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Preface

We would like to present, with great pleasure, the inaugural volume-10, Issue-9, September 2024, of a scholarly journal, *International Multispecialty Journal of Health*. This journal is part of the AD Publications series *in the field of Medical, Health and Pharmaceutical Research Development*, and is devoted to the gamut of Medical, Health and Pharmaceutical issues, from theoretical aspects to application-dependent studies and the validation of emerging technologies.

This journal was envisioned and founded to represent the growing needs of Medical, Health and Pharmaceutical as an emerging and increasingly vital field, now widely recognized as an integral part of scientific and technical statistics investigations. Its mission is to become a voice of the Medical, Health and Pharmaceutical community, addressing researchers and practitioners in below areas

Clinical Specialty and Super-specialty Medical Science:

It includes articles related to General Medicine, General Surgery, Gynecology & Obstetrics, Pediatrics, Anesthesia, Ophthalmology, Orthopedics, Otorhinolaryngology (ENT), Physical Medicine & Rehabilitation, Dermatology & Venereology, Psychiatry, Radio Diagnosis, Cardiology Medicine, Cardiothoracic Surgery, Neurology Medicine, Neurosurgery, Pediatric Surgery, Plastic Surgery, Gastroenterology, Gastrointestinal Surgery, Pulmonary Medicine, Immunology & Immunogenetics, Transfusion Medicine (Blood Bank), Hematology, Biomedical Engineering, Biophysics, Biostatistics, Biotechnology, Health Administration, Health Planning and Management, Hospital Management, Nephrology, Urology, Endocrinology, Reproductive Biology, Radiotherapy, Oncology and Geriatric Medicine.

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It includes articles related to Pathology, Microbiology, Forensic Medicine and Toxicology, Community Medicine and Pharmacology.

Basic Medical Science:

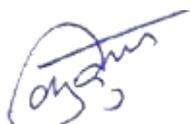
It includes articles related to Anatomy, Physiology and Biochemistry.

Spiritual Health Science:

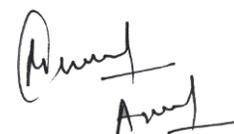
It includes articles related to Yoga, Meditation, Pranayam and Chakra-healing.

Each article in this issue provides an example of a concrete industrial application or a case study of the presented methodology to amplify the impact of the contribution. We are very thankful to everybody within

that community who supported the idea of creating a new Research with *IMJ Health*. We are certain that this issue will be followed by many others, reporting new developments in the Medical, Health and Pharmaceutical Research Science field. This issue would not have been possible without the great support of the Reviewer, Editorial Board members and also with our Advisory Board Members, and we would like to express our sincere thanks to all of them. We would also like to express our gratitude to the editorial staff of AD Publications, who supported us at every stage of the project. It is our hope that this fine collection of articles will be a valuable resource for *IMJ Health* readers and will stimulate further research into the vibrant area of Medical, Health and Pharmaceutical Research.



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Dr. Praveen Mathur is working as Professor- Pediatric Surgery and is recipient of Commonwealth Fellowship in Pediatric Laparoscopy from Uk and fellowship award in minimal access Surgery (FMAS). He has done Clinical observer ship in the Department of Pediatric Surgery, Johns Hopkins University, Baltimore, USA. (2008). He has presented and published a number of research articles at national and international level. He is reviewer of prestigious Journal of Pediatric Surgery (JPS) and World Journal of Gastroenterology, Journal of neonatal Surgery (JNS).

Research Area: Pediatric Surgery & Laparoscopy.

Table of Content

Volume-10, Issue-9, September 2024

S.No	Title	Page No.
1	Improved Strabismus Surgical Outcomes with a New Table Authors: Prof. (Dr.) Bijay Kumar Parida, Dr.Anannya Anupurva  DOI: https://dx.doi.org/10.5281/zenodo.13859044  Digital Identification Number: IMJH-SEP-2024-1	01-09
2	The Impact of Physical Parameters on Organ Weight: An Autopsy Analysis Authors: Rafik Khan, R.K Mathur  DOI: https://dx.doi.org/10.5281/zenodo.13959413  Digital Identification Number: IMJH-SEP-2024-2	10-15
3	Novel Heterocyclic Compounds for Cancer Chemotherapy Authors: Mohan Rahul Sopan, Dr. Deepak Kumar Birla  DOI: https://dx.doi.org/10.5281/zenodo.14910232  Digital Identification Number: IMJH-SEP-2024-3	16-22
4	Evaluation of Wound healing activity of leaves of <i>Passiflora foetida</i> L in Streptozotocin-induced diabetes mellitus and Diabetic Excision Model Authors: Gopal Singh Sisodiya; Dr Kuldeep Hemraj Ramteke  DOI: https://dx.doi.org/10.5281/zenodo.14926205  Digital Identification Number: IMJH-SEP-2024-4	23-28

Improved Strabismus Surgical Outcomes with a New Table

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Abstract—

Purpose: To find out the most scientific formula for strabismus surgery.

Patients and method: 84 subjects having normal eyes ranging from 3 years of age to 48 years over 4 years from 2011 to 2015 were photographed by iPhone with flash to locate reflex of the light on a part of eye, while 6 extra ocular muscles moved the eye to the extremes, in the direction of their action. The distance of the reflex was measured from center of the pupil.

The diameter of the cornea was measured from white to white by caliper. Pupil diameter was also measured in every case.

Each mm of reflex away from the center of the pupil is equal to 15 prism diopter (PD)¹. So the total deviation of eye at extreme action of a particular muscle is measured and converted to PD.

Each extraocular muscle has different length.

Assumption: The length of the muscle is responsible for total deviation of the eye by full action of the muscle.

Then the surgical table was applied to surgically correct 84 eyes having, either esotropia or exotropia.

Results: 1 mm of resection or recession of Lateral Rectus (LR) corrects 5PD. Similarly, 1mm of either recession or resection of Medial Rectus (MR), Superior Rectus (SR), Inferior Rectus (IR) and Superior Oblique (SO) corrects 2.5PD. 1mm of recession or resection of Inferior Oblique (IO) corrects 4PD. This finding is statistically significant and p value less than 0.05.

Conclusion: The strabismus surgical table created by the author is accurate as verified by strabismus operations over 4 years.

Keywords— Strabismus, surgical table, surgical correction.

I. INTRODUCTION

Many strabismus surgical tables were proposed by erudite authors of strabismology in different established journals and also faithfully followed all over the world. These tables are empirical, rather than scientific. So, dissatisfactory outcome and reoperation are being done to correct the strabismus.

First a strabismus surgical table was invented in this article and then applied to surgical correction of eyes having either an esotropia or an exotropia.

The success of the operation made the hypothesis a thesis.

II. MATERIAL AND METHOD

84 pairs of normal eyes of subjects ranging from age 3 years to 48 years of age. Equal numbers of male and female individuals were selected. From 3 years to 14 years 42 persons and equal 42 persons from the age of 15 years to 48 years were also selected. Each group had equal number of males and females.

The diameter of each eye was measured from limbus to limbus by caliper. The diameter of the pupil was also recorded.

By iPhone the photos of the extreme position of the pair of eyes were photographed with flash light active. Lateral rectus and medial rectus were evaluated by asking the patient to look at the extreme on horizontal plane. The position of the eyes was photographed from 2 ft, so that reflexes on cornea and sclera could be photographed without using accommodation of eye. Similarly, right superior rectus and left inferior oblique were evaluated by asking the subject to look right superior temporal and left superior rectus and right inferior oblique were evaluated by asking to look to left superior temporal. Right Inferior rectus and left superior oblique were measured by moving the eye ball to right inferior temporal and left inferior rectus and right superior oblique were evaluated asking to move the eye to left inferior temporal.

Position of the light reflex was measured from the center of the pupil. These positions were converted to prism diopters. From the center of pupil to the border of the pupil is 2mm, from the border of the pupil to the limbus is 4 mm and midpoint between these 2 is 2mm from the pupil.

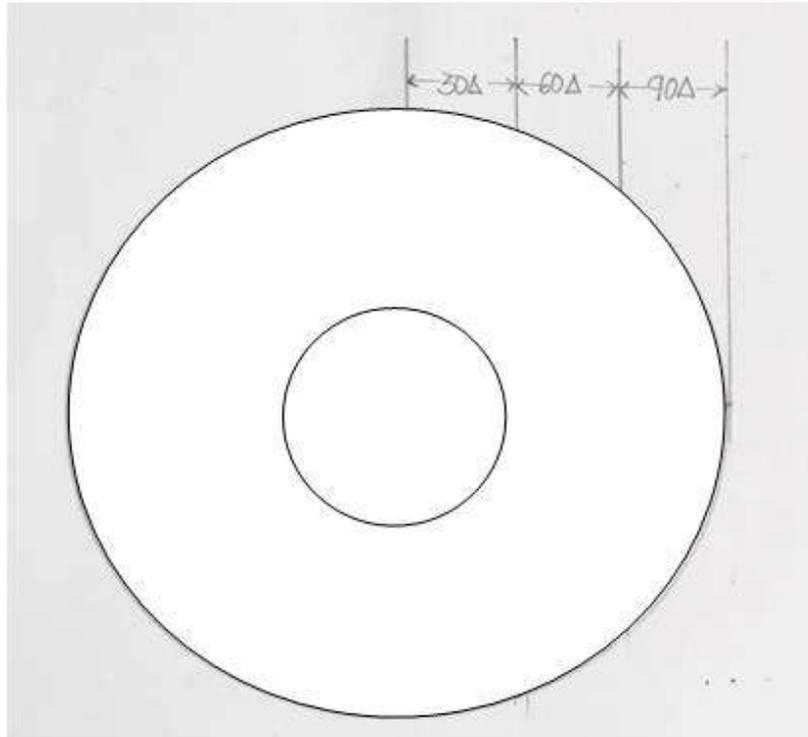


FIGURE 1: Position of the light reflex

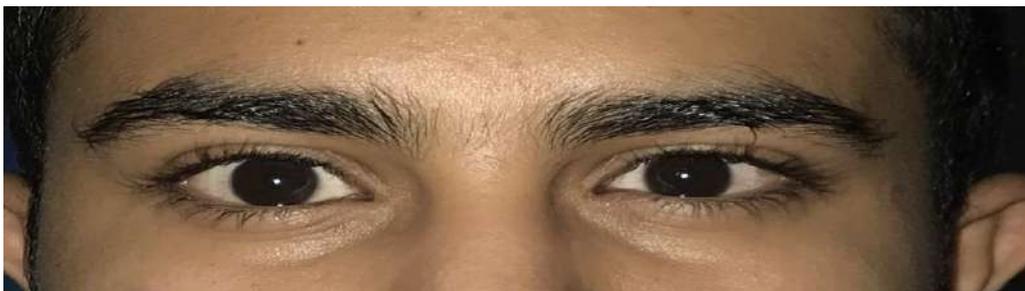


PHOTO 1: corneal reflex eyes looking straight



PHOTO 2: Scleral reflex on right eye medial side, eyes looking at extreme right, showing full action of lateral rectus of right eye and medial rectus of left eye



PHOTO 3: Scleral reflex on right eye medial side, eyes looking at extreme right and left eye occluded



PHOTO 4: Corneal reflex on limbus of left eye, looking extreme right due to full action of medial rectus



PHOTO 5: Corneal reflex on limbus, looking extreme left superior temporal due to full action of superior rectus (left eye) & inferior oblique (right eye)



PHOTO 6: Corneal reflex on limbus, looking extreme left superior temporal due to full action of inferior oblique (right eye)



PHOTO 7: Corneal reflex on limbus, looking extreme left inferior temporal due to full action of inferior rectus (left eye)

The length of lateral rectus from its origin to insertion including tendinous part is 38.4mm ,medial rectus 38.5,superior rectus 38.2mm,inferior rectus 37.2mm,superior oblique 39.2mm and inferior oblique 22.5 mm ² .

