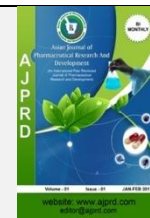


Available online on 15.06.2022 at <http://ajprd.com>

# Asian Journal of Pharmaceutical Research and Development

Open Access to Pharmaceutical and Medical Research

© 2013-20, publisher and licensee AJPRD, This is an Open Access article which permits unrestricted non-commercial use, provided the original work is properly cited

Open  Access

Review Article

## A Prospective Study on Hypertension-Revealing it to be a key factor for various Medical Complications, their Management and Prevalence in a Secondary Care Hospital

Dr. Amreen Sultana, Shaima Fatima, Arham Sultana, Summaya Anum, Mohd Ziya Uddin

Department of Clinical Pharmacy, MRM College of Pharmacy, Chintapallyguda (V), Ibrahimpatnam (M), R.R Dist. Telangana .

### ABSTRACT

**Background:** High blood pressure or HTN is a heterogeneous group of disorder characterized by a persistent increase in blood pressure due to the force of blood pushing against the blood vessel walls, which develops over time due to unhealthy lifestyle choices, lack of awareness accompanied by low levels of treatment and uncontrolled rates lead to mortality. Globally Hypertension (HTN) affects two-third of the population resulting in 10.4 million deaths annually. Despite several initiatives, the prevalence of HTN and its adverse impact on cardiovascular, renal, and cerebrovascular morbidity and mortality are globally increasing.

**Objectives:** The objective of the study is to detect the adverse outcomes of uncontrolled hypertension and review the treatment patterns in the management of hypertension to reduce its further complications. To assess whether the higher prevalence of undiagnosed hypertension or poor adherence to antihypertensive therapy or both may explain the higher prevalence of hypertensive complications.

**Results:** In the study, the prevalence of hypertension was found to be 46% among the patient population with males (52.5%) being more prevalent than females (47.5%). Among all age groups, individuals aged 50-69 years were highly affected. From the study, it was found that a greater number of patients fall in the category of stage-2 hypertension (38.75%) followed by hypertension crisis (28.75%), stage-1 hypertension (25%), and normal (7.5%). More patients with uncontrolled hypertension experienced cardiovascular complications (55%) when compared to cerebrovascular (27.5%) and renal (17.5%) complications. The choice of antihypertensive drugs used in the management were diuretics (43.75%), CCB (41.25%), ARB (37.5%), BB (32.5%), B+A (11.25%), ACEI (6.25%), CS (3.75%), and AAB (2.5%). The most commonly prescribed drugs in the study were Furosemide (11.25%), Telmisartan (11.25%), Amlodipine (7.5%), and Metoprolol (6.25%).

**Conclusion:** The study concludes that most of the patients with uncontrolled hypertension were suffering from cardiovascular complications with least being affected by renal and cerebrovascular complications. A regular and moderate degree of physical activity in combination with good lifestyle choices may have a good impact on hypertension control thus preventing further complications. However, blood pressure control is obtained in some individuals, while in some blood pressure was still elevated after the drug management due to the presence of co-morbid conditions and poor lifestyle modifications.

**Keywords:** Blood Pressure, Complications, Cardiovascular, Stroke, Chronic Kidney Disease

**ARTICLE INFO:** Received; 20 April 2022; Review Complete; 26 May 2022 Accepted; 11 June 2022 Available online 15 June. 2022



#### Cite this article as:

Sultana A, Fatima S, Sultana A, Anum S, Uddin MZ, A Prospective Study on Hypertension-Revealing it to be a key factor for various Medical Complications, their Management and Prevalence in a Secondary Care Hospital, Asian Journal of Pharmaceutical Research and Development. 2022; 10(3):94-102.

DOI: <http://dx.doi.org/10.22270/ajprd.v10i3.1139>

\*Address for Correspondence:

Dr. Amreen Sultana, Department of Clinical Pharmacy, MRM College of Pharmacy, Chintapallyguda (V), Ibrahimpatnam (M), R.R Dist. Telangana.

## INTRODUCTION

Globally Hypertension (HTN) affects two-thirds of the population resulting in 10.4 million deaths annually. Lack of awareness accompanied by low levels of treatment and uncontrolled rates lead to mortality. HTN is a heterogeneous group of disorder characterized by a persistent increase in blood pressure due to the force of blood pushing against the blood vessel walls, which develops over time due to unhealthy lifestyle choices. It is expressed in terms of the systolic and diastolic pressure, measured in millimeters of mercury or "mmHg". Despite several initiatives, the prevalence of HTN and its adverse impact on cardiovascular, renal, and cerebrovascular morbidity and mortality is globally increasing.

