awareness of Diclofenac in Syria



Reem Al-Saroukhy, Reem Al-Kara, Reem Habib, Ayat Abboud

Abstract: Diclofenac, known as diclone in Syria, is the most widely used drug in multiple medical conditions. This research was conducted to assess the use and awareness of diclofenac in Syria through a survey. 601 responses were included in this research. Most participants were female (67.7%), between the ages of 18 and 30 years (82.9%), and did not have a chronic disease (86.3%). More than half of the participants were university students (53.4%). A high proportion of the participants had a university education level (87.7%). The most commonly used dosage form for diclofenac was tablets among participants (70.9%). 43.8% chose 50mg as the dose of diclofenac. Most participants improved after using diclofenac (73.7%). Participants were satisfied after diclofenac treatment (66.56%). Most had no side effects after treatment with diclofenac (79.5%). 81.3% of the participants who experienced side effects suffered from stomach pain. Fortunately, 84.4% of the participants did not use the injection combining diclofenac with cortisone and an antibiotic. 56.38% used this combination to treat respiratory infections. A minority of the participants experienced allergic reactions after taking this medication (4%). More than two-thirds of the participants will continue to use diclofenac for pain management in the future (65.9%). 77.9% of the participants used diclofenac without a prescription. Most participants used this medicine after a meal (82%). 36.6% of the participants recorded half an hour as the onset of diclofenac. The participants reported an action duration of 6 hours (24.5%) and 8 hours (31%). This study confirmed the high use of diclofenac among the Syrians. A good level of awareness was observed among the surveyed participants.

Keywords: Diclofenac, Syria, usage, practice, survey.

I. INTRODUCTION

Diclofenac is a non-steroidal, non-selective anti-inflammatory drug derived from acetic acid [1]. Diclofenac was discovered in 1965 by a Swiss pharmaceutical company called Ciba-Geigy. Novartis first marketed it as Voltaren in 1973 for its anti-inflammatory and analgesic properties. Today this medication is available in

more than 150 countries [2]. Diclofenac is often used to relieve pain and inflammation by inhibiting prostaglandin production. It treats and manages various medical conditions such as arthritis, menstrual pain, toothache, and many more [1]-[20]. Diclofenac can be taken orally as a tablet or applied topically as a gel or by injection [21-40]. It is important to follow the prescribed dosage and specific duration of treatment to avoid possible potential side effects including stomach ulcers, kidney problems, and heart diseases [41]-[50]. Diclofenac is generally well tolerated, but individuals with a history of ulcers, heart disease, or kidney problems should use it with caution. It should not be used in late pregnancy due to potential harm to the fetus. Generally, diclofenac is a common and effective drug for managing pain and inflammation [51]-[53]. However, it must be used under the supervision of doctors to ensure safety and good results. This research was carried out to explore practices and knowledge of diclofenac among Syrians.

II. METHODS

A questionnaire was distributed on social media from March to April 2024 to evaluate the Syrians' usage and awareness of the diclofenac. The survey included questions to collect the demographic characteristics of participants and to assess the participants' use and knowledge of diclofenac.

III. RESULTS

A. Demographic Data of Participants

601 responses were collected. The demographic characteristics of the participants are shown in Table I. 82.9% (498) of the surveyed participants were between 18 and 30 years old. 32.3% (194) of the participants were male and 67.7% (405) were female.

32.6% (196) of the participants lived in urban areas, and 67.4% (405) lived in villages. The questionnaire covers a wide range of social situations at different levels of education. The majority of participants have a university education at 87.7%, followed by a master's degree and a doctorate at 8.5%, lower secondary education level at 2.5%, and finally preparatory and elementary education level at 1% and 0.3% respectively. The questionnaire included two categories; First category: participants were university students (53.4%). Second category: participants were not university students (46.6%). The questionnaire covered several different areas of work or study. The work or the study of most of the participants was related to pharmacy or medicine (83.2%).

Manuscript received on 17 August 2024 | Revised Manuscript received on 27 August 2024 | Manuscript Accepted on 15 October 2024 | Manuscript published on 30 October 2024.