The deviation of eye in PD was divided by the length of the muscle to find out the possible deviation the muscle can create per 1mm of action of the muscle.

TABLE 1

Name of muscle	Length in mm
Lateral Rectus	38.4
Medial Rectus	38.5
Superior Rectus	38.2
Inferior Rectus	37.2
Superior Oblique	39.2
Inferior Oblique	22.5

Photograph 1: Lateral Rectus; light reflex was found on sclera 6 to 7.5 mm away from limbus. In average its 6.75 mm away from limbus on moving lateral rectus on horizontal deviation and 12.75 mm away from center of the pupil. $(90 \text{ PD}/6\text{mm})=15\text{PD}$. Total distance of light reflex on sclera from pupil is $(6+6.75) =12.75\text{mm}$. So, $15 \times 12.75=191.25 \text{ PD}/$ length of lateral rectus= $191.25/38.4 \text{ mm}=4.99= 5 \text{ PD}/1\text{mm}$.

Photograph 2: Medial rectus; corneal reflex is on the limbus= $90\text{PD}/38.5 \text{ mm}=2.35=2.4= 2.5 \text{ PD}/1\text{mm}$ (for convenience)

Photograph 3: Superior rectus; corneal reflex is on the limbus= $90\text{PD}/38.2\text{mm}=2.36=2.4= 2.5 \text{ PD}/1\text{mm}$ (for convenience)

Photograph 4: Inferior rectus; corneal reflex is on the limbus= $90\text{PD}/37.2\text{mm}=2.42=2.5 \text{ PD}/1\text{mm}$ (for convenience)

Photograph 5: Superior Oblique; corneal reflex is on the limbus= $90PD/39.2mm=2.3=2.5 PD/1mm$ (for convenience)

Photograph 6: Inferior Oblique; corneal reflex is on the limbus= $90PD/22.5mm=4 PD/1mm$

TABLE 2

Name of the muscle	Correction in PD/ 1 mm
Lateral Rectus	5
Medial Rectus	2.5
Superior Rectus	2.5
Inferior Rectus	2.5
Superior Oblique	2.5
Inferior Oblique	4

Surgical procedures used to correct esotropia and exotropia are a combination of recession and resection. The table for strabismus surgery thus generated was applied on 84 cases, spreading from age 3 years to 45 years. They were divided into 2 groups; pediatric from 3 years to 14 years. The second group was from 15 years to 45 years. The number of pediatric group was 42 and adult were 42 cases. Eyes with esotropia were 42 and exotropia were 42. Each patient had undergone cycloplegic refraction of refractive error. Fundus examination and amblyopia therapy was done before the operation. The results of the operation were recorded on 1st postop day, 1 month, and 3 months after the surgery and followed till 3 years. Any refractive error was also corrected and amblyopia therapy was applied as necessary.

III. RESULTS

All the 84 cases were perfectly operated resulting accurate alignment and motility correct in all 9 cardinal positions.

Photo 8a preoperative: ESOTROPIA with INFERIOR OBLIQUE OVERACTION.

Photo 8b-BILATERAL LATERAL RECTUS RESECTION WITH INFERIOR RECTUS TRANSPOSITION ANTERIORLY AND NASAL TO INFERIOR RECTUS.40PD of IO overaction.10mm of transposition of Inferior oblique.

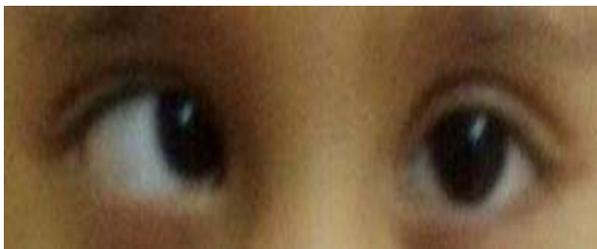


PHOTO 8a: Preoperative ESOTROPIA



PHOTO 8b: Postop



PHOTO 9a: Preop ESOTROPIA



PHOTO 9b: Postop



PHOTO 10a: preop ESOTROPIA with mild inferior oblique overaction



PHOTO 10b: Postop



PHOTO 11a: Preop EXOTROPIA



PHOTO 11b: Postop



PHOTO 12a: Preop EXOTROPIA



PHOTO 12b: Postop



PHOTO 13a: Preop EXOTROPIA



PHOTO 13b: Post op

IV. DISCUSSION

Standardization of surgical treatment of strabismus has long been the ambition of surgeons³. Even for the most experienced, the number of millimeters (mm) of recession and resection to perform is always a difficult decision. Because of individual variation in response to similar surgical procedures, Cooper (1961) believed it difficult to predict the result. Knapp ¹(1958) considered accurate estimation impracticable and Scobee^{5,6} (1952) and Stallard (1965) regarded it as impossible.

The general principle of muscle surgery are discussed often enough, but precise detail regarding the amount of muscle to move or remove is frequently omitted and the decision is left to the surgeon’s skill and experience in each individual case. Lyle (1950), Scobee (1952), Castanova Puyeo³ (1958) and Cooper (1961)²,who have all described the conditions that may influence the result of the operation vary considerably in their estimation of the relationship between the amount of recession or resection and the degree of correction of strabismus.Lyle⁴ (1950) stated that 1 5mm recession of the medial rectus produced an average final reduction between 7 ⁰and 12⁰and that the average effect of resection of the lateral rectus “is to reduce the angle of deviations by about 10⁰.” adding that “it is usually combined with either recession or tenotomy of the medial rectus”.

Castanova Puyeo (1958) stated that for each millimeter of recession of the medial rectus that should be correction of 3⁰. but for each millimeter of resection of the lateral rectus only 1⁰ or even less. Stallard (1965) held that roughly 1mm of recession of the rectus corrected about 4⁰of strabismus and 1mm of adjustment to the lateral rectus about 2⁰.

Among the most interesting attempts to standardize the surgical treatment of horizontal strabismus, reference must be made to the work of Urist^{7,8} (1951).His surgery, as he stated ‘is theoretically based on the concept that the position of the eyes is determined by a state of balance between convergence and divergence innervations’, and his operative procedure is predetermined by the amount of deviation present for distance vision and downward gaze.

V. STRABISMUS SURGICAL TABLES BY PARKS

**TABLE 3
SURGERY OF ESOTROPIA**

Esotropia PD	Bilatera Medial Rectus Recessions(mm)
15-20	3
21-30	4
31-40	5
41-50	6
51-60	7

TABLE 4
BILATERAL LATERAL RECTUS RESECTION

Esotropia (PD)	Lateral Rectus (mm)
15-20	4
21-30	5
31-40	6
41-50	7

TABLE 5
UNILATERAL MEDIAL RECTUS RESECTION AND LATERAL RECTUS RESECTION

Esotropia (PD)	Medial Rectus Recession(mm)	Lateral Rectus Resection(mm)
15-20	3	5
21-30	4	6
31-40	5	7
41-50	6	8

TABLE 6
SURGERY ON EXOTROPIA; BILATERAL LATERAL RECTUS RESECTION

Exotropia (PD)	Lateral Rectus Recession (mm)
15-20	5
21-30	6
31-40	7
41-50	8
51-60	9

TABLE 7
BILATERAL MEDIAL RECTUS RESECTION

Exotropia (PD)	Medial Rectus Resection (mm)
15-20	3
21-30	4
31-40	5

TABLE 8
UNILATERAL MEDIAL RECTUS RESECTION & LATERAL RECTUS RESECTION

Exotropia (PD)	Media Rectus Resection (mm)	Lateral Rectus Recession (mm)
15-20	3	5
21-30	4	6
31-40	5	7
41-50	6	8

VI. AUTHOR'S SURGICAL TABLE

TABLE 9

ESOTROPIA: BILATERAL MEDIAL RECTUS RESECTION WITH 5mm OF OVERCORRECTION

Esotropia (PD)	Medial Rectus Resection(mm)
15+5=20	4
20+5=25	5
30+5=35	7
40+5=45	9
50+5=55	11

TABLE 10

ESOTROPIA: BILATERAL LATERAL RECTUS RESECTION WITH 5 mm OF OVERCORRECTION

Esotropia (PD)	Bilateral Lateral Rectus Resection(mm)
15+5=20	2
20+5=25	2.5
30+5=35	3.5
40+5=45	4.5
50+5=55	5.5
60+5=65	6.5
70+5=75	7.5
80+5=85	8.5
90+5=95	9.5

TABLE 11

ESOTROPIA: UNILATERAL RESECTION AND RESECTION WITH 5 mm OF OVERCORRECTION

Esotropia (PD)	Medial Rectus Resection(mm)	Lateral Rectus Resection(mm)
15+5=20	4	2
20+5=25	4	3
30+5=35	4	5
40+5=45	8	5
50+5=55	8	7
60+5=65	8	9
70+5=75	10	10

TABLE 12**EXOTROPIA: BILATERAL MEDIAL RECTUS RESECTION WITH 5 mm OF OVERCORRECTION**

Exotropia (PD)	Bilateral Medial Rectus Resection (mm)
15+5=20	4
20+5=25	5
30+5=35	7
40+5=45	9
50+5=55	11

TABLE 13**EXOTROPIA: BILATERAL LATERAL RECTUS RESECTION WITH 5 mm OF OVERCORRECTION**

Exotropia (PD)	Bilateral Lateral Rectus Resection (mm)
15+5=20	2
20+5=25	2.5
30+5=35	3.5
40+5=45	4.5
50+5=55	5.5
60+5=65	6.5
70+5=75	7.5
80+5=85	8.5
90+5=95	9.5

TABLE 14**EXOTROPIA: UNILATERAL MEDIAL RECTUS RESECTION & LATERAL RECTUS RESECTION WITH 5 mm OF OVERCORRECTION**

Exotropia (PD)	Medial Rectus Resection(mm)	Lateral Rectus Resection(mm)
15+5=20	4	2
20+5=25	4	3
30+5=35	4	5
40+5=45	6	6
50+5=55	6	8
60+5=65	8	9
70+5=75	8	11

It is evident from above discussion that the strabismus surgical table proposed by the author is most scientific and most applicable as proved by strabismus surgery on esotropic and exotropic cases of horizontal deviations. However, the formulae to correct strabismus due to vertical muscles and oblique deviations due to superior oblique muscle have to be proved by application of these formulae on surgery.