### Complications:

The risk of complication is related to a degree of elevation of BP. With each 10 mmHg increase in BP, there is a 30% increase in cardiovascular, renal, and cerebrovascular morbidity and mortality. As blood pressure rises and the longer it remains consistent, the greater is the damage.

### Hypertension and Cardiovascular Diseases

#### *Coronary artery disease:*

Hypertension acts as a major threat in causing various cardiovascular diseases (CVD), one of which is coronary artery disease or CAD. Coronary artery disease is defined as narrowing or blockage of one of the major arteries of the heart known as the "coronary artery", due to plaque build-up or atherosclerosis, eventually causing heart attack.

#### *Myocardial Infarction:*

It is a feared consequence of CAD and also occurs due to imbalance between oxygen supply and demand. HTN is an important contributor in causing MI, which may even lead to heart failure.

#### *Left Ventricular Hypertrophy:*

Left ventricular hypertrophy (LVH) is defined as an abnormal thickening (hypertrophy) of the left ventricular wall or an increase in LVM, which increases the pressure in the left ventricle due to a decrease in the elasticity of the thickened ventricular wall and hence contributes for cardiac motility in hypertensive patients. LVH regression is achieved through aggressive control of HTN thus decreasing the onset of other cardiovascular and cerebrovascular events.

### Hypertension and Chronic Kidney Disease

The hallmark of hypertensive renal injury is mainly caused due to a progressive incline in renal vascular resistance. To prevent further renal damage, optimize control of hypertension is necessary (i.e., BP<130/80mmHg). The effective management of hypertension is crucial which helps in reducing renal damage.

#### **Chronic Kidney Disease (CKD):**

Chronic kidney disease is defined as persistent kidney damage which may lead to the reduction in Glomerular

filtration rate (GFR) i.e., <60ml/min, urinary and structural abnormalities resulting in an accumulation of metabolic waste products in blood. Despite an increase no. of effective interventions made, CKD is under diagnosed and untreated. CKD occurs approximately in 80-90% of hypertensive patients.

### Hypertension and Cerebrovascular Complications

The major and common complication of hypertension is stroke or cerebrovascular accidents (CVA). When a blood vessel in the brain ruptures and bleeds, the oxygen supply to the brain is blocked leading to stroke and also occurs when there is a blockage of blood supply to the brain, which can be either temporary or permanent. The permanent blockages leave lasting physical and mental deficits. Temporary blockages are termed transient Ischemic Attacks (TIA) that does not leave lasting physical and mental deficits. They alter behavior and thinking for 24 hours. Since the damage is temporary the TIA'S are termed as "mini" strokes or "warning strokes".

The blood pressure effect is higher for hemorrhagic stroke than ischemic stroke.

#### **Ischaemic Stroke:**

When a fatty plaque or blood clot blocks the blood flow to any part of the brain it results in the death of the associated neurons or brain cells, an ischemic stroke occurs. These plaques act as points around which blood starts to clot and narrows the arterial lining. Thrombi thus formed causes blockage thereby resulting in blockage of blood supply to the brain. Sometimes these clots detach and float downstream leading to subsequent brain damage.

#### **Haemorrhagic Stroke:**

Brain artery when gets ruptured and the blood spills in the tissues of the brain a hemorrhagic stroke occurs. The spilled blood gets pooled up in the skull and starts exerting pressure and causes damage to brain tissue. Being starved of nutrients, oxygen, and pressure due to the spilled blood, brain ends up being severely damaged or destroyed. Strokes, approximately 12% are hemorrhagic.

## MATERIALS AND METHODS:

### **Study Design:**

This is an observational study conducted for six months from January to June 2021, at THUMBAY HOSPITAL NEW LIFE, in an inpatient department. Patients who met the inclusion criteria are taken into consideration.

### **Collection Of Data:**

Using a suitably designed collection data form, the following details are collected from patient demographics, Clinical examination, Prescription chart, Laboratory data, Progress notes, Patients medical record.

### **Inclusion Criteria:**

- Patients of either sex above 18 years of age
- Patients with blood pressure >130/90 mmHg

- Patients with cardiovascular, renal, or cerebrovascular diseases.

**Exclusion Criteria:**

- Patients of age < 18 years
- Pediatric department
- Pregnant and lactating women

**Methods and Collection Of Data:**

Data is collected through

- Patient interview to determine their chief complaints, History of Present Illness, past medical history, and medication history
- Family history
- Medical records
- Patient prescription

**Duration of The Study:**

The study has been conducted for six months

**Place Of The Study:**

Thumbay Hospital New Life, Chaderghat.

**Statistical Analysis Test:**

Two-Way Annova Test

**RESULTS**

**Evaluation of Age and Gender Distribution:**

Of the total 80 hypertensive patients included in our study, 42 (52.5%) of the participants were males and 38 (47.5%) females, indicating the high prevalence of hypertensive complications among males than females and a large proportion of the sample, 13.75% falling around 50-59 years, making it the high risk age group. [Results summarized in fig 1]

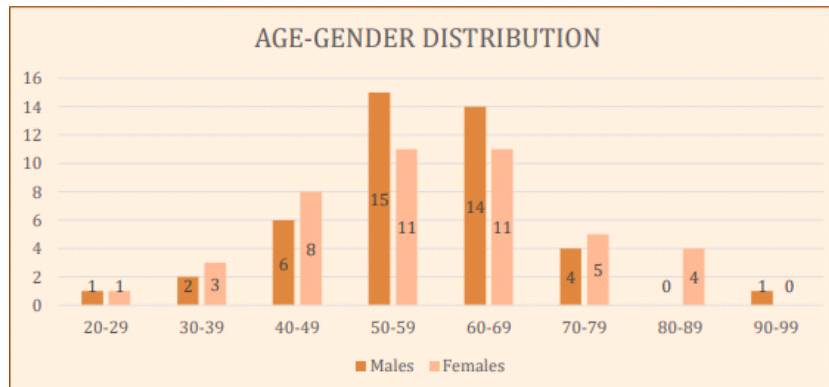


Figure 1: Evaluation of age and gender distribution (n=80)

**Prevalence of Hypertension & Hypertensive Complications**

The prevalence of Hypertension among the patient population during the study period based on age, gender

and different complications was found to be 46%. According to the study (n=80) more number of patients I.e., 44 of the study population experienced cardiovascular complications (55%) followed by 22 (27.5%) cerebrovascular and 14 (17.5%) renal complications.

Table1: Prevalence of Hypertension

The Total No of Patients Who Visited Hospital During The Study	Total No of Hypertensive Patients	Percentage
2450	1128	46%

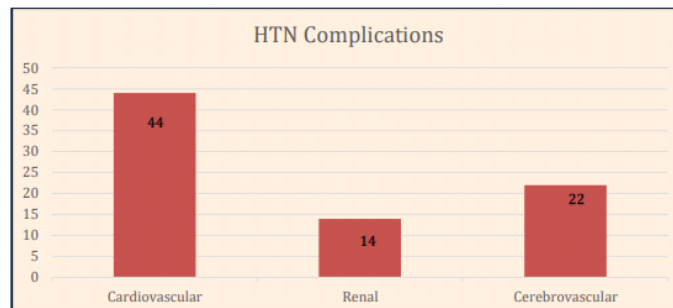


Figure 3: Hypertensive complications

**Drugs Prescribed in CVD:**

In patients with CVD the antihypertensives prescribed were diuretics, calcium channel blockers, ACE inhibitors,

angiotensin receptor blockers, beta blockers, central sympatholytics. Among which Metoprolol (45.45%) was highly Rx, followed by Telmisartan (38.63%), Torsemide (11.36%), and other drugs.

**Table: 2** Drug Prescribe in CVD

Drugs Prescribed CVD	Number of Patients	Percentage
Furosemide	8	18%
Torsemide	5	11.36%
Spirolactone	3	6.81%
HCT	2	4.54%
Metolazone	1	2.27%
Ramipril	1	2.27%
Telmisartan	17	38.63%
Olmesartan	1	2.27%
Valsartan	1	2.27%
Amlodipine	8	18%
Cilnidipine	4	9.09%
Nifedipine	1	2.27%
Metoprolol	20	45.45%
Bisoprolol	1	2.27%
Carvedilol	6	13.63%
Labetalol	2	4.54%
Prazosin	2	4.54%
Clonidine	1	2.27%
Moxonidine	1	2.27%

**Drugs Prescribed in CKD:**

In patients with CKD the antihypertensives drugs prescribed were diuretics, calcium channel blockers, ARBs.

Among which furosemide (50%) was highly prescribed, followed by Cilnidipine (37.7%), Torsemide (22%).