*Correspondence Author(s)

Reem Al-Saroukhy*, Student, Faculty of Pharmacy, University of Tishreen, Latakia, Syria. Email ID: reemalsaroukhy@gmail.com ORCID ID: 0009-0006-0089-2696

Reem Al-Kara, Student, Faculty of Pharmacy, University of Tishreen, Latakia, Syria. Email ID: arye13254@gmail.com ORCID ID: 0009-0008-2189-1216

Reem Habib, Student, Faculty of Pharmacy, University of Tishreen, Latakia, Syria. Email ID: reemhabib2000@gmail.com ORCID ID: 0009-0002-0801-512X

Prof. Ayat Abboud, Department of Medicinal Chemistry and Quality Control, Faculty of Pharmacy, University of Tishreen, Latakia, Syria. Email ID: ayatabboud@tishreen.edu.sy ORCID ID: 0000-0001-8387-3875

© The Authors. Published by Lattice Science Publication (LSP). This is an open access article under the CC-BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

The work or study of the rest of the participants was distributed between engineering (6.3%), science (0.8%), or other (7%). Most participants have no chronic disease (86.3%). At the same time, 9.3% of the participants had peptic ulcers, 3.3% had, and 2.7% had heart disease.

Table- I: Demographic Characteristics of Participants in the Survey

Demographic Characteristics		Total Number of Participants (601)	Percentage
1. Age	< 18 years	3	0.5%
	18-30 years	498	82.9%
	31-45 years	64	10.6%
	46-60 years	27	4.5%
	>60 years old	9	1.5%
2. Sex	Male	194	32.3%
	Female	407	67.7%
3. life area	Urbane areas	405	67.4%
	Village	196	32.6%
4. Are you a university student?	Yes	319	53.4%
	non	278	46.6%
4. Educational level	Elementary	2	0.3%
	Preparatory	6	1%
	Secondary	15	2.5%
	University	527	87.7%
	Master-doctorate	51	8.5%
5. Do your study or work relate to?	Medicine/Pharmacy	500	83.2%
	Engineering	38	6.3%
	Science	5	0.8%
	Other	42	7%
	I do not work	16	2.7%
6. Do you have any following diseases?	Gastric ulcer	56	9.3%
	Asthma	20	3.3%
	Hypertension-heart diseases	16	2.7%
	I have not	517	86.3%
7. Have you ever taken Diclofenac before?	Yes	553	88.7%
	No	68	11.3%

B. Level of Participant Usage, Awareness, and Practices

Table II shows the participant's responses regarding the use and knowledge of diclofenac. The most common dosage form of diclofenac was tablets (70.9%), followed by suppositories and creams with 41% and 21.4% respectively. Regarding the conditions of using diclofenac, the highest percentage was related to the treatment of fever and inflammation at 38.1%, followed by toothache at 35.8%, joint, and bone pain at 32.9%, headache at 26.1%, and finally for other medical conditions at 22%. For the dose of diclofenac for an adult, 22.8% of the participants do not know the appropriate dose. 43.8% chose 50mg as the dose, while 20.8% and 18.5% chose 75mg and 100mg respectively. Finally, 10% chose 25mg. When participants were asked how

often they took diclofenac, half (55.2%) rarely took the drug. One-third of participants took this medicine as needed (37.8%). A few took this medicine daily (4%) or several times a week (3%). Majority of the participants felt significant improvement after using diclofenac (73.7%). While 14.3% felt a slight improvement and 0.7% did not notice any improvement.

The degree of satisfaction after the treatment with diclofenac was assessed among the participants in the questionnaire from No. 1 to No. 5, where number 1 indicates complete dissatisfaction and number 5 indicates complete satisfaction. Participants were satisfied (66.56% choosing 4 and 5). The highest percentage of participants did not experience any side effects of diclofenac (79.5%), and only 20.5% experienced side effects. Participants answering the previous question with yes were asked about the types of side effects. The highest percentage of them suffered from stomach pain 91.87%, and 8.13% suffered from other symptoms such as constipation, diarrhea, dizziness, and shortness of breath. In Syria, many patients, even without medical advice, take in cases of common colds an injection containing a combination of diclone, cortisone, and an antibiotic. Fortunately, participants did not use this combination of medications (84.4%) while few participants had previously taken it (15.6%). The percentages of conditions for using this combination were 56.38% for respiratory infections, 21.2% for arthritis, 19.15% for enteritis, and finally 3.19% for skin allergies. Regarding the question of allergic reactions experienced by the participants after taking diclofenac, not all participants answered this question (only 376 responses). Few of the participants had allergic reactions (4%) The percentage was similar among participants who felt better after long-term use (52.7%) and those who did not (47.3%). Most participants will continue to use diclone to treat pain in the future (65.9%).