VII. CONCLUSION

1mm of either recession or resection of lateral rectus corrects 5PD of strabismus. But resection and recession of medial rectus, superior rectus, inferior rectus and superior oblique corrects 2.5PD of strabismus. 1mm of recession and resection of inferior oblique corrects 4PD of strabismus

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The Impact of Physical Parameters on Organ Weight: An Autopsy Analysis

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Abstract— Organ weight serves as a critical indicator in forensic medicine for distinguishing between normal and abnormal conditions. This study analyzed the weights of six major organs—brain, lungs, heart, spleen, liver, and kidneys—in 200 cases, comprising 80 females and 120 males. The findings show that organ weights are consistently higher in males than in females across all age groups. For instance, the mean weight of the liver in females is 1240.27 ± 101 grams, while in males, it is 1352.16 ± 99 grams. Similarly, the brain weighs 1114.82 ± 98 grams in females and 1224 ± 96 grams in males. The right lung in females weighs 487.52 ± 53.53 grams and in males, 524.6 ± 45.65 grams, while the left lung weighs 448.70 ± 50.36 grams in females and 473.8 ± 39 grams in males. Spleen weight in females is 107.52 ± 13.5 grams and in males, 114.68 ± 14.16 grams. The heart weighs 258.29 ± 27.18 grams in females and 267.84 ± 25.49 grams in males. Kidney weights also differ, with the left kidney weighing 108.74 ± 16.17 grams and the right kidney 107.96 ± 15.78 grams in females, while in males, the left kidney weighs 113.72 ± 15.20 grams and the right kidney 112.9 ± 14.96 grams. These findings provide baseline organ weight data for the population in this region.

Keywords— Organ weight, Postmortem, Autopsy, Forensic medicine.

I. INTRODUCTION

Organ weight plays a crucial role in both medico-legal and pathological autopsies. Establishing region-specific normal organ weights is essential for distinguishing them from abnormalities caused by trauma, pathology, or disease, which aids in determining the cause of death. Additionally, organ weight can offer valuable insights into an individual's body weight and height estimation. Various factors, including genetics, age, sex, and race, influence organ weight, alongside external factors like socioeconomic status, dietary habits, and environmental conditions.

In a culturally diverse country like India, these external factors can vary significantly between regions. The current study, conducted in the Ajmer region of Rajasthan, aims to establish normal weight ranges for major internal organs and explore any correlations between body weight and organ weight.

This research is the first of its kind for the population in this region and provides essential data for forensic specialists, pathologists, and physicians.

II. MATERIALS AND METHODS

This study was carried out in the Department of Forensic Medicine at J.L.N. Medical College and Hospital, Ajmer, Rajasthan. It involved a sample size of 200 cases, selected randomly from routine autopsies conducted between January 2018 and August 2019. The inclusion criteria required cases where the cause of death was unrelated to any condition affecting organ weight, and the postmortem interval was less than 24 hours. Cases with decomposition, congenital organ anomalies, trauma to the organs, or long-term medical conditions that could influence organ weight were excluded.

After conducting the autopsies, organs including the brain, lungs, heart, liver, spleen, and kidneys were removed, cleaned, and weighed using a standard electronic weighing machine, accurate to within 1 gram. Each organ was weighed after removing

any surrounding fat or connective tissue. The organ weights were recorded and analyzed in relation to the subject's sex, body weight, and age.

III. OBSERVATIONS AND RESULTS

The study included 200 cases, of which 120 were male and 80 were female. The mean age of males was 37.5 years, while the mean age of females was 35.2 years. Organ weights were found to be consistently higher in males than in females across all six organs studied.

The brain in females weighed an average of 1114.82 ± 98 grams, while in males, the mean weight was 1224 ± 96 grams. The lungs showed similar differences, with the right lung in females weighing 487.52 ± 53.53 grams and in males 524.6 ± 45.65 grams. The left lung weighed 448.70 ± 50.36 grams in females and 473.8 ± 39 grams in males.

The liver, the heaviest organ in both sexes, weighed 1240.27 ± 101 grams in females and 1352.16 ± 99 grams in males. The heart weighed 258.29 ± 27.18 grams in females and 267.84 ± 25.49 grams in males. The spleen showed less variation, weighing 107.52 ± 13.5 grams in females and 114.68 ± 14.16 grams in males.

For the kidneys, the left kidney weighed 108.74 ± 16.17 grams and the right kidney 107.96 ± 15.78 grams in females, while in males, the left kidney weighed 113.72 ± 15.20 grams and the right kidney 112.9 ± 14.96 grams.

These results indicate that organ weights in this population are within the range of previously reported values in the literature, with slight variations based on sex and individual body weight.

TABLE 1
MEAN STANDARD DEVIATION AND RANGE OF ORGANS WEIGHTS AS REGARD TO THE AGE GROUP 20-29 YEARS AND GENDER

Female (n=20)					Male (n=30)				
	Mean	S.D.	Min	Max		Mean	S.D.	Min	Max
Age	25	2.922734	21	29	Age	24.5	2.555708	21	29
Bodyweight	65.6	8.988128	52	80	Bodyweight	71.7	9.829431	56	88
Liver	1226	114.1097	1000	1380	Liver	1336	94.63588	1200	1500
Brain	1073	76.80704	980	1240	Brain	1200	120.1687	1000	1410
Heart	292.8	34.85408	220	360	Heart	296.8	21.39821	268	350
Right lung	502	55.38157	400	580	Right lung	510	56.20937	450	650
Left lung	454	39.62536	380	510	Left lung	462	47.15716	400	560
Spleen	98.6	5.986425	88	110	Spleen	106.8	7.64795	98	120
Left. kidney	99.4	5.918085	88	108	Left. kidney	105.6	5.075631	98	112
Right kidney	97.4	5.848946	84	104	Right kidney	102.5	6.256136	90	110

TABLE 2
MEAN STANDARD DEVIATION AND RANGE OF ORGANS WEIGHTS AS REGARD TO THE AGE GROUP 30-39 YEARS AND GENDER

Female (n=15)					Male (n=30)				
	Mean	S.D.	Min	Max		Mean	S.D.	Min	Max
Age	34.2	2.582864	31	39	Age	35.7	2.848051	31	39
Bodyweight	62.2	7.80873	52	78	Bodyweight	68.7	9.201541	55	87
Liver	1230	65.86272	1100	1322	Liver	1384.8	62.02784	1322	1500
Brain	1113	74.52221	1000	1210	Brain	1267.2	116.4024	1100	1434
Heart	251	16.53963	220	280	Heart	285	22.61399	240	320
Right lung	478	43.44488	410	560	Right lung	521.8	49.73611	450	610
Left lung	441	41.44427	380	520	Left lung	458.2	31.1462	420	520
Spleen	109.4	12.72552	90	130	Spleen	119.8	18.49967	100	170
Left .kidney	110.6	15.67596	90	134	Left .kidney	114.2	11.14962	100	140
Right kidney	109.8	15.13196	90	132	Right kidney	112	11.94078	100	140

TABLE 3
MEAN STANDARD DEVIATION AND RANGE OF ORGANS WEIGHTS AS REGARD TO THE AGE GROUP 40-49
YEARS AND GENDER

Female (n=20)					Male (n=30)				
	Mean	S.D.	Min	Max		Mean	S.D.	Min	Max
Age	44.9	2.447413	41	49	Age	45.1	2.932144	41	49
Body weight	61.7	7.627559	52	76	Body weight	62	5.150888	54	69
Liver	1226.2	72.01384	1100	1322	Liver	1357	97.52481	1200	1488
Brain	1103	82.0562	1000	1210	Brain	1222	106.4064	1100	1360
Heart	251	16.53963	220	280	Heart	254.8	12.30663	240	270
Right lung	476	42.11365	410	550	Right lung	534	35.20644	480	580
Left lung	447	52.60341	380	560	Left lung	489	34.69943	420	530
Spleen	109.4	12.72552	90	130	Spleen	116.2	13.02617	100	134
Left kidney	111.6	15.2751	90	134	Left. kidney	117	17.38907	90	142
Right kidney	111	14.77286	90	132	Right kidney	117.8	16.26241	98	142

TABLE 4
MEAN STANDARD DEVIATION AND RANGE OF ORGANS WEIGHTS AS REGARD TO THE AGE GROUP 50-59
YEARS AND GENDER

Female(n=15)					Male(n=20)				
	Mean	S.D.	Min	Max		Mean	S.D.	Min	Max
Age	54.81818	2.711282	51	59	Age	54.8	3.045644	50	59
Body weight	59.72727	6.587974	52	74	Body weight	60.6	5.193959	52	67
Liver	1194.727	78.49793	1100	1322	Liver	1354	110.7013	1180	1488
Brain	1076.727	85.51285	980	1210	Brain	1223.4	107.8134	1100	1360
Heart	247.4545	18.21089	210	280	Heart	252.3	10.38061	240	270
Right lung	461.0909	56.81623	380	570	Right lung	534	35.26392	480	586
Left lung	429.8182	62.75199	340	560	Left lung	486.2	31.91698	420	520
Spleen	105.6364	15.10134	88	130	Spleen	115.8	12.83823	100	134
Left kidney	106.9091	17.88917	80	134	Left kidney	116.4	17.0966	90	142
Right kidney	106.1818	17.30354	80	132	Right kidney	116.6	15.59097	98	142

TABLE 5
MEAN STANDARD DEVIATION AND RANGE OF ORGANS WEIGHTS AS REGARD TO THE AGE GROUP 60-69
YEARS AND GENDER

Female(n=10)					Male(n=10)				
	Mean	S.D.	Min	Max		Mean	S.D.	Min	Max
Age	64.4	2.929684	60	69	Age	64.4	2.923497	60	69
Bodyweight	59.9	5.051263	54	68	Body weight	59.9	5.040595	54	68
Liver	1329	114.4523	1180	1482	Liver	1329	114.2106	1180	1482
Brain	1212.2	101.2724	1100	1360	Brain	1212.2	101.0585	1100	1360
Heart	250.3	13.36362	224	270	Heart	250.3	13.3354	224	270
Right lung	523.2	44.87451	442	586	Right lung	523.2	44.77974	442	586
Left lung	473.6	39.96066	412	520	Left lung	473.6	39.87626	412	520
Spleen	114.8	13.65532	100	134	Spleen	114.8	13.62648	100	134
Left. kidney	115.4	18.33141	90	142	Left kidney	115.4	18.2927	90	142
Right kidney	115.6	16.94177	90	142	Right kidney	115.6	16.90599	90	142

TABLE 6
SHOWING THE CORRELATION BETWEEN BODY WEIGHT AND ORGAN WEIGHT

	Female (n=80)						Male (n=120)					
	Mean	S.D.	Min	Max	Correlation	p value	Mean	S.D.	Min	Max	Correlation	p Value
Weight	61.7843 14	7.574713	52	80			64.58	8.601661	52	88		
Liver	1240.27 45	101.5169	100 0	148 2	0.608435	P<0.01	1352.1 6	99.02572	118 0	150 0	0.554704	p<0.01
Brain	1114.82 35	98.04074 9	980	136 0	0.486752	p<0.01	1224.9 6	112.3597 8	100 0	143 4	0.525279	P<0.01
Heart	258.294 12	27.18844 6	210	360	0.310085	P<0.01	267.84	25.49194	224	350	0.583806	P<0.01
Rt.lung	487.529 41	53.53289 9	380	586	0.334494	P<0.01	524.6	45.65227 6	442	650	0.325787	P<0.01
Lt.lung	448.705 88	50.36132	340	560	0.403257	P<0.01	473.8	39.25777 5	400	560	0.298173	P<0.01
Spleen	107.529 41	13.50898 1	88	134	0.33121	P<0.01	114.68	14.16896 3	98	170	0.331702	P<0.01
Lt kidney	108.745 1	16.17264 6	80	142	0.392179	P<0.01	113.72	15.20327 1	90	142	0.149658	P<0.01
Rt kidney	107.96 78	15.78124 3	80	142	0.403778	P<0.01	112.9	14.96428 5	90	142	0.064473	P<0.01
Age	44.8627 45	14.27737 4	21	69	-0.28004	P<0.01	44.9	14.29829	21	69	-0.51044	p>0.05