**Table: 3** Drug prescribe in CKD

Drugs Prescribed In CKD	NumeroOf Patients	Percentage
<b>Furosemide</b>	<b>7</b>	<b>50%</b>
<b>Amlodipine</b>	<b>3</b>	<b>21%</b>
<b>Bisoprolol</b>	<b>1</b>	<b>7.14%</b>
<b>Cilnidipine</b>	<b>5</b>	<b>35.7%</b>
<b>Moxonidine</b>	<b>1</b>	<b>7.14%</b>
<b>Spirolactone</b>	<b>1</b>	<b>7.14%</b>
<b>Metoprolol</b>	<b>1</b>	<b>7.14%</b>
<b>Torsemide</b>	<b>3</b>	<b>21%</b>
<b>Telmisartan</b>	<b>1</b>	<b>7.14%</b>

**Drugs Prescribed in CVA:** In patients with CKD the antihypertensive drugs prescribed were diuretics, calcium channel blockers, ARBs, & Beta blockers. Among which

Telmisartan (45.445%) was highly prescribed, followed by Amlodipine (36.36%), Metoprolol(13.63) and Mannitol (13.63%).

Table: 4 Drugs Prescribed in CVA

Drugs prescribed in CVA	No f of Patients	Percentage
Furosemide	1	4.54%
Chlorthalidone	1	4.54%
Mannitol	3	13.63%
Cardiopril	1	4.54%
Perindopril	3	13.63%
Telmisartan	10	45.445%
Amlodipine	8	36.36%
Nifedipine	1	4.54%
Cilnidipine	1	4.54%
Metoprolol	3	13.63%
Labetalol	1	4.54%

### Medications Used In Treatment of Hypertensive Complications:

Among the Anti-Hypertensive drugs, the most common class of drugs prescribed were Diuretics-35 (43.75%), with Calcium channel blockers-33 (41.25%) as the next highly prescribed drug class followed by ARB-30 (37.5%), BB-26 (32.5%), B+A-9 (11.25%), ACEI-5 (6.25%), CS-3 (3.5%) and AAB-2 (2.25%) of the total Anti-Hypertensives prescribed.

Table: 5 Medications Used In The Treatment Of Hypertensive Complications

CLASS	DRUGS	NO OF PATIENTS	TOTAL	PERCENTAGE
Diuretics P<0.005	Furosemide Torsemide Spirinolactone Hydrochlorothiazide Chlorthalidone Metolazone Mannitol	16 4 1 3	35	43.75 %
ACEI P < 0.005	Ramipril Cardiopril Perindopril	1 3	5	6.25 %
ARB P < 0.005	Telmisartan Olmesartan Valsartan	28 1	30	37.5 %
CCB P < 0.005	Amlodipine Cilnidipine Nifedipine	19 10 2	31	38.75 %
BB P < 0.005	Metoprolol Bisoprolol	24 2	26	32.5 %
B+a P < 0.005	Carvedilol Labetalol	6 3	9	11.25 %
AAB P < 0.005	Prazosin	2	2	2.5 %
CS P < 0.005	Clonidine Moxonidine	1 2	3	3.75 %

### Prescribing Pattern of Anti-Hypertensives:

For the management of hypertensive complications, anti-hypertensives were prescribed based on the stages of

hypertension and the associated complications, as the main aim was to treat hypertensive complications by optimizing blood pressure to the targeted BP goals.

**Table: 6** Prescribing Pattern of Anti-Hypertensives Therapy

Type of Therapy	No of Patients	Total	Percentage
Monotherapy Diuretics BB ARB ACEI B+A CCB *P < 0.05	11 05 09 02 01 10	38	47.5%
Dual therapy Labetalol+Telmisartan Furosemide+Amlodipine Metoprolol+ Telmisartan Metoprolol+Amlodipine Metoprolol+Prazosin Furosemide+Carvedilol Carvedilol+Spirinolactone Metoprolol+Cilnidipine Amlodipine+Perindopril Amlodipine+Moxonidine Mannitol+Telmisartan Telmisartan+Chlorthalidone Torsemide+Telmisartan Carvedilol+Cilnidipine Telmisartan+Torsemide *P < 0.05	02 01 05 04 01 02 01 01 01 01 01 02 01 02 01 01	26	32.5%
Triple therapy Metoprolol+Telmisartan+Furosemide Valsartan+Carvedilol+Torsemide Telmisartan+Metoprolol+Amlodipine Telmisartan+Clonidine+Prazosin Furosemide+Amlodipine+Bisoprolol Cilnidipine+Torsemide+Telmisartan Labetalol+Telmisartan+Cilnidipine Furosemide+Mannitol+Nifedipine Nifedipine+Amlodipine+Perindopril *P < 0.05	01 01 02 01 01 01 01 01 01 01	10	12.5%
Multiple Therapy Nifedipine+Moxonidine+Metoprolol+Torsemide Spirinolactone+ Torsemide+Bisoprolol+Amlodipine Lasilactone+Metoprolol+Cilnidipine+Torsemide *P < 0.005	01 01 01	03	3.75%