Table III demonstrates the assessment of the level of knowledge among participants. The survey showed that 77.9% of participants used diclofenac without a prescription, while 29.1% used it with a prescription. Three periods were determined to take diclofenac: after meals, before meals, or at any time. Most participants took this medicine after meals (82%), followed by the participants who took the medicine at any time (15.3%), and finally the participants who took the medicine before food (2.7%). The responses to the average onset of action varied among the participants. 36.6% of the participants recorded a half-hour time. 20.4% of the participants recorded a quarter of an hour. 16.3% of the participants recorded a third of an hour time 11.4% of the participants recorded different times ranging from one hour to 8 hours, and there is a group that did not answer this question and their percentage was 15.3%. For the duration of diclofenac action, answers ranged between 4 hours and 12 hours. The highest percentages of the participants reported an action duration of 6 hours (24.5%) and 8 hours (31%).



Table II: Assessing the use and Awareness Among Participants of Diclofenac (Participants Can Select More than Responses for Some Questions)

Questions	Options	Total number of Participants (601)	Percentage
8. What dosage form did you use?	Tablets	400	70.9%
	Ointments and creams	121	21.42%
	Suppositories	125	22.2%
	Parenteral dosage forms	231	41%
9. What are the conditions for diclofenac use?	Headache	157	26.1%
	Joint and bone pain	198	32.9%
	Toothache	215	35.8%
	inflammation and fever	229	38.1%
	Other	132	22%
10. What is the dose of this medication used for an adult?	25 mg	60	10%
	50 mg	263	43.8%
	75 mg	125	20.8%
	100 mg	111	18.5%
	I do not know	137	22.8%
	Other	31	5.2%
10. How many times have you taken diclofenac?	Daily	18	3.1%
	Several times a week	23	4%
	appropriately	220	37.8%
	Rarely	321	55.2%
11. Did you feel better after taking this medication?	Yes, a big improvement	465	73.70%
	Yes, a slight improvement	83	14.30%
	No, I didn't notice any improvement	5	0.70%
12. How do you evaluate your improvement after taking diclofenac?	1	19	3.16%
	2	17	2.83%
	3	117	19.47%
	4	251	41.76%
	5	149	24.79%
13. Did you experience side effects when taking this medication?	yes	123	20.5%
	No	478	79.5%
14. Did you suffer from side effects?	Stomach pain	113	91.87%
	Other	10	8.13%
15. Have you ever taken diclofenac in combination with cortisone and antibiotics?	Yes	94	15.6%
	No	507	84.4%
16. What were the conditions for taking this combination?	Respiratory tract infection	53	56.38%
	arthritis	20	21.28%
	Inflammatory diseases	18	19.15%
	Skin allergies	3	3.19%
17. Have you had an allergic reaction to diclofenac	Yes	15	4%
	No	361	96%
18. Have you noticed improvement after prolonged use of diclofenac?	Yes	317	52.7%
	No	284	47.3%
19. Will you continue using diclofenac to treat pain in the future?	Yes	396	65.9%
	No	205	34.1%

Table III: Assessing the Level of Knowledge Among Participants

Questions	Options	Total number of participants (601)	Percentages
How well do you know about diclofenac?	In-depth knowledge	228	37.9%
	Relatively good knowledge	352	58.6%
	I don't know it at all.	21	3.5%
How to get diclofenac?	With a prescription	175	29.1%
	Without a prescription	468	77.9%
What time should you take diclofenac?	Before meals	16	2.7%
	After meals	493	82%
	In any time	92	15.3%
What is the average time for diclofenac to start its effects?	Half an hour	220	36.6%
	A quarter of an hour	123	20.4%
	Third of an hour	98	16.3%
	Other	68	11.4%
	No response	98	15.3%
How effective does diclofenac last?	4 hours	40	6.6%
	6hours	147	24.5%
	8 hours	186	31%
	12 hours	67	11.2%
	Other	55	9.1%
	No response	106	17.6%

IV. DISCUSSION

Diclofenac, like other analgesic medication, is available as OTC, which assumes its frequent self-medicated use to treat mild pain symptoms. Diclofenac is widely used in Syria. Diclofenac has various side effects, so people should be aware enough to avoid misuse or excessive use of diclofenac. This research assessed the usage and knowledge of diclofenac among the Syrians. The study results showed that most participants had previously used diclofenac (88.7%). This finding reflected the high consumption of diclofenac among the Syrians. A similar percentage (77.9%) of the participants reported using diclofenac without consulting a doctor. These results are in concordance with the results of similar studies conducted for NSAIDs [52] wherein self-medication and high consumption of NSAIDs were found. There was not a single medical condition that prompted participants to use diclofenac. The following medical conditions received similar percentages: fever and inflammation (38.1%), toothache (35.8%), and joint and bone pain (32.9%). Diclofenac is available in the Syrian pharmaceutical market in various pharmaceutical forms: tablets, suppositories, injections, and creams. Tablets were the most used among the participants (70.9%). Fortunately, despite the high consumption of diclofenac, the percentage of the participants who experienced side effects was low (20.5%).