TABLE 7A
SHOWING MEAN AGE AND S.D OF WEIGHT OF ORGANS IN MALES AS REGARD TO AGE

Age	20-29		30-39		40-49		50-59		60-69	
Subject	30		30		30		20		10	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
liver	1336	94.63588	1384.8	62.02784	1357	97.52481	1354	110.7013	1329	114.2106
brain	1200	120.1687	1267.2	116.4024	1222	106.4064	1223.4	107.8134	1212.2	101.0585
heart	296.8	21.39821	285	22.61399	254.8	12.30663	252.3	10.38061	250.3	13.3354
Rt .lung	510	56.20937	521.8	49.73611	534	35.20644	534	35.26392	523.2	44.77974
Lt. lung	462	47.15716	458.2	31.1462	489	34.69943	486.2	31.91698	473.6	39.87626
spleen	106.8	7.64795	119.8	18.49967	116.2	13.02617	115.8	12.83823	114.8	13.62648
Lt. kidney	105.6	5.075631	114.2	11.14962	117	17.38907	116.4	17.0966	115.4	18.2927
Rt kidney	102.5	6.256136	112	11.94078	117.8	16.26241	116.6	15.59097	115.6	16.90599

TABLE 7B
SHOWING MEANS AGE AND S.D OF WEIGHT OF ORGANS IN FEMALES AS REGARD TO AGE

Age	20-29		30-39		40-49		50-59		60-69	
Subject	15		20		20		15		10	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Liver	1226	114.1097	1230	65.86272	1226.2	72.01384	1194.727	78.49793	1329	114.4523
Brain	1073	76.80704	1113	74.52221	1103	82.0562	1076.727	85.51285	1212.2	101.2724
Heart	292.8	34.85408	251	16.53963	251	16.53963	247.4545	18.21089	250.3	13.36362
Rt lung	502	55.38157	478	43.44488	476	42.11365	461.0909	56.81623	523.2	44.87451
Lt lung	454	39.62536	441	41.44427	447	52.60341	429.8182	62.75199	473.6	39.96066
Spleen	98.6	5.986425	109.4	12.72552	109.4	12.72552	105.6364	15.10134	114.8	13.65532
Lt. kidney	99.4	5.918085	110.6	15.67596	111.6	15.2751	106.9091	17.88917	115.4	18.33141
Rt kidney	97.4	5.848946	109.8	15.13196	111	14.77286	106.1818	17.30354	115.6	16.94177

IV. DISCUSSION

Organ weight assessment is essential in forensic pathology, providing valuable information to identify abnormalities or disease processes. This study found that the organ weights in males were higher than in females, a trend that has been observed in similar studies worldwide. These findings can be attributed to the generally higher body mass in males, which correlates with larger organ sizes. However, the data also reveal specific variations in organ weights when compared to other populations, possibly due to regional, dietary, and genetic differences.

The brain weight in this study, for instance, aligns with international findings that report average male brain weights around 1200-1300 grams and female brain weights around 1000-1200 grams. Similarly, the liver weights fall within known ranges, although the values in this study are slightly lower than those reported in Western populations, likely reflecting dietary and environmental influences.

While the spleen, heart, and lung weights are also consistent with other studies, the variations between individual cases underscore the need for region-specific reference ranges. These results provide a vital baseline for the Ajmer population, aiding in the forensic evaluation of autopsies in this region.

V. CONCLUSION

This study presents organ weight data from 200 postmortem cases conducted in the Ajmer region of Rajasthan, offering valuable baseline information for forensic experts. Organ weights were consistently higher in males compared to females, a trend that aligns with other global studies. The data will contribute to more accurate forensic assessments in this population, providing a reference for distinguishing between normal and pathological conditions.

Further studies with larger sample sizes and consideration of additional factors such as height and body mass index (BMI) are recommended to refine these findings and support broader forensic applications.

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Novel Heterocyclic Compounds for Cancer Chemotherapy

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Abstract— *Heterocyclic molecules are very important to medical chemistry because they are used to make drugs, especially chemotherapy. The goal of this study is to build on existing manufacturing methods for heterocyclic drugs so that they can be used more effectively in cancer medicine. We want to find new ways to make compounds and get around problems that come up with making complex heterocyclic structures. This will help us find chemicals that are very good at fighting cancer. Biocatalysis and flow chemistry are two current synthetic techniques that we use in our method to speed up the synthesis process, protect the environment, and increase yield and purity. As an environmentally friendly option to standard chemical methods, biocatalysis uses the precision and efficiency of enzymes to speed up processes in mild conditions. Flow chemistry, on the other hand, lets synthesis happen all the time, which makes it easier to direct reactions and make them bigger. For our study, we made a bunch of new heterocyclic chemicals and tested how well they killed different kinds of cancer cells. In early tests, a number of chemicals have shown promise in fighting cancer, showing that they could be used as treatment drugs. Structure-activity relationship (SAR) studies have been done to figure out what about the molecules makes them work, which will help make these chemicals even better. We also used computer chemistry tools to guess how these heterocyclic molecules would react with proteins that play a role in the growth of cancer. These predictions are confirmed by tests done in vitro and in vivo, which give us a full picture of how the drug works and its possible uses in therapy.*

Keywords— *Cancer chemotherapy, cancer stem cells mechanisms of action, side effects.*

I. INTRODUCTION

Cancer is the second most common cause of death in people, after heart disease. These days, early diagnosis and the right care are helping hundreds of thousands of people with cancer live longer. Most of the cells in our bodies are specialized, which means they have a shape and set of traits that are unique to the job they do. Normal cells and differentiated cells grow together in a single, well-organized layer under the control of controlled processes like contact inhibition. Most cancer cells can divide quickly, not differentiate properly, invade nearby tissue, and start new growth in places they shouldn't be. These are the main differences between normal cells and most cancer cells.

Normally, cells can only go through the cell cycle about fifty times before they die. But cancer cells can go through and out of the cycle infinite times. Most cancer cells have nuclei that are large and have a lot of chromosomes. When cancer cells divide, they form tumors, which are abnormal groups of cells that invade and kill nearby tissues. It looks like an encapsulated mass that is disordered but doesn't go through nearby tissue. This type of tumor is benign. The second type of tumor is one that has gotten out of hand. These tumors have abnormal, uncontrollable cell growth along with a loss of organization in some ways. At different times during the illness, malignant tumors invade nearby organs.

Cancer is a genetic disease that is usually caused by things in the environment. Carcinogens are chemicals that can be found in a lot of popular foods, drinks, air, and outdoor factors, like sunlight. A mutation in a single normal cell is where most cancers begin. A mutagen is any chemical that can change the DNA code; these chemicals are also called toxins. But mistakes made by DNA polymerase while DNA is being copied can also cause changes. Bishop et al. (1987) say that cancer can show up in many different ways, affecting many different organs and tissues and even growing in many different ways within the same tissue. Cell division is the process by which normally growing cells turn into cells that differentiate wrongly. This is its beginning. In the second stage, cancer cells metastasize, which makes it hard to treat a single cell that has spread to another

part of the body. Another study by Kundsonet. et. al. (2010) looked at how molecular processes inside and outside of cells can control cell growth and division. Changes in genes that control development, virus diseases, and higher levels of growth hormones that stimulate cells can all make editing impossible.

Cancer is a group of difficult diseases that starts with cells dividing in a way that isn't normal and can spread to other parts of the body. When cells don't differentiate properly, people often lose weight, cough up a lot of mucus, and get lumps that don't belong. Cancer rates are going up all over the world. Cancer is expected to cause 19.3 million new cases and almost a million deaths each year by 2020. It is the second most common cause of death in the world. Based on these numbers, just over half of the new cases that happen each year end in death. Some types of cancer have been found in the esophagus, breast, cervix, and colon areas, but esophageal, breast, and lung cancers are the most common. Prostate cancer is most common in older men. They found that age and sex have a big effect on the chance of getting cancer and the types of treatments that can be used. Some research suggests that men are more likely to get illnesses than women.

Vascular networks help cancer cells get air, nutrients, and waste products, all of which are necessary for their survival and growth from the start. Angiogenesis is the process by which new blood vessels are made. When there is no arterial extension, cancer cells die or go through death, which slows the growth rate. The amount of factors that cause cells to die, or necrosis, is a sign of how severe a tumor is. Usually, the process of making new blood vessels starts when the basement membrane breaks, letting out angiogenic factors. When vascular cells are told to move, multiply, and stay stable, a shield of protection is made. Controlling tumor vascularization has been the focus of many experts who want to slow the development of cancer. It is important to carefully target the activators of arterial growth and know how they control this chemical signal in order to keep things in check. They will not get enough food because of this.

II. LITERATURE REVIEW

Bhawal Ganesh Shivaji (2021) A major worldwide health problem, the rise of antibiotic-resistant bacteria calls for the search for new and improved antimicrobials. Various heterocyclic compounds have different chemical structures and pharmacological effects, which makes them a promising source for new antibacterial medicines. To that end, this review article will survey the literature on heterocyclic compound production and antimicrobial activity testing. We will talk about several synthetic techniques and methods for producing heterocyclic scaffolds, and how they work against bacterial infections. In addition, we will take a close look at the obstacles and present research on heterocyclic compounds as antibacterial agents.

Sharma (2023) Worldwide, cancer is responsible for the deaths of millions of people. It is very necessary to develop novel anticancer medications. because to the inadequacy and side effects of current chemotherapy. Among the most significant chemical frameworks demonstrating anticancer action is the thiazolidin-4-one scaffold. Extensive study on thiazolidin-4-one derivatives has indicated that these chemicals have strong anticancer effects, according to recent scholarly articles. This review focusses on thiazolidin-4-ones and its anticancer effects via the inhibition of different enzymes and cell types. It also discusses the several ways these compounds may be synthesized, including synthetic, green, and nanomaterial-based methods. Scientists may find this article's comprehensive overview of current best practices in the area to be both intriguing and useful as they investigate these heterocyclic compounds further for potential anticancer effects.

Rao (2021) Eighty percent of commercial pharmaceuticals use heterocyclic moieties as their fundamental skeleton, based on the 2014–2015 US retail market. But a lot of artificial processes aren't long-lasting, therefore we need tactics that are less harmful to the environment. As an example, molecules may be quickly and efficiently synthesized with high yields utilizing minimal energy by microwave-assisted synthesis. Moreover, the use of metal-impregnated nanoparticles offers many benefits in nanoparticle-catalyzed synthesis, such as the capacity to recycle the catalyst, achieve high yields, and accelerate reaction times. Additional ecologically friendly methodologies include Water-based organic synthesis, solvent-free synthesis, combinatorial synthesis, and sonochemical synthesis, and synthesis facilitated by ionic liquids. We examine the synergistic relationship between organic synthesis, solvent-free synthesis, microwave radiation, and organic synthesis in water. The application of nanoparticles is discussed below. As catalysts in the production of complicated heterocyclic compounds. We highlight environmentally friendly features of synthetic processes.

Javahershenas, Ramin. (2022). Lately, the process of creating heterocyclic compounds has been has garnered significant interest from organic and medicinal chemists, who have investigated a wide range of materials. As an effective, affordable, adaptable, and versatile intermediate, phenacyl bromide is one of numerous organic molecules that may be synthesized in various chemical processes. This article provides a synopsis of phenacyl bromide's important uses, with an emphasis on its function in multicomponent reactions and its involvement in recent synthetic breakthroughs up to the end of 2021.

Sharma, Shivali & Utreja, Divya. (2021). Because of their ubiquitous presence in nature and their many useful uses in many different areas, including medicine, agriculture, photochemistry, biocidal formulations, polymer science, and substantial clinical usage, heterocyclic moieties constitute a significant portion of organic chemistry. They have medicinal qualities that make them a potential weapon against several infectious illnesses. Virus infections are among the most frequent infectious illnesses, and they pose a significant threat to public health throughout the globe. In order to extend people's lives, it is critical to find and develop antiviral medications and therapeutic approaches that can ward against different types of viruses. To assist researchers and other stakeholders better understand the topic at hand, this study provides a synopsis of all heterocyclic compounds synthesized and tested for antiviral activity from 2015 forward. In an effort to discover novel, potentially effective antiviral medicines, many alterations were considered centred on the various heterocyclic scaffolds.

III. TRANSFORMING CHEMICALS

Heterocyclic compounds are not like homocyclic compounds, which only have carbon atoms in their rings. Heterocyclic compounds have rings made up of different types of atoms. When you look at molecules, an organic heterocyclic substance is one that has at least one carbon atom in each of its rings. Ring atoms that don't have carbon are all hetero atoms. Different types of atoms are made up of the three most common elements: sulfur, nitrogen, and oxygen. A huge number of chemicals with heterocyclic rings are useful in environmental engineering and study, and a lot of these molecules are also very important for living things. A hetero atom ring can be made out of any element except for alkali metals, according to the idea. It's not just the type of ring atoms that matter; the number of them also shows how big the ring is. Still, rings with three members are the smallest. Rings with five or six members are the smallest, and heterocyclic rings are the most important. Triazoles, thiadiazole, and thiazolidinone are all chemical molecules that have five parts that are not in the same ring. These chemicals can help with many biological processes, such as controlling seizures, killing fungi and bacteria, reducing inflammation, protecting cells from damage, and lowering histamine levels. They are very important in medical chemistry.

In their ring shape, most heterocyclic molecules have carbon plus at least one element, such as sulfur, oxygen, or nitrogen. They can also be artificial. Most people think that non-carbon atoms have replaced carbon atoms, which is why they are often called heteroatoms. They could be made up of aromatic or non-aromatic rings. Heterocyclic chemistry is the study of heterocycles, including how they are made, what they are like, and what they might be used for. Heterocyclic derivatives can be broken down into two main groups: aromatic and non-aromatic. The aromatic product furan is shown by the first row of rings in Figure 1, which has five members.

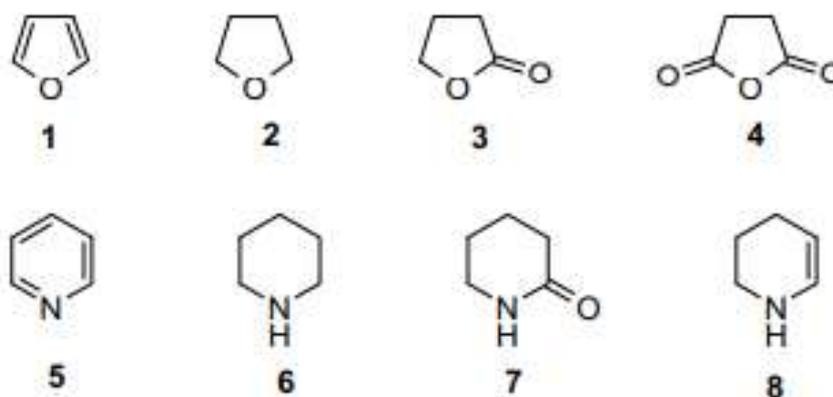
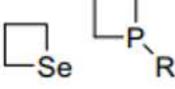


FIGURE 1: Heterocyclic compounds, with examples provided

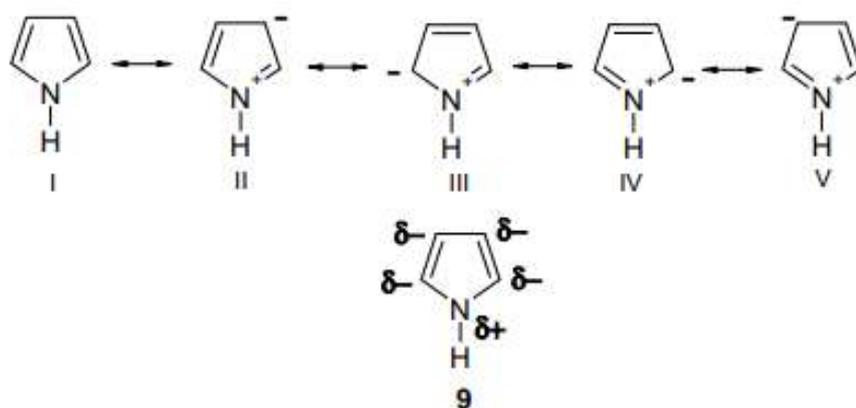
In the second row, the six-membered rings are aromatic at first (pyridine (5)), but they lose their aromaticity as you move down the list. These are piperidin-2-one (7), piperidine (6), 1, 2, 3, 4-tetrahydropyridine (8), and more. They react like an amine, an enamine, or an amide, based on the order in which they are present. When you mix the expected reactivity of aromatic systems with heteroatoms, you get aromatic heterocycles. These have a more complicated reactivity profile than non-aromatic systems, which are otherwise very similar to normal non-cyclic forms. Because of this, most books on heterocyclic chemistry are mostly about how aromatic molecules respond. The tables 1.1–1.4 in these books show heterocyclic derivative models. In Table 1.1, you can see simple heterocyclic systems with three or four members. Their expected reaction is always linked to the ring strain, which gives off energy when it comes in contact with aliphatic chemicals.

TABLE 1
PRIMARY HETEROCYCLES WITH THREE OR FOUR MEMBERS

Ring Size	Heteroatom			
	N	O	S	Other
3	 Aziridine	 Oxirane	 Thiirane	
	 Diaziridine	 Dioxirane		 Oxaziridine
4	 Azetidine	 Oxetane	 Thietane	 Seletane Phosphetane

3.1 Characteristics and Responses of Aromatic Five-Membered Compounds:

The reaction time of an individual to prominent aromatic heterocycles is often elucidated using a graphical valence bond resonance framework, as shown in most educational resources on heterocyclic chemistry. We examine two examples that exemplify the majority of aromatic rings: pyrrole, which symbolizes p-excessive rings, and pyridine, which symbolizes p-deficient rings. Pyrrole demonstrates electrical neutrality in its isoelectronic link with the cyclopentadienyl anion; its aromatic sextet comprises a nitrogen atom with two electrons; and the sound it produces. A hybrid may be represented as a combination of kinds I through V (Scheme 1.1), with one type being entirely devoid of charges while the others exhibit separated charges. Diverse types, as anticipated, influence the structure of pyrrole in distinct ways. The charged and uncharged forms of nitrogen, which use their own pair of electrons, are particularly relevant. Forms III, IV, II, and V are shown here. Structure 9, as a whole, suggests that the electrical density of the carbon sites exceeds that of the typical aromatic system, benzene, and the heteroatom has a partial positive charge. Consequently, electrophiles, as opposed to nucleophiles, would easily engage with a π -excessive system such as pyrrole.



SCHEME 2: A variety of pyrrole resonance hybrids

IV. CHEMOTHERAPY

Chemotherapy is defined as the use of chemical agents to treat disease. Chemotherapeutic agents are chemical compounds used. The paramount attribute of efficacious chemotherapeutic agents is their pronounced toxicity selectivity for a particular germ; this allows for the inhibition or eradication of bacteria throughout the body at levels that do not harm host cells. Tumor cell resistance to chemotherapeutic agents is a significant challenge in cancer treatment; thus, a comprehensive arsenal of selective and potent compounds is required to tackle cancer-associated proliferation difficulties. Anticancer medicines are classified into many groups based on their mechanisms of action (refer to figure 2). The majority of chemotherapeutic agents may induce the death of tumor cells, either directly or indirectly.

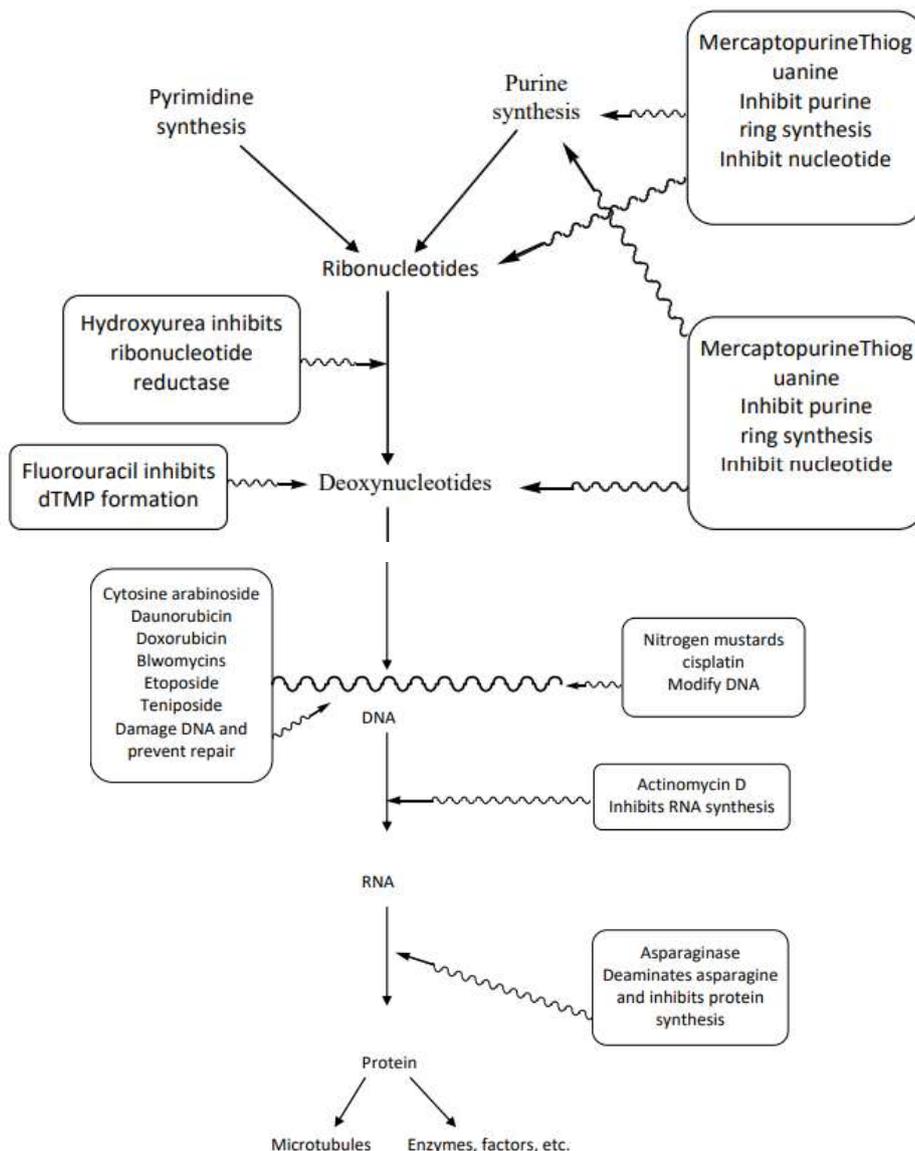
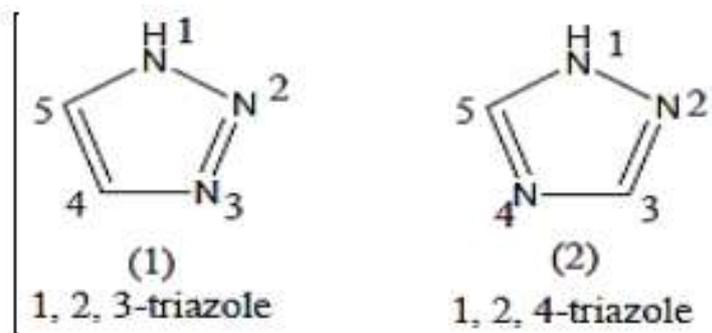


FIGURE 2: Potential cancer-fighting medication sites of action

4.1 Triazole:

There are three nitrogen and three carbon atoms in a triazole, making it a heterocyclic molecule with five members. One kind of triazole contains a nitrogen that is similar to pyrrole while the other has two nitrogen’s that are similar to pyridine. In early 1885, Bladin identified variants of the carbon nitrogen ring system C₂N₃H₃, and the term "triazole" was first used to them, even though the structure was somewhat off³⁵. There is a chance of tautomerism in 1, 2, and 3-triazole in both classes of triazoles, and these tautomers are essentially the same.



4.2 Types of Chemotherapy:

Many distinct chemotherapies exist for the treatment of cancer; these chemo medicines are categorized according to their chemical structures and the way they interact with cancer cells. As new medications are developed, these categories might be changed. Some categorization is helpful for understanding the action processes, even if some medications function with distinct groups.

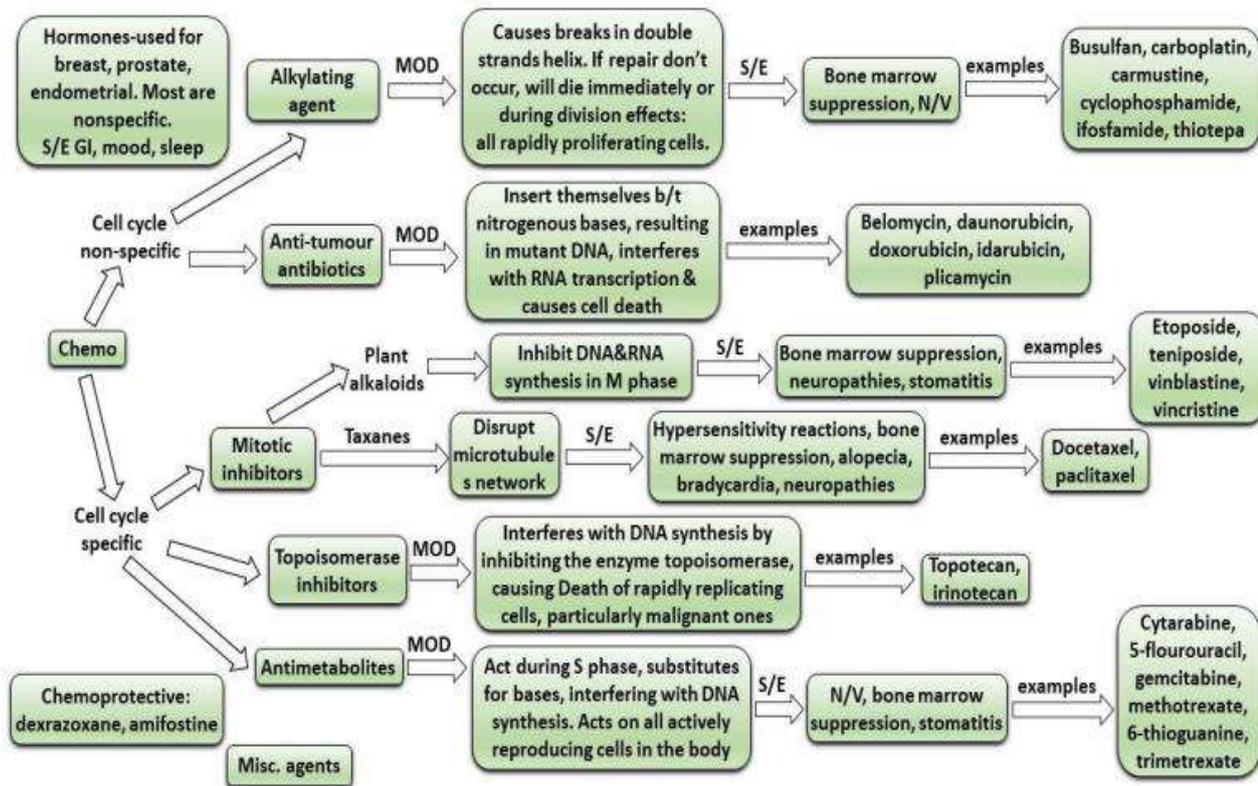


FIGURE 3: Chemotherapy medication categorisation according to mode of effect

4.3 Cancer Therapy:

Cancer risk factors, encompassing both hereditary and environmental components, are responsible for the majority of cancer cases. However, many of these factors are within our control or can be mitigated. The primary objective of mitigating cancer risk factors through modifications in lifestyle and environmental conditions is a crucial strategy for decreasing the cancer burden. Sexually transmitted infections, obesity, alcohol consumption, and tobacco exposure are risk factors that could potentially prevent nearly 30% of cancer-related deaths.

Early and reliable diagnosis of premalignant stages of tumor growth may facilitate timely intervention, representing an effective treatment option. Early detection of cancer, prior to metastasis, frequently allows for curative treatment options. In the initial, premalignant phases of colon cancer, minor surgical interventions may completely eliminate the disease. A variety of cancer treatment options exist; however, the selection of a specific treatment depends on the type of cancer, its location, and the stage of the disease. Cancer treatment has traditionally focused on three primary modalities: systemic therapy, radiation therapy, and surgical intervention. Systemic treatment, surgery, and radiation therapy represent prevalent combinations for cancer management.

Hormonal treatment, immunotherapy, chemotherapy, and targeted medications represent various forms of systemic treatments. The hormone-dependent characteristics of breast and prostate cancers, which develop or progress in reaction to hormonal influences, render hormone therapy a critical element of their treatment strategies. Targeted treatments are essential for certain cancer types as they inhibit disease progression and dissemination by disrupting specific molecules involved in these processes. Cancer cells exhibit heightened susceptibility to chemotherapy due to their rapid proliferation. This treatment functions by inhibiting the cell cycle, thereby diminishing or eradicating the capacity of cancer cells to replicate. Anticancer medications can be categorized as stage-specific, which target cancer cells during specific phases of proliferation or rest, or non-specific, which affect cancer cells across the entire cell cycle. Chemotherapy can be rendered more selective by targeting cancer cells

rather than healthy cells. All cells, including cancer cells, are surrounded by a dense layer of sugar-containing molecules known as polysaccharides. This category of polysaccharides demonstrates structural diversity across various tissues and organs in the body.

The chemical compositions of polysaccharides in cancerous regions differ from those in normal tissue. Consequently, the adverse effects of chemotherapy may be markedly diminished through the use of an appropriate drug carrier capable of identifying specific polysaccharides (Longmuir et al., 2009). Some cancers may be treated more effectively with a combination of chemotherapy agents. Effective combined chemotherapy treatments must target tumors at multiple levels and address cancer cells through distinct pathways. The first medication may inhibit DNA replication, whereas the second may obstruct protein synthesis.

V. CONCLUSION

Research into novel synthetic strategies for heterocyclic compounds has produced notable advancements in organic synthesis methodology and the potential for new chemotherapy treatments. This study effectively addresses key aspects of synthetic chemistry and its pharmaceutical applications, resulting in promising outcomes for cancer treatment. The incorporation of contemporary synthetic methodologies, including biocatalysis and flow chemistry, has shown significant advancements in the synthesis of heterocyclic compounds. These methods demonstrate reductions in reaction times, enhancements in yields, and a decrease in the utilization of hazardous reagents, thus fostering more sustainable and efficient synthetic processes. The synthesis and screening of diverse heterocyclic compounds have identified several candidates with notable cytotoxicity against various cancer cell lines. The findings indicate the potential of these novel compounds as effective agents in chemotherapy, presenting new opportunities for cancer treatment. Comprehensive SAR studies have clarified the molecular characteristics that enhance the anticancer efficacy of the synthesized compounds. This comprehension has informed the optimization of lead compounds, improving their efficacy and specificity toward cancer cells. Computational chemistry tools have yielded significant predictions about the interactions between heterocyclic compounds and target proteins associated with cancer proliferation. The predictions have been validated via *in vitro* and *in vivo* experiments, providing a thorough understanding of the mechanisms of action of these compounds. Optimizing synthetic routes for scalability and environmental sustainability facilitates the production of promising compounds in large quantities for subsequent development and clinical trials. The scalability is essential for moving from laboratory research to practical pharmaceutical application.

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Evaluation of Wound healing activity of leaves of *Passiflora foetida* L in Streptozotocin-induced diabetes mellitus and Diabetic Excision Model

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Abstract— The present study aimed to evaluate the wound healing activity of the leaves of *Passiflora foetida* L. in Streptozotocin (STZ)-induced diabetes mellitus in rats. Diabetes was induced by a single intraperitoneal injection of STZ (50 mg/Kg) in Wistar albino rats after overnight fasting. The diabetic rats were subjected to excision wounds on the dorsal side, which were treated with varying doses (100, 200, and 400 mg/Kg) of ethanol and ethyl acetate extracts of *Passiflora foetida* leaves for 21 days. The wound healing parameters, including wound contraction rate, epithelialization time, and scar area, were monitored and compared with the control group and standard treatment (Metformin 5 mg/Kg). The results revealed that both ethanol and ethyl acetate extracts exhibited significant wound healing activity, with the ethyl acetate extract (400 mg/Kg) showing the most potent effect. The extracts significantly enhanced wound closure, reduced epithelialization time, and promoted granulation tissue formation. The findings suggest that *Passiflora foetida* leaves possess substantial wound healing properties and could be a potential therapeutic candidate for the management of diabetic wounds.

Keywords— *Passiflora foetida* L, ethyl acetate extract, ethanol extract, Streptozotocin, antidiabetic activity.

I. INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia, which often leads to complications such as delayed wound healing. Diabetic wounds are a major health concern, as they are prone to infection, poor healing, and prolonged recovery times. Traditional therapeutic approaches have limitations, thus prompting the need for alternative treatments that can promote wound healing in diabetic patients. *Passiflora foetida* L., commonly known as wild passionflower, has been traditionally used for its medicinal properties, including anti-inflammatory, antioxidant, and antimicrobial effects. Recent studies have highlighted its potential in promoting tissue regeneration and wound healing. However, the wound healing activity of *Passiflora foetida* in the context of diabetic wounds remains underexplored.

In this study, we aimed to evaluate the wound healing potential of *Passiflora foetida* leaf extracts in a rat model of Streptozotocin (STZ)-induced diabetes mellitus. By assessing key wound healing parameters, such as wound contraction, epithelialization time, and granulation tissue formation, this study seeks to determine the efficacy of *Passiflora foetida* leaf extracts in promoting wound healing in diabetic conditions. The findings could provide valuable insights into the therapeutic potential of *Passiflora foetida* for managing diabetic wounds.

II. MATERIALS AND METHODS

Streptozotocin (Sigma–Aldrich Canada, Oakville, Ontario, Canada). All other chemicals and reagents used were of analytical grade.

2.1 Reagents:

Buffer (pH 5): 50 g citric acid monohydrate, 12 ml glacial acetic acid, 120 g sodium acetate trihydrate, and 34 g sodium hydroxide added to distilled water up to 1000 ml.

2.2 Animals:

Wistar albino rats weighing 150–200 g were used for experimentation. The rats were procured from the disease-free small animal house, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar (Reg. No. 1669/GO/abc/12/CPCSEA Dated 08/04/2013). Pathogen-free conditions were provided to the rats. The rats were housed, fed, and treated as per the international guidelines and principles of laboratory animal use and care. The animals were maintained in polypropylene cages under standard conditions ($25\pm 2^{\circ}\text{C}$, 12 hrs light and dark cycle) with pelleted food (Purina), while tap water was available ad libitum (Hedrich HH, 2006). They were maintained on the standard pellet diet and water ad libitum for 2 weeks to acclimatize prior to the investigation. All experimental procedures and protocols were approved by the Institutional Animals Ethics Committee, Department of Pharmaceutical Sciences, M.D. University, Rohtak (1767/GO/Re/S/14/CPCSEA, 18/07/2014).

2.3 Diabetes Induction:

2.3.1 Streptozotocin-induced diabetes mellitus:

After overnight fasting, streptozotocin (STZ; 50 mg/Kg, i.p.) (Sigma–Aldrich Canada, Oakville, Ontario, Canada), prepared in citrate buffer (0.1M, pH 4.5), was administered to rats to induce diabetes (Junod A et al., 1969). 24 hours after the injection, fasting blood glucose levels were determined using a Glucometer (Accu-Chek® Extra Care, Roche Diabetes Care India Pvt. Ltd., 601B, Silver Utopia, Chakala Road, Andheri (East), Mumbai, Maharashtra) with glucose oxidase reagent strips after withdrawing blood from the retro-orbital plexus. Animals with a glucose level greater than 250 mg/dl were used for the study, 7 days after streptozotocin injection.

2.4 Diabetic Excision Model for Wound Healing Activity:

2.4.1 Surgical Procedures and Treatment:

On the 7th day after diabetes induction, excision wounds were created. These wounds were used for biochemical parameters study and for the rate of wound contraction. Using thiopentone sodium (40 mg/Kg i.p.), animals were anesthetized, and each rat was shaved from the right side. Ethanol 70% v/v was used for disinfection of the shaved area. From the shaved area on the dorsal middle line, excision wounds of size 4 cm² were made by cutting a 2 cm x 2 cm piece of skin. For 21 days, ethanol and ethyl acetate extracts in concentrations of 100 mg/Kg, 200 mg/Kg, and 400 mg/Kg were orally given. The control group received an equal amount of vehicle (citrate buffer).

2.5 Excision Wound:

The epithelialization time (Villegas LF et al., 1997) was noted when no raw wound was left behind and when the scar fell off. Excision wounds on a transparent paper with a millimeter scale were traced to determine the rate of wound contraction. The percentage of wound area healed was calculated using the change in wound size. The number of days taken for complete epithelialization was expressed as the period of epithelialization (when no raw wound was left behind).

2.5.1 Excision Wound Model:

As mentioned above, the excision wound model was performed. Parameters like percentage contraction in the wound, the period of epithelialization, and granulated tissue scar area were evaluated (Nayak BS et al., 2007). Every third day, photographs were taken, and the wound boundaries were traced on transparent paper to measure the area of wounds in all groups.

2.6 Parameters Monitored:

2.6.1 Rate of Wound Contraction:

At 0 days, before extract treatment and after wounding on days 3, 6, 9, 12, 15, and 18, excision wounds were traced on a transparent paper with a millimeter scale. On every third day, the change in wound size was calculated as the percentage of wound area that had healed. The percentage contraction of the wound was calculated using the formula:

$$\% \{ \text{wound contraction} \} = (A_0 - A_t) / A_0 * 100 \quad (1)$$

Where (A₀) is the original wound area and (A_t) is the area of the wound at a specific time period after wounding (Yates CC et al., 2007; Rashed AN et al., 2003).

2.6.2 Epithelialization Period:

Epithelialization period is the number of days required for the scar to fall off without any raw wound left behind. The epithelialization period of the wound was expressed as the number of days taken for complete epithelialization (when no raw wound was left behind) (Dinesh M et al., 2010).

2.6.3 Animals Grouping:

Nine groups of animals, each consisting of six rats, were made. Rats were given extracts for 21 days. Among all the extracts, ethyl acetate and ethanol extracts were selected for the study of pharmacological activities. Ethyl acetate and ethanol extracts of different plant species showed the maximum number of potent chemical constituents determined by qualitative phytochemical analysis and chromatographic profiles. For these reasons, ethyl acetate and ethanol extracts in different doses were selected for further study. In the literature survey of plants, it is clearly mentioned that the above-mentioned two extracts are safe at a dose level of 2000 mg/Kg; the dose level was selected as 100 mg/Kg (1/20th), 200 mg/Kg (1/10th), and 400 mg/Kg (1/5th) of the safe dose, i.e., 2000 mg/Kg (Vikram PK et al., 2012; Bhide NK, 1962).

- Group I: Standard (Metformin 5 mg/Kg)
- Group II: Diabetic rats with wound without treatment (normal control group)
- Group III: Diabetic rats without wound (for diabetes only)
- Group IV: Diabetic rats with wound treated with ethyl acetate extract by oral route at a dose of 100 mg/Kg
- Group V: Diabetic rats with wound treated with ethyl acetate extract by oral route at a dose of 200 mg/Kg
- Group VI: Diabetic rats with wound treated with ethyl acetate extract by oral route at a dose of 400 mg/Kg
- Group VII: Diabetic rats with wound treated with ethanol extract by oral route at a dose of 100 mg/Kg
- Group VIII: Diabetic rats with wound treated with ethanol extract by oral route at a dose of 200 mg/Kg
- Group IX: Diabetic rats with wound treated with ethanol extract by oral route at a dose of 400 mg/Kg

2.7 Statistical Analysis:

Wound area was measured as the percentage contraction in wound size. Analysis of data was performed using Dunnett's t-test with GraphPad Prism 7.0. When $P < 0.05$ compared with control, the data is considered significant.

III. RESULTS AND DISCUSSION

There is a reduction in blood glucose level when extracts of *Passiflora foetida* L. were administered to glucose-loaded normal rats fasted for 18 h. In our study, the difference observed between the initial and final fasting blood glucose levels of different groups under investigation revealed a significant elevation in blood glucose in the diabetic control group at the end of the 14th day experimental period along with healing of wounds by excision wound healing method observed for 21 days. There is a significant decrease in the fasting blood glucose level and increase in the percentage contraction of wound area when extracts were administered to diabetic rats.

The rich fiber content of *Passiflora foetida* L. may be responsible for the activity. Dietary fibers lower the level of blood glucose by decreasing the rate of absorption of carbohydrate from the intestine and so are beneficial for type II diabetic patients (Khan A and Safdar M, 2003).

On 0 day, 7th day, and 14th day, there is a significant decrease in the level of plasma glucose in the ethanolic extract at the dose of 400 mg/Kg and 200 mg/Kg as illustrated in Table 1. There is an increase in the percentage area of wound contraction from 27.60% to 98.51%, 22.18% to 96.90% respectively on 15th day in ethanolic and ethyl acetate extract respectively at the dose of 400 mg/Kg. There is not much increase in the percentage contraction in the wound area in the lower doses (100 mg/Kg and 200 mg/Kg) in ethyl acetate and ethanol extract¹ as illustrated in Table 2. Complete wound healing is shown by ethyl acetate and ethanol extract at the dose level of 400 mg/Kg on 17th day. 100 mg/Kg and 200 mg/Kg showed complete healing of wounds on 18th day.

Decrease in the blood glucose level may be due to these active constituents present in the extract. The flavonoids present in ethyl acetate extract 400 mg/Kg and 200 mg/Kg showed the hypoglycemic activity on 0 days, 7th day, and 14th day.

Phenolic compounds present in plant extract may be beneficial in diabetes and many other diseases as reported from earlier studies. Therefore, the activity of the plant may be due to these phenolic compounds (Vasco C et al., 2008; Ahmad N and Mukhtar H, 1999).

3.1 Antidiabetic activity of leaves of *Passiflora foetida* L. in streptozotocin-induced diabetes mellitus:

TABLE 1
ANTIDIABETIC ACTIVITY OF LEAVES OF *PASSIFLORA FOETIDA* L. IN STREPTOZOTOCIN-INDUCED DIABETES MELLITUS

S. No	Group	Plasma glucose level (mg/dl)		
		0 day	7thday	14thday
1	Standard (Metformin)	275.83±4.945	151.66±3.626*	160.33±2.21*
2	Diabetic Control with wound	285.16±2.072	296.33±3.412	304.16±6.263
3	Diabetic Control without wound	281.66±5.420	284.16±4.490	285.00±5.721
4	Ethyl acetate extract 100mg/Kg	286.00±7.000	200.50±4.500	221.50±8.500
5	Ethyl acetate extract 200mg/Kg	282.50±5.500	181.5±4.500*	201.00±5.100
6	Ethyl acetate extract 400mg/Kg	285.50±4.500	165.50±7.500*	192.50±4.500*
7	Ethanol extract 100 mg/Kg	279.50±12.500	226.50±4.500	235.00±7.000
8	Ethanol extract 200mg/Kg	284.50±11.500	185.02±3.000*	224.50±6.500*
9	Ethanol extract 400mg/Kg	283.50±9.500	163.00±7.000*	211.00±9.000*

Values are expressed as mean±SEM, n=6, p<0.05 versus diabetic control group (Dunnett's t-test after analysis of variances)

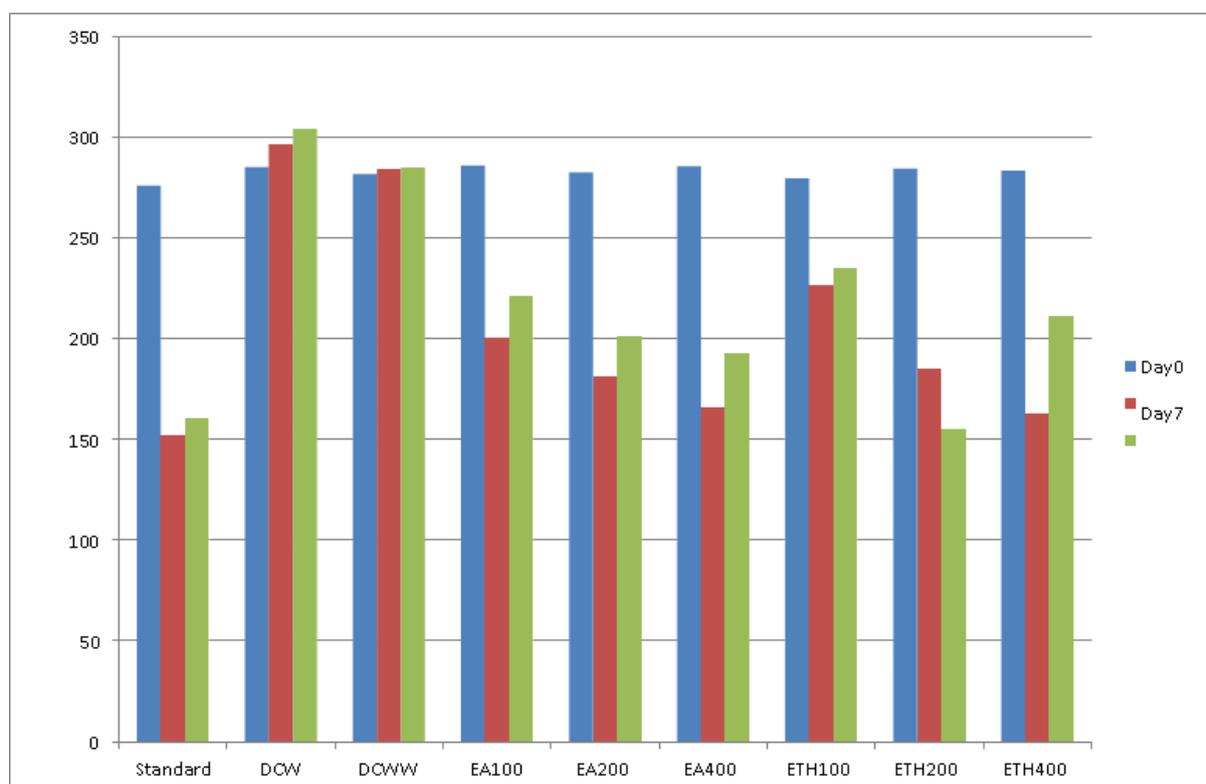


FIGURE 1: Effect of *Passiflora foetida* L. in streptozotocin-induced diabetes mellitus

TABLE 2
WOUND HEALING ACTIVITY OF LEAVES OF *PASSIFLORA FOETIDA L.* IN DIABETIC EXCISION MODEL

S. No.	Group	Percentage contraction in wound area							Epithelization on period (in days)
		3 rd day	6 th day	9 th day	12 th day	15 th day	18 th day	21 st day	
1	Standard (Metformin)	33.30±0.304	56.34±0.432*	78.71±0.354*	96.96±0.692*	100	100	100	14.86±0.307*
2	Control with wound	15.54±0.164	35.06±0.284	48.37±0.189	67.19±0.276	78.62±0.392	95.45±0.761	100	20.50±0.365
3	Ethylacetate extract 100 mg/Kg	19.09±0.180	38.98±0.75	56.50±0.250	81.43±0.185	92.82±0.395	100	100	17.50±0.50
4	Ethylacetate extract 200 mg/Kg	19.49±0.020	39.26±0.735	60.50±0.020	85.31±0.050	94.92±0.195	100	100	17.50±0.50
5	Ethylacetate extract 400 mg/Kg	22.18±0.380	42.81±0.260*	67.09±0.075*	95.29±0.085*	96.90±0.035*	100	100	16.50±0.50*
6	Ethanol extract 100 mg/Kg	20.66±0.145	39.73±0.315	62.52±0.420	81.91±0.190	90.68±0.685	100	100	17.50±0.50
7	Ethanol extract 200 mg/Kg	24.13±0.335	43.56±0.185*	68.50±0.250*	86.87±0.100*	93.96±0.310*	100	100	17.00±0.00*
8	Ethanol extract 400 mg/Kg	27.60±0.495	54.69±0.105*	73.74±0.305*	91.15±0.195*	98.51±0.225*	100	100	16.00±0.00*

Values are expressed as mean ± SEM, n=6, p<0.05 versus diabetic control group (Dunnett's t-test after analysis of variances)

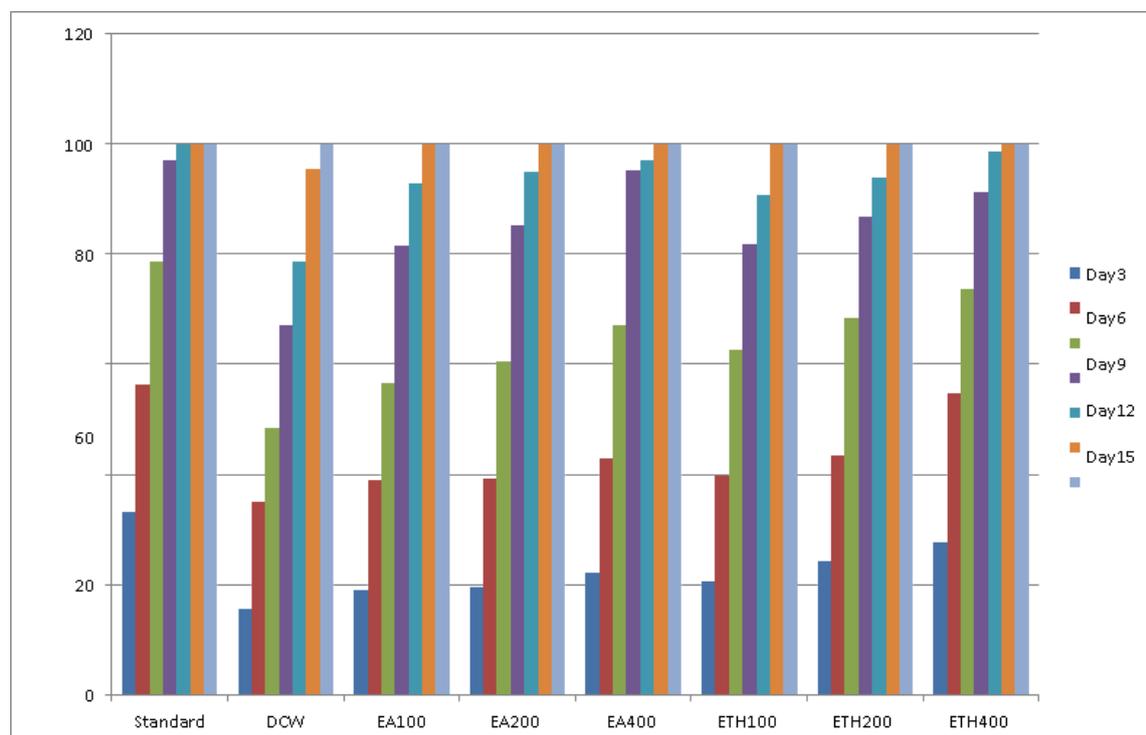


FIGURE 2: Wound healing activity of *Passiflora foetida L.* in diabetic excision model.

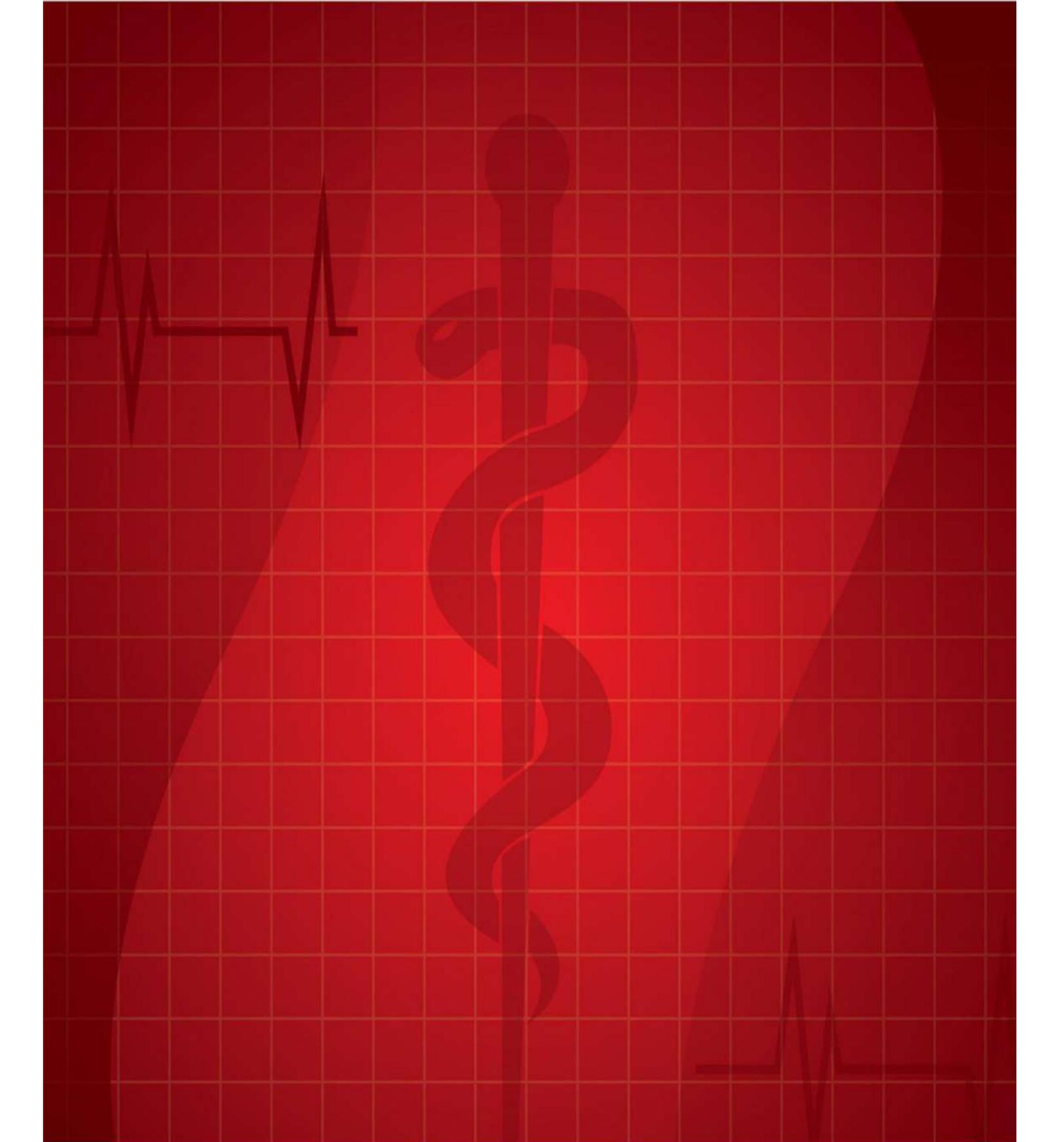
IV. CONCLUSION

The present study reveals that the ethyl acetate and ethanol extracts accelerate healing of wounds in diabetic patients. The results suggest that extracts may have a beneficial effect on wound healing phases. It is quite possible that the increase in the healing of wounds in diabetic rats is due to hypoglycemic activity (Rosenthal SP, 1968).

The study confirms the traditional use of *Passiflora foetida* leaves for the treatment of diabetic wounds. This result motivates us to carry out a vast study to isolate responsible potent active chemical constituents and to better evaluate the diabetic wound healing activity of the plant.

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