



## A Cost Comparison and Cost Variation Analysis of Anti Rheumatoid Drugs and Anti-Hypertensive Drugs in Ayurveda and Allopathy

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### ABSTRACT

Our study aimed to analyze and compare monthly costs along with cost variation between Ayurveda and Allopathy medicines used to treat 2 chronic disease conditions, viz. Rheumatoid Arthritis and Hypertension. The prices of Allopathic & Ayurvedic drugs mentioned in the treatment guidelines for these 2 conditions were obtained from different sources. The minimum and the maximum cost of a particular drug of the same strength manufactured by various pharmaceutical companies were noted for both Ayurvedic and as Allopathic medicines. Cost Ratio and percent Cost Variation were also calculated. The results showed that the percent Cost Variation Difference (%CVD) for ayurvedic medicines for Anti-Rheumatoid arthritis ranged from 105% to 166.33%. In the case of Allopathic drugs, the %CVD ranged from 182% for DMARDs to 1184.39% for Corticosteroids. In the case of Anti-hypertensive medicines, too, the mean %CVD ranged from 84.21% for Rasaushadhi to 353.33% for Arishta, while %CVD ranged from 150.70% for ACE inhibitors to 269.85% for Calcium channel blockers for Ayurvedic and Allopathic medicines, respectively. A comparison of the monthly medicine cost for Rheumatoid Arthritis in Ayurveda and Allopathy showed that the cost for Ayurveda medicine ranged from ₹993.16 to ₹1994 while that for Allopathic medicines ranged from ₹735.53 to ₹2634.57. In the case of hypertension, the monthly medicine cost ranged from ₹255.64 to 2136.35 depending on the grade of Hypertension for Ayurvedic medicines and ₹312.65 to ₹631.15 for Allopathic medicines. Thus, we can conclude that there is a wide difference in the prices of the various brands of the same oral Antihypertensive and Anti-Rheumatoid arthritis drugs available in both Ayurveda and Allopathy in the Indian market.

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### INTRODUCTION

Consumption of medications from the Alternative Systems of Medicine is on the rise globally. Ayurveda is the most commonly practised Alternative systems of Medicine in India, fulfilling the medical needs of 80% of the population [1]. The debate on the efficacy of therapies in Ayurveda medicine and Allopathic medicine has been going on since decades, as also on the cost of treatment and acceptance of the various treatment modalities. Public interest for the treatment with complementary and alternative medicine is mainly due to the adverse effect profile

of synthetic drugs, lack of curative treatment for several chronic diseases, high cost of new drugs, microbial resistance, and emerging diseases, etc. [2].

The Ayurveda market in India was valued at INR 300 billion in 2018 and is expected to reach INR 710.87 billion by 2024, expanding at a compound annual growth rate (CAGR) of ~16.06%, during the forecast period (2019-2024) [3].

In recent years, as a holistic healing system, Ayurveda has witnessed an evolution in the form of Ayurveda products and services. Rising awareness about the importance of a healthy lifestyle, increasing preference in favor of chemical-free natural products, as well as favourable government initiatives have led to the expansion of the Ayurveda market in India. In 2018, around 75% of Indian households used Ayurveda products against only 67% in 2015. Many a times, people tend to use more than one system of medicine simultaneously.

In a study conducted in Australia, 50% of people reported that they used alternative therapy along with conventional medicine [4]. About 80% of the world's population depend largely on traditional plant-derived drugs for their primary health care (PHC) [5, 6].

Although Allopathic treatment is often the best available option in emergency situations and for the treatment of acute medical conditions, in chronic medical conditions, Allopathic medicine has faced some difficulties which has driven people towards alternative medicines for better relief and the belief that ayurvedic medicines are more cost-effective especially for chronic medical conditions.

This paper aims to determine the cost of medicines used in 2 chronic diseases viz. Rheumatoid arthritis (RA) and Essential Hypertension, be it Ayurveda or Allopathic medicine and do a cost comparison to understand which treatment is more cost-effective when used for the management of chronic diseases for prolonged periods of time.