### Two Way Annova Test Annalysis

To assess the relationship between hypertension and its leading complications.

Null Hypothesis:

**There is no relationship between Hypertension and its leading complications.**

Since the data compares more than 2 variables and is parametric, the Two Way Annova test is used to analyse the hypothesis. According to the test, if the calculated F value is higher than the tabulated F value then we reject the null hypothesis.

The test is run at 5% level of significance.

**Table: 7** Correlation between Hypertension and its leading complications

Blood Pressure	Cardiac Complications	Renal Complications	Cerebral Complications	Total
Normal	6	0	0	6
Stage-1	10	5	5	20
Stage-2	14	11	6	31
HTN Crisis	14	6	3	23
ΣX	44	22	14	80

$$\Sigma X^2 = \Sigma X^2 C1 + \Sigma X^2 C2 + \Sigma X^2 C3$$

$$\Sigma X^2 = 528 + 182 + 70$$

$$\Sigma X^2 = 780$$

A

COLUMNS:

$$(\Sigma X)^2 = (\Sigma X C1)^2 + (\Sigma X C2)^2 + (\Sigma X C3)^2$$

$$n_c \quad \quad \quad n_{c1} \quad \quad \quad n_{c2} \quad \quad \quad n_{c3}$$

$$= \frac{(44)^2}{4} + \frac{(22)^2}{4} + \frac{(14)^2}{4}$$

$$= \frac{1936}{4} + \frac{484}{4} + \frac{196}{4}$$

$$= 484 + 121 + 149$$

$$= 654$$

B

ROWS:

$$(\Sigma X)^2 = (\Sigma X r1)^2 + (\Sigma X r2)^2 + (\Sigma X r3)^2 + (\Sigma X r4)^2 + (\Sigma X r5)^2 + (\Sigma X r6)^2 + (\Sigma X r7)^2 + (\Sigma X r8)^2$$

$$n_r \quad \quad \quad n_{r1} \quad \quad \quad n_{r2} \quad \quad \quad n_{r3} \quad \quad \quad n_{r4} \quad \quad \quad n_{r5} \quad \quad \quad n_{r6} \quad \quad \quad n_{r7} \quad \quad \quad n_{r8}$$

$$= \frac{(6)^2}{3} + \frac{(20)^2}{3} + \frac{(31)^2}{3} + \frac{(23)^2}{3}$$

$$= \frac{36}{3} + \frac{400}{3} + \frac{961}{3} + \frac{529}{3}$$

$$= 12 + 133.33 + 320.33 + 176.33$$

CORRECTION FACTOR (C.F)

$$C.F. = (\Sigma X)^2$$

$$C.F. = \frac{n}{(G.T)^2}$$

$$C.F. = \frac{n}{12^2}$$

$$C.F. = \frac{6400}{12}$$

$$C.F. = 533.33$$

$$C.F. = 533.33$$



D

Table: 8 Different data for the variance of treatment

Source Of Variance	Degree of Freedom	Sum of Squares	Mean Squares	F
Between Varities (Column)	c-1 =4-1 =3	B-D =654-533.33 =120.67	MSC=B-D/c-1 =120.67/3 =40.22	MSC/MSE =40.22/2.89 = 13.916
Between Treatments (Rows)	r-1 =3-1 =2	C-D =641.99-533.33 =108.66	MSE=C-D/r-1 =108.66/2 =54.33	MSE/RESIDUAL = 54.33/2.89 = 18.79
RESIDUALS	(c-1)(r-1) =3x2 =6	[A-D-(B-D)+(C-D)] =[780-533.33-(120.67)+(108.66)] =246.67-229.33 =17.34	[A-D-(B-D)+(C-D)]/(c-1) =17.34/6 =2.89	
TOTAL	Cr-1 =12-1 =11	A-D =780-533.33 =246.67		

## CONCLUSION:

### F for between the rows:

Calculated value=13.91

Tabulated value=9.77

Degree of Freedom= n1=3, n2=6

Since the calculated F value is very high than the tabulated F value, the mean yield of varieties is significant. The null hypothesis is rejected.