Stomach pain was the principal side effect resulting from treatment with diclofenac (81.3%). Few participants had allergic reactions after taking this medication (4%). Knowing the recommended dose and the delay between doses of medication is of great importance to achieve the goal of treatment. Generally, 50mg is the recommended dose for diclofenac sodium and potassium. 43.8% chose 50mg as the recommended dose of diclofenac. Administration of some medications is better when taken on an empty stomach. Diclofenac, as with other NSAIDs, should be taken with or after meals to avoid some side effects like stomach pain. Fortunately, most participants took this medicine after meals (82%). For respiratory infections, some patients are given an injection combining diclofenac, an antibiotic, and cortisone. Fortunately, most participants did not use this injection. Half of them reported using this combination to treat respiratory infections. Most participants are satisfied after the treatment with diclofenac and will continue to use diclofenac to treat pain in the future. This result indicates a good knowledge regarding diclofenac. Despite this fact, they took diclofenac without consulting a doctor in most medical conditions. Therefore, there is a need to increase the knowledge and awareness about diclofenac and other OTC medications.

V. CONCLUSION

The finding of this study revealed a high usage of diclofenac among Syrians. A good level of knowledge about diclofenac was remarked. However, there is a need to conduct further research to evaluate the usage and knowledge of other OTC medications among the Syrian population.

DECLARATION STATEMENT

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/ Competing Interests:** Based on my understanding, this article has no conflicts of interest.
- **Funding Support:** This article has not been sponsored or funded by any organization or agency. The independence of this research is a crucial factor in affirming its impartiality, as it has been conducted without any external sway.
- **Ethical Approval and Consent to Participate:** The data provided in this article is exempt from the requirement for ethical approval or participant consent.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Authors Contributions:** The authorship of this article is contributed equally to all participating individuals.

REFERENCES

1. Brogden RN, Heel RC, Pakes GE et al. Diclofenac Sodium: A Review of its Pharmacological Properties and Therapeutic Use in Rheumatic Diseases and Pain of Varying Origin. *Drugs*. 1980;20: 24–48 <https://doi.org/10.2165/00003495-198020010-00002>
2. Skoutakis VA, Carter CA, Mickle TR, et al. Review of Diclofenac and Evaluation of its Place in Therapy as a Nonsteroidal Antiinflammatory Agent. *Drug Intelligence & Clinical Pharmacy*. 1988;22(11):850-859. doi:<https://doi.org/10.1177/106002808802201102>
3. Maihöfner C, de Haas A, Sethi V, Shanga G, Wilcox TK, Csoke E, Fabrikant K. Patients' experience and utilization patterns of diclofenac gel in Germany: a real-world study with a prospective longitudinal survey and a retrospective analysis of pharmacy data. *Current Medical Research and Opinion*. #2023;39(12): 1649–1661. <https://doi.org/10.1080/03007995.2023.2243804>

4. Rainsford KD. Ibuprofen: from invention to an OTC therapeutic mainstay. *Int J Clin Pract Suppl*. 2013 Jan;(178):9-20. PMID: 23163543. <https://doi.org/10.1111/ijcp.12055>
5. Bacchi S, Palumbo P, Sponta A, Coppolino MF. Clinical pharmacology of non-steroidal anti-inflammatory drugs: a review. *Antiinflamm Antiallergy Agents Med Chem*. 2012;11(1):52-64. doi: <https://doi.org/10.2174/187152312803476255>
6. Isbera M, Abbood A, Ibrahim W. Weight and Content Uniformity of Warfarin Sodium Half Tablets. *Research Journal of Pharmacy and Technology*. 2016; 9(3):215-218. doi: <https://doi.org/10.5958/0974-360X.2016.00039.1>
7. Abbood A, Layka R. Weight and content uniformity Study of captopril half-tablets. *Research Journal of Pharmacy and Technology*. 2017;10(6):1621-1626. doi: <https://doi.org/10.5958/0974-360X.2017.00285.2>
8. Chbani D, Abbood A, Alkhayer M. Determination of Nitrite and Nitrate Ions levels in some types of processed meats marketed locally. *Research Journal of Pharmacy and Technology*. 2018;11(4):1442-1447. doi: <https://doi.org/10.5958/0974-360X.2018.0269.X>
9. Abbood A, Malek Z, Al-Homsh Y, Thallaj N. In vitro Study for Antibiotic resistance of bacteria causing Urinary Tract Infection from Syrian adults. *Research Journal of Pharmacy and Technology*. 2022;15(10):4727-2. doi: <https://doi.org/10.52711/0974-360X.2022.00794>
10. Abbood A, Malek Z, Thallaj N. Antibiotic resistance of urinary tract pathogens in Syrian children. *Research Journal of Pharmacy and Technology*. 2022;15(11):4935-9. doi: <https://doi.org/10.52711/0974-360X.2022.00829>
11. Abbood A. Determination of phenolic content and antioxidant activity of some cosmetic creams available in the Syrian market. *Journal of Chemical and Pharmaceutical Sciences*. 2018;11:280-3. <https://doi.org/10.30558/jchps.20181104006>
12. Zrekeh GH, Diab DA, Abboud AY. Determination of Protein and fat oxidation levels in imported infant formula available in Syria. *International Journal of Pharmacy and Pharmaceutical Sciences*. 2016;8:169-72.
13. Abbood A, Optimization of the Imaged cIEF Method for Monitoring the Charge Heterogeneity of Antibody-Maytansine Conjugate, *Journal of Analytical Methods in Chemistry*, 2023, Article ID 8150143, 10 pages. <https://doi.org/10.1155/2023/8150143>
14. Abbood A, Monitoring the charge variant profile of antibody-tomaymycin conjugates by icIEF method, *Acta Pharm. Sci*. 2023, 62 (1), 226-239. <https://doi.org/10.23893/1307-2080.APS6215>
15. Abbood A, Aldiab D, HPLC determination of caffeine in some beverages and pharmaceutical dosage forms available in the Syrian market, *Journal of Chemical and Pharmaceutical Sciences* 3 (10), 1174-1179
16. Wongrakpanich S, Wongrakpanich A, Melhado K, Rangaswami J. A Comprehensive Review of Non-Steroidal Anti-Inflammatory Drug Use in The Elderly. *Aging Dis*. 2018 Feb 1;9(1):143-150. doi: 10.14336/AD.2017.0306. Doi: <https://doi.org/10.14336/AD.2017.0306>
17. Al-Azayzih A, Al-Azzam SI, Alzoubi KH, Jarab AS, Kharaba Z, Al-Rifai RH, Alnajjar MS. Nonsteroidal Anti-inflammatory Drugs Utilization Patterns and Risk of Adverse Events due to Drug-Drug Interactions among Elderly Patients: A Study from Jordan. *Saudi Pharm J*. 2020 Apr;28(4):504-508. doi: <https://doi.org/10.1016/j.jsps.2020.03.001>
18. Brennan R, Wazaify M, Shawabkeh H, Boardley I, McVeigh J, Van Hout MC. A Scoping Review of Non-Medical and Extra-Medical Use of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs). *Drug Saf*. 2021;44(9):917-928. doi: <https://doi.org/10.1007/s40264-021-01085-9>
19. Laveti D, Kumar M, Hemalatha R, Sistla R, Naidu VG, Talla V, Verma V, Kaur N, Nagpal R. Anti-inflammatory treatments for chronic diseases: a review. *Inflamm Allergy Drug Targets*. 2013 Oct;12(5):349-61. doi: 10.2174/18715281113129990053. <https://doi.org/10.2174/18715281113129990053>
20. Mahesh G, Anil Kumar K, Reddanna P. Overview on the Discovery and Development of Anti-Inflammatory Drugs: Should the Focus Be on Synthesis or Degradation of PGE2? *J Inflamm Res*. 2021;14:253-263. Published 2021 Feb 3. doi: <https://doi.org/10.2147/JIR.S278514>
21. Dinarello CA. Anti-inflammatory Agents: Present and Future. *Cell*. 2010;140(6):935-950. doi: <https://doi.org/10.1016/j.cell.2010.02.043>