## STUDY OBJECTIVES

1. To determine the number of brands with their prices of anti-Rheumatic medicines in Ayurveda and Allopathy.
2. To determine the number of brands and prices of anti-hypertensive medicines in Ayurveda and Allopathy.
3. To compare the monthly cost of both Ayurveda and Allopathy medicines used in Rheumatoid Arthritis and Hypertension.

## MATERIALS AND METHODS

Initially, the treatment guidelines for both the medical conditions under study were obtained from Central Council for Research in Ayurveda Sciences (CCRAS) [7] [8], Ayurveda Medicine textbook [9], API Textbook of Medicine [10], Harrison's Principles of Internal Medicine [11] and the Ministry of Health and Family Welfare, Govt of India. Screening, Diagnosis, Assessment, and Management of Primary Hypertension in Adults in India. [12].

Next, the prices of the Allopathic & Ayurvedic drugs mentioned in the treatment guidelines were obtained from different sources, both offline and online.

The offline sources accessed were the latest issues of Drug Today, CIMS and MIMS, Ayurveda Line (Ayurveda Drug Index Book), while the online sources accessed were: "India Drug Index" and "Drug Brands" Drugs Update, and Ayurveda medicines.

Various websites selling Ayurveda medicines were also referred to, which included from small scale manufacturers to branded companies like Patanjali, Dabur, Baidyanath etc.

The minimum and the maximum cost in Rupees (INR) of a particular drug manufactured by various pharmaceutical companies in the same strength were noted for both Ayurvedic as well as Allopathic medicines.

The cost ratio, i.e., the ratio of the cost of the costliest to a cheapest brand of the same drug, was calculated. This determines the difference in the cost between the costliest brand to the cheapest one in each group.

Percentage cost variation was calculated as follows,

$$\% \text{ Cost variation} = \frac{\text{Maximum cost} - \text{Minimum cost}}{\text{Minimum cost}} \times 100$$

As these are chronic disorders and the medications are prescribed for longer periods of time, their monthly cost was calculated as per the treatment guidelines.

## RESULTS

The latest prices of the various anti-rheumatic and antihypertensive drugs obtained from various offline and online sources available in the Indian market for both Ayurveda and Allopathic medicine were documented. All the commonly prescribed groups of antihypertensive drugs and anti-rheumatoid arthritis drugs were included.

The treatment cost for one month for each medicine was calculated according to the standard treatment

guidelines. The total monthly cost of treatment was calculated, and a wide cost-variation was found in most of the antihypertensive drugs and the anti-rheumatoid arthritis drugs both in Ayurveda and Allopathy was observed.

The following tables give details of the medicines and their monthly costs,

### **Anti-Rheumatoid arthritis Drugs**

The medicines used to treat RA, both in Ayurveda and Allopathy as per the Treatment Guidelines, are listed below

#### **Ayurveda Treatment Guidelines**

According to Ayurveda, the main cause of the disease is the formation of Ama due to Agnimandya. The general principles of treatment of this disease in Ayurveda lay emphasis on stimulating and normalizing the impaired Agni by the use of Langhana, Deepana, Pachana, and Katu, Tikta Rasa predominant drugs (for the correction of digestion and metabolism).

For detoxification Swedana (sudation), Virechana (therapeutic purgation) and Vasti (therapeutic enema) are recommended.

#### **Modern treatment guidelines**

First and foremost is the recognition that damage and disability accrue rapidly in the first few months to two years. A delay of even as little as 3-4 months in initiating appropriate treatment makes a significant difference in the outcome over long periods.

The second principle is that accurate objectified assessment of disease activity used as a guide for titrating treatment leads to much-improved outcomes both in the short as well as long-term.

The third principle is based upon a notable observation that the toxicity of disease-modifying anti-rheumatic drugs (DMARDs; see below), especially the newer ones led by methotrexate (MTX), was actually less than the so-called simple painkillers, non-steroidal anti-inflammatory drugs (NSAIDs).

Use of glucocorticoids for a short period to control flares, low dose-long term and low dose taper to be used.

To prevent osteoporosis (calcium + vitamin D<sub>3</sub> supplementation). A topical application containing salicylates, capsaicin and NSAID's in various combinations may provide symptomatic relief.

The costs of the medicines to treat Rheumatoid arthritis as per Ayurveda and the mean monthly cost of the same are summarized in Table 1 and Table 2. The costs of the medicines as per Allopathy is summarized in Table 3, Table 4 and Table 5.