### F for between the columns:

Calculated value =18.79

Tabulated F value=10.92

Degree of Freedom= n1=2, n2=6

Since the calculated F value is very high than the tabulated F value, the mean yield of varieties is significant.

### Thus, Rejecting Null Hypothesis

## DISCUSSION:

Consistently elevated blood pressure if left untreated may cause various other complications which include coronary artery disease, heart failure, chronic kidney disease, stroke, and many more. During the study period, the prevalence of HTN was found to be 46% among the patient population. The numbers of hypertensive males were higher than that of hypertensive females due to lack of awareness, low medication adherence, deleterious social history, and unhealthy lifestyle choices. Among all the age groups, individuals aged 50-69 were highly affected with the number of males (56%) being superior to the number of females (44%). From the study, it was found that a greater number of patients fall in the category of stage-2 HTN (38.75%) followed by HTN crisis (28.75%), stage-1 HTN (25%), and normal (7.5%).

Poor control of HTN is the best indicator of the onset of various medical complications, of which more number of patients experienced cardiovascular complications (55%) followed by cerebrovascular (27.5%) and renal (17.5%) diseases. The choice of antihypertensive drugs used in the management were diuretics (43.75%), CCB (41.25%), ARB (37.5%), BB (32.5%), B+A (11.25), ACEI (6.25%), (CS 3.75) and AAB (2.5%). The most commonly prescribed drugs in the study were Furosemide (11.25%), Telmisartan (11.25%), Amlodipine (7.5%), Metoprolol (6.25%), Cilnidipine (4%) followed by carvedilol, metolazone. Perindopril, cardiopril, torsemide.

Depending upon the hypertension control, combination therapy with two or more drugs is used. The most preferred dual therapy was BB+ARB (6.25%) and BB+CCB (5%), triple therapy was ARB+BB+CCB (2.5%) and multiple therapies being used was CCB+CS+BB+DIURETIC (1.25%) which had a positive impact on the overall control of blood pressure.

## LIMITATIONS

The study limits to a period of about 6 months with a sample size of 80. Our study does not include out-patients, pediatrics department, and pregnant women. Do not include patients of ill will. The patients will only be monitored for the duration of their hospital stay.

## CONCLUSION

Our study which includes 80 samples provides the prevalence of hypertension higher in males. The study concludes that most of the patients with uncontrolled hypertension were suffering from cardiovascular diseases. Individuals with early stages of hypertension were treated with monotherapy depending upon the single comorbid condition while the patients with severe complications or more than one comorbid condition and uncontrolled blood pressure values were treated with dual, triple, and multiple therapies respectively.

A regular and moderate degree of physical activity in combination with good lifestyle choices, importance of medication adherence may have a good impact on hypertension control thus preventing further complications. However, blood pressure control is obtained in some individuals, while in some blood pressure was still elevated after drug management due to the presence of co-morbid conditions and poor lifestyle modifications.

### Conflict of Interest:

There is no conflict of interest.

## REFERENCES:

- Ledingham JG, Rajagopalan B. Cerebral complications in the treatment of accelerated hypertension. *The Quarterly Journal of Medicine*. 1979 Jan; 48(189):25-41.
- Awuchi CG, Amagwula IO, Priya P, Kumar R, Yezdani U, Khan MG. Aflatoxins in foods and feeds: A review on health implications, detection, and control. *Bull. Environ. Pharmacol. Life Sci*. 2020 Aug 9;9:149-55
- Saha P, Nyarko RO, Lokare P, Kahwa I, Boateng PO, Asum C. Impact of Covid-19 in Management of Lung Cancer Disease: A Review. *Asian Journal of Pharmaceutical Research and Development*. 2022 Jun 14; 10(3):58-64..
- Milane A, Abdallah J, Kanbar R, et al. Association of hypertension with coronary artery disease onset in the Lebanese population. *Springerplus*. 2014; 3:533. Published 2014 Sep 16. doi:10.1186/2193-1801-3-533
- Umama Y, Venkatajah G, Shourabh R, Kumar R, Verma A, Kumar A, Gayoor MK. Topic-The scenario of pharmaceuticals and development of microwave as; sisted extraction technique. *World J Pharm Pharm Sci*. 2019; 8(7):1260-71.
- Roshan K. Priya damwani, Shivam kumar, Adarsh suman, Suthar Usha. An overview on health benefits and risk factor associated with coffee. *International Journal Research and Analytical Review*. 2020; 7(2):237-49.
- Daharia A, Jaiswal VK, Royal KP, Sharma H, Joginath AK, Kumar R, Saha P. A Comparative review on ginger and garlic with their pharmacological Action. *Asian Journal of Pharmaceutical Research and Development*. 2022 Jun 14; 10(3):65-9.
- Nyarko RO, Kumar R, Sharma S, Chourasia A, Roy A, Saha P. Antibacterial Activity Of Herbal Plant-Tinospora Cordifolia And Catharthus Roseus.



9. Singh, M. K., Kumar, A., Kumar, R., Kumar, P. S., Selvakumar, P., & Chourasia, A. Effects of Repeated Deep Frying on Refractive Index and Peroxide Value of Selected Vegetable Oils. *International Journal for Research in Applied Sciences and Biotechnology*, 2022; 9(3), 28-31.
10. Kumar R, Saha P, Lokare P, Datta K, Selvakumar P, Chourasia A. A Systemic Review of Ocimum sanctum (Tulsi): Morphological Characteristics, Phytoconstituents and Therapeutic Applications. *International Journal for Research in Applied Sciences and Biotechnology*. 2022 Apr 7; 9(2):221-6.
11. Sahana S. Purabi saha, Roshan kumar, Pradipta das, Indranil Chatterjee, Prasit Roy, Sk Abdur Rahamat. A Review of the Corona virus (COVID-19) *World Journal of Pharmacy and Pharmaceutical science*. 2020; 9(9):2367-81.
12. Bind A, Das S, Singh VD, Kumar R, Chourasia A, Saha P. Natural Bioactives For The Potential Management Of Gastric Ulceration. *Turkish Journal of Physiotherapy and Rehabilitation*.;32(3).
13. Saha, P., Nyarko, R. O., Lokare, P., Kahwa, I., Boateng, P. O., & Asum, C. Impact of Covid-19 in Management of Lung Cancer Disease: A Review. *Asian Journal of Pharmaceutical Research and Development*, 2022; 10(3):58-64.
14. Dubey A, Yadav P, Verma P, Kumar R. Investigation of Proapoptotic Potential of Ipomoea carnea Leaf Extract on Breast Cancer Cell Line. *Journal of Drug Delivery and Therapeutics*. 2022 Jan 15; 12(1):51-5.
15. Roshan, K. Priya damwani, Shivam kumar, Adarsh suman, Suthar Usha. An overview on health benefits and risk factor associated with coffee. *International Journal Research and Analytical Review*, 2020; 7(2):237-249.
16. Saha, P., Kumar, R., Nyarko, R. O., Kahwa, I., & Owusu, P. (2021). Herbal Secondary Metabolite For Gastro-Protective Ulcer Activity With Api Structures.
17. Sahana S. Roshan kumar, Sourav nag, Reshmi paul, Nilayan guha, Indranil Chatterjee. A Review on Alzheimer disease and future prospects. *World Journal of Pharmacy and Pharmaceutical science*. 2020; 9(9):1276-85.
18. Sahana S, Kumar R, Nag S, Paul R, Chatterjee I, Guha N. A Review on Alzheimer Disease and Future Prospects.
19. Nyarko RO, Prakash A, Kumar N, Saha P, Kumar R. Tuberculosis a globalized disease. *Asian Journal of Pharmaceutical Research and Development*. 2021 Feb 15; 9(1):198-201.
20. Kumar R, Dubey A. Phytochemical Investigation And Hepatoprotective Evaluation Acacia Rubica Extract Isonized And Paracetamol Indused Animal Toxicity. *Turkish Journal of Physiotherapy and Rehabilitation*.; 32(3).
21. Singh MK, Kumar A, Kumar R, Kumar PS, Selvakumar P, Chourasia A. Effects of Repeated Deep Frying on Refractive Index and Peroxide Value of Selected Vegetable Oils. *International Journal for Research in Applied Sciences and Biotechnology*. 2022 May 11; 9(3):28-31.
22. Raj A, Tyagi S, Kumar R, Dubey A, Hourasia AC. Effect of isoproterenol and thyroxine in herbal drug used as cardiac hypertrophy. *Journal of Cardiovascular Disease Research*. 2021:204-17.
23. Purabisaha Rk, Rawat Ss, Prakash A. A Review on Novel Drug Delivery System.
24. Shafqat Zaidi Rk, Mehra, Dr. Sachin Tyagi, Roshan Kumar Anubhav Dubey. Effect of Kalahari Cactus Extract on Appetite, Body Weight and Lipid Profile In Cafeteria Diet Induced Obesity In Experimental Animal. *Annals of the Romanian Society for Cell Biology*.2021; 25(6):13976-87.
25. Kumar R, Saha P, Kumar Y, Sahana S, Dubey A, Prakash O. A Review on Diabetes Mellitus: Type1 & Type2. *World Journal of Pharmacy and Pharmaceutical Sciences*. 2020 Aug 2; 9(10):838-50.
26. Nyarko RO, Saha P, Kumar R, Kahwa I, Boateng EA, Boateng PO, Christian A, Bertram A. Role of Cytokines and Vaccines in Break through COVID 19 Infections. *Journal of Pharmaceutical Research International*. 2021; 33:2544-9.
27. Kumar R, Saha P, Kumar Y, Sahana S, Dubey A, Prakash O. A Review on Diabetes Mellitus: Type1 & Type2. *World Journal of Pharmacy and Pharmaceutical Sciences*. 2020 Aug 2; 9(10):838-50.
28. KUMAR A. The Scenario of Pharmaceuticals and Development of Microwave Assisted Extraction Techniques.
29. Kumar R, Saha P, Pathak P, Mukherjee R, Kumar A, Arya RK. Evolution Of Tolbutamide In The Treatment of Diabetes Mellitus. *Jour. of Med. P'ceutical & Alli. Sci.*; 9.
30. Nyarko RO, Saha P, Kumar R, Kahwa I, Boateng EA, Boateng PO, Christian A, Bertram A. Role of Cytokines and Vaccines in Break through COVID 19 Infections. *Journal of Pharmaceutical Research International*. 2021; 33:2544-9.
31. Toto RD. Treatment of hypertension in chronic kidney disease. *Semin Nephrol*. 2005 Nov; 25(6):435-9. doi: 10.1016/j.semnephrol.2005.05.016. PMID: 16298269.
32. James E. Paullin, Harold M. Bowcock, R.Hugh Wood, Complications of hypertension, *American Heart Journal*, Volume 2, Issue 6,1927, Pages 613-617, ISSN 0002-8703,https://doi.org/10.1016/S0002-8703(27)90209-9.
33. Daharia, A., Jaiswal, V. K., Royal, K. P., Sharma, H., Joginath, A. K., Kumar, R., & Saha, P. A Comparative review on ginger and garlic with their pharmacological Action. *Asian Journal of Pharmaceutical Research and Development*, 2022; 10(3):65-69.
34. Singh, M. K., Kumar, A., Kumar, R., Kumar, P. S., Selvakumar, P., & Chourasia, A. Effects of Repeated Deep Frying on Refractive Index and Peroxide Value of Selected Vegetable Oils. *International Journal for Research in Applied Sciences and Biotechnology*, 2022; 9(3):28-31.
35. Leopoldo Raij, The pathophysiologic basis for blocking the renin-angiotensin system in hypertensive patients with renal disease, *American Journal of Hypertension*, Volume 18, Issue 4, Supplement,2005, Pages 95-99, ISSN 0895-7061,https://doi.org/10.1016/j.amjhyper.2004.11.040.
36. Nyarko, R. O., Kumar, R., Sharma, S., Chourasia, A., Roy, A., & Saha, P. (2022). Antibacterial Activity Of Herbal Plant-Tinospora Cordifolia And Catharthus Roseus.
37. Kumar, R., Saha, P., Lokare, P., Datta, K., Selvakumar, P., & Chourasia, A. A Systemic Review of Ocimum sanctum (Tulsi): Morphological Characteristics, Phytoconstituents and Therapeutic Applications. *International Journal for Research in Applied Sciences and Biotechnology*, 2022; 9(2): 221-226.
38. Sahana, S. (2020). Purabi saha, Roshan kumar, Pradipta das, Indranil Chatterjee, Prasit Roy, Sk Abdur Rahamat. A Review of the Corona virus (COVID-19) *World Journal of Pharmacy and Pharmaceutical science*, 2019; 9(9):2367-2381.
39. Bind, A., Das, S., Singh, V. D., Kumar, R., Chourasia, A., & Saha, P. Natural Bioactives For The Potential Management Of Gastric Ulceration. *Turkish Journal of Physiotherapy and Rehabilitation*, 2020; 32(3).