22. Abbood A, Herrenknecht C, Proczek G, Descroix S, Rodrigo J, Taverna M, Smadja C. Hexylacrylate-based mixed-mode monolith, a stationary phase for the nano-HPLC separation of structurally related enkephalins. *Anal Bioanal Chem.* 2011 Apr;400(2):459-68. doi: <https://doi.org/10.1007/s00216-011-4762-4>
23. Kamel F, Magadmi R, AbuOuf NM, et al. Knowledge, Attitude, and Practice of Paracetamol and Ibuprofen Administration Among Caregivers of the Pediatric Age Group in Jeddah. *Cureus.* 2021;13(1):e12460. Published 2021 Jan 3. doi: <https://doi.org/10.7759/cureus.12460>
24. Asaad RA, Abdullah SS. Breast Cancer Subtypes (BCSs) Classification according to Hormone Receptor Status: Identification of Patients at High Risk in Jableh- Syria. *Research J. Pharm. and Tech.* 2018; 11(8): 3703-3710. doi: <https://doi.org/10.5958/0974-360X.2018.00680.7>
25. Asaad RA. Hormone Receptor Status and its Relation to C-Reactive Protein and other Prognostic factors in Breast Cancer in Jableh- Syria. *Research J. Pharm. and Tech.* 2017; 10(9): 3003-3010. doi: <https://doi.org/10.5958/0974-360X.2017.00532.7>
26. Morkus R, Abbood A. A Survey of the Awareness and Practices of Antibiotic Use Among College Undergraduates and Graduates in Latakia International Journal of Advanced Pharmaceutical Sciences and Research (IJAPSR) ISSN: 2582-7618 (Online), Volume-4 Issue-3, April 2024. DOI: <https://doi.org/10.54105/ijapsr.C4039.04030424>
27. Machkour A, Thallaj NK, Benhamou L, Lachkar M, Mandon D. The Coordination Chemistry of FeCl₃ and FeCl₂ to Bis [2-(2,3-dihydroxyphenyl)-6-pyridylmethyl](2-pyridylmethyl) amine: Access to a Diiron (iii) Compound with an Unusual Pentagonal-Bipyramidal/Square-Pyramidal Environment. *Chemistry–A European Journal.* 2006 ;25;12(25): 6660-6668. <https://doi.org/10.1002/chem.200600276>
28. Labban L, Thallaj N. The Effect of Magnesium Supplementation on Hba1c Level and Lipid Profile Among Type 2 Diabetics. *Acta Scientific Nutritional Health,* 2019, 3,10, 7-12. <https://doi.org/10.31080/ASNH.2019.03.0435>
29. Labban L, Thallaj N, Malek Z. The implications of E-cigarettes or "vaping" on the nutritional status. *Journal of Medical Research and Health Sciences,* 2019, 2, 11, 784-787. <https://doi.org/10.15520/jmhrs.v2i11.128>.
30. Labban L, Thallaj N, Labban A. Assessing the Level of Awareness and Knowledge of COVID-19 Pandemic among Syrians. *Archives of Medicine,* 2020, 12, 2:8, 1-5. DOI: <https://doi.org/10.36648/1989-5216.12.3.309>
31. Labban L, Thallaj N. The medicinal and pharmacological properties of Damascene Rose (*Rosa damascena*): A review. *International Journal of Herbal Medicine.* 2020, 8, 2, 33-37. Corpus ID: 226058951.
32. Labban L, Thallaj N, 2019. *Acta Scient. Nutr. Health.* 3: 7-12. <https://doi.org/10.36648/1989-5216.12.3.309>
33. Thallaj NK, Przybilla J, Welter R, Mandon D. A ferrous center as a reaction site for hydration of a nitrile group into a carboxamide in mild conditions. *J. Am. Chem. Soc.* 2008, 130, 2414-2415. <https://doi.org/10.1021/ja710560g>. <https://doi.org/10.1021/ja710560g>
34. Thallaj N. Microwave-Assisted Synthesis of Oxadiazole and Thiazolidine Derivatives. *Indian Journal of Advanced Chemistry,* 1, 3, 2022. 10-14. DOI: <https://doi.org/10.54105/ijac.D2015.102222>
35. Thallaj N. Quick Review of Chemistry Related to the [Fe]-Hydrogenases. *International Journal of Advanced Pharmaceutical Sciences and Research (IJAPSR)* 2022. 2,4, 1-15. DOI: <https://doi.org/10.54105/ijapsr.C4016.062422>
36. Thallaj N. A Short Review of Some Examples of the Binding of Fullerenes C60 to Transition Metal Complexes. *International Journal of Advanced Pharmaceutical Sciences and Research (IJAPSR)* 2022. 2,6, 1-12. DOI: <https://doi.org/10.54105/ijapsr.C4015.102622>
37. Thallaj N. Review of a Few Selected Examples of Intermolecular Dioxygenases Involving Molecular Oxygen and Non-Heme Iron Proteins. *International Journal of Advanced Pharmaceutical Sciences and Research (IJAPSR)* 2023. 3, 2, 1-18. DOI: <https://doi.org/10.54105/ijapsr.C4011.023223>
38. Thallaj N. A Brief Overview of the General Characteristics and Reactivity Towards Dioxygen of the Ferrous Tris (2-Pyridylmethyl Amine) Series Complexes is Presented. *International Journal of Advanced Pharmaceutical Sciences and Research (IJAPSR)* 2023. 3, 3, 1-18. DOI: <https://doi.org/10.54105/ijapsr.C4012.043323>
39. Thallaj N. Detecting Antioxidant Behavior for Phenolic Content of Some Beauty Care Creams in Syrian Market. *Indian Journal of Advanced Chemistry,* vol. 2, no. 1, pp. 10–14, Jan. 2024, <https://doi.org/10.54105/ijac.C2013.041322>
40. Thallaj N. Synthesis of a New Ligand Tris (2-pyridylmethyl) amine functionalized by a methoxy group and study of Dichloroferrous complexes, its reactivity to dioxygen both in the presence and absence of substrate. *International journal of applied chemistry and biological sciences* 2021, 2 (4), 65-77.
41. Thallaj N. Efficiency in transporting molecular oxygen to iron(II) complexes with ligands type tri (2-pyridylmethyl) amine substitution aromatic in (α) position by a mechanism that mimics biological oxidation. *International Journal of Research Publication and Reviews,* 2021, 2, 10, 951-959.
42. Thallaj NK, Mandon D, White KA. The Design of Metal Chelates with a Biologically Related Redox-Active Part: Conjugation of Riboflavin to Bis (2-pyridylmethyl) amine Ligand and Preparation of a Ferric Complex. *Eur. J. of Inorg. Chem.,* 2007, 44–47. <https://doi.org/10.1002/ejic.200600789>
43. Thallaj NK, Orain PY, Thibon A, Sandroni M, Welter R, Mandon D. Steric Congestion at, and Proximity to, a Ferrous Center Leads to Hydration of α-Nitrile Substituents Forming Coordinated Carboxamides. *Inorg Chem.* 2014 Aug 4;53(15):7824-36. P7826-7827-7828. <https://doi.org/10.1021/ic500096h>
44. Thallaj NK, Rothaus O, Benhamou L, Humbert N, Elhabiri M, Lachkar M, Welter R, Albrecht-Gary AM, Mandon D. *Chemistry.* 2008;14(22):6742-53. P6745-6746-6747. <https://doi.org/10.1002/chem.200701967>
45. Thallaj N, Machkour A, Mandon D, Welter R. Square pyramidal geometry around the metal and tridentate coordination mode of the tripod in the [6-(3'-cyanophenyl)-2-pyridylmethyl] bis (2-pyridylmethyl) amine FeCl₂ complex: a solid state effect. *New. J. Chem.,* 2005, 29, 1555 – 1558. <https://doi.org/10.1039/b512108f>
46. Wane A, Thallaj NK, Mandon D. The Reactivity of Molecular Dioxygen on a Series of Isostructural Dichloroferrous Complexes with Tripodal Tetraamine Ligands: General Access to μ-oxo Diferric Complexes, and Effect of α-Fluorination on the Kinetics of the Reaction. *Chemistry A European journal* 14 (22), 6742-6753. <https://doi.org/10.1002/chem.200701967>
47. Malek ZS, Labban LM. Photoperiod regulates the daily profiles of tryptophan hydroxylase-2 gene expression the raphe nuclei of rats. *International Journal of Neuroscience,* 2021,131 (12), 1155-1161. <https://doi.org/10.1080/00207454.2020.1782903>
48. Abbood A, Thallaj N. Comparison between chromatofocusing and icIEF charge variant profiles of unconjugated monoclonal antibodies and their drug conjugates. *Arab Journal of Pharmaceutical Sciences.* 2023;7;(1).
49. Thallaj N. Characterization of charge heterogeneity of antibody -drug conjugate by anion-exchange chromatofocusing. *Tishreen University Journal-Medical Sciences Series.* (2023). 44,(6),21-29.
50. Beshar S, Alallan L, Hasan Agha MI, Alshamaa I, Thallaj N. Influence of Soil Salinity on the Chemical Composition of Essential Oil of *Rosmarinus officinalis* in Syria. *Research Journal of Pharmacy and Technology.* <https://doi.org/10.52711/0974-360X.2024.00358> 2024; 17(5):2282-8. doi: 10.52711/0974-360X.2024.00358.
51. Khatib O, Alshimala T, Alsaadi A, Thallaj N. The Global Impact of HIV: A Comprehensive Review. *IJAPSR,* vol. 4, no. 3, pp. 6–19, Apr. 2024, doi: <https://doi.org/10.54105/ijapsr.C4040.04030424>
52. Salloum R, Baddour F, Abbood A. A Questionnaire to Evaluate Undergraduate Students' Consumption and Awareness of Non-Steroidal Anti-Inflammatory Drugs in Syria. *International Journal of Advanced Pharmaceutical Sciences and Research (IJAPSR),* Volume-4 Issue-4, June 2024, pages 1-6. DOI: <https://doi.org/10.54105/ijapsr.C4041.04040624>
53. Zamboua R, Abbood A. Survey of Knowledge About the Interaction Between Food and Drugs Among the Syrian Population. *International Journal of Advanced Pharmaceutical Sciences and Research (IJAPSR),* Volume-4 Issue-4, June 2024, pages 22-28. DOI: <https://doi.org/10.54105/ijapsr.D4044.04040624>

AUTHORS PROFILE



Reem Al-Saroukhy, Undergraduate Student, Fifth year in pharmaceutical chemistry and quality control department at faculty of Pharmacy, Tishreen University, Latakia, Syria. Pharmacy student at Tishreen University and registration date at the university during 2019 and 2024. ICDEL certificate in 2024.

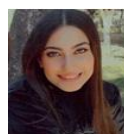


Highlights: Board theoretical experience in analytical methods, synthesis of organic compounds, pharmaceutical preparations, medicinal chemistry principles, TLC methods, high liquid performance methods, Gc methods, UV/visible spectrophotometer principles, electrochemical techniques, IR and NMR specters, extraction methods, gel electrophoresis methods, capillary electrophoresis methods, quality control of solid dosage forms, quality control of liquid dosage forms, quality control of semi-solid dosage forms, GMP, GLP, sampling, Food chemistry.



Reem Al-Kara, Undergraduate Student, Fifth year in pharmaceutical chemistry and quality control department at faculty of Pharmacy, Tishreen University, Latakia, Syria. Pharmacy student at Tishreen University and registration date at the university during 2019 and 2024.

ICDL certificate in 2024. Highlights: Board theoretical experience in analytical methods, synthesis of organic compounds, pharmaceutical preparations, medicinal chemistry principles, TLC methods, high liquid performance methods, Gc methods, UV/visible spectrophotometer principles, electrochemical techniques, IR and NMR specters, extraction methods, gel electrophoresis methods, capillary electrophoresis methods, quality control of solid dosage forms, quality control of liquid dosage forms, quality control of semi-solid dosage forms, GMP, GLP, sampling, Food chemistry.



Reem Habib, Undergraduate Student, Fifth year in pharmaceutical chemistry and quality control department at faculty of Pharmacy, Tishreen University, Latakia, Syria. Pharmacy student at Tishreen University and registration date at the university during 2019 and 2024. ICDL certificate in 2024. Highlights: Board theoretical experience

in analytical methods, synthesis of organic compounds, pharmaceutical preparations, medicinal chemistry principles, TLC methods, high liquid performance methods, Gc methods, UV/visible spectrophotometer principles, electrochemical techniques, IR and NMR specters, extraction methods, gel electrophoresis methods, capillary electrophoresis methods, quality control of solid dosage forms, quality control of liquid dosage forms, quality control of semi-solid dosage forms, GMP, GLP, sampling, Food chemistry.



Prof. Ayat Abbood, Professor in pharmaceutical chemistry and quality control department, Tishreen University - Ph.D. in pharmacy in the field of drug control (2006- 2010, university Paris-11, France) - Master 2 Research: Research and Analytical Development (2005-2006, university Paris-11, France) - Professional

Master 1: Quality Control of Medicines and Other Health Products (2004-2005, university Paris-11, France) - Bachelor's degree in Pharmacy and Medicinal Chemistry (1996-2000, Tishreen University, Latakia) Head of Medicinal Chemistry and Quality Control -Faculty of Pharmacy -Tishreen University (2021 until now) - - Head of Pharmacy Department - College of Pharmacy and Health Sciences - Al-Manara University (3 years) - Dean of Pharmacy Faculty –Al-Jazeera University (one year).

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the Lattice Science Publication (LSP)/ journal and/ or the editor(s). The Lattice Science Publication (LSP)/ journal and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.