Thus, the mean cost of Ayurveda medicines for the treatment of Rheumatoid arthritis for a period of 30 days ranged from ₹933.16 to ₹1994.

Thus, the mean cost of treating Rheumatoid arthritis with allopathic medicines for a period of 30 days ranged from ₹735.53 to ₹2634.57.

### **Anti-Hypertensive Drugs**

The medicines used to treat hypertension, both in Ayurveda [8] and Textbook of Kayachikitsa [9] and in Modern medicine [12], are listed below

Ayurvedic treatment for Hypertension has both single drugs as well as compound formulations, the details of which are listed below

#### **Single Drugs**

Sarpagandha churna, Ashwagandha churna, Jatamansi churna, Arjuna twaka churna

#### **Compound Formulations**

Sarpagandha ghana vati, Brahmi vati, Prabhakara vati, Arjunarishta, Pravala pishti, Sveta parpati, Nagarjunabhra rasa, Hridayarnava rasa, Mukta bhasma, Akika pishti

Treatment in Ayurveda for Hypertension according to Central Research Council of India and Textbook of Kayachikitsa is as follows:

Grade 1 Hypertension - Churna or Vati or kadha

Grade 2 Hypertension - Churna + Vati, Vati + kadha, Churna + kadha

Grade 3 Hypertension - Churna + Kadha + Rasaushadhi, Vati + kadha + Rasaushadhi

#### **Churna**

Sarpagandha churna, Ashwagandha churna, Jatamansi churna, Arjuna twaka churna

#### **Vati**

Sarpagandha ghana vati, Brahmi vati, Prabhakara vati

#### **Kadha**

Arjunarishta

#### **Ras Aushadi**

Pravala pishti, Sveta parpati, Nagarjunabhra rasa, Hridayarnava rasa, Mukta bhasma, Akika pishti

### **The Treatment Guidelines for Hypertension**

According to the Ministry of Health & Family Welfare Government of India, 2021 are as follows:

#### **Drug classes**

**A:** Angiotensin-converting enzyme (ACE) inhibitors, (e.g., enalapril) or Angiotensin II receptor blockers (ARBs) (e.g., losartan) if intolerance to ACE inhibitors,

**Table 1: Cost of Medicines for Rheumatoid Arthritis in Ayurveda**

Drug	Dosage	Formulation	Min. cost (INR)	Max. cost (INR)	% Cost variation	Range in terms of monthly expenses of the medicines
Shunthi Churna	3gm BD	100 gm	52	180	246	93.6-324
Simhanaad guggulu	500mg BD	60 tabs	56	149	166	112-298
Vaisvanar Churna	3gm BD	60 gm	72	96	33	216-288
Maharasnadi Kadha	30ml BD	450 ml	170	350	105	680-1400
Aamvaatari Ras	250mg BD	60 tabs	54	135	150	108-270
Yograaj guggulu	500 mg BD	60 tabs	65	180	176	130-360
Chitrakadi Vati	250 mg BD	60 tabs	50	160	220	100-360

**Table 2: Mean Monthly Cost of the Ayurvedic medicines**

Type of medicine	Name	Mean Monthly Cost of medicine	
		Min (INR)	Max (INR)
Deepan	Vaisvanar churna, Shunthi Churna, Chitrakadi Vati	136.50	304
Guggulu or Vati	Simhanaad Guggulu, Yograaj Guggulu, Aamvatari Vati	116.66	290
Kadha	Maharasnadi kadha	680	1400

**Table 3: Cost of Disease Modifying Anti Rheumatic Drugs**

Drug	Dosage	Formula -tion	Min. cost (INR)	Max. cost (INR)	% Cost variation	Monthly expenses of the medicines
Sulfasalazine	500mg BD	10	37.74	65.09	72%	226.44 – 390.54
Leflunomide	10mg BD	10	80	112	40%	240 – 336
	20mg BD	10	160	223	42.94%	480 – 669
Hydroxychloroquine	200mg BD	10	34.00	72.00	238%	204 – 432
Methotrexate	2.5mg weekly once	10	14.00	57.85	378%	16.8 – 69.42
	5mg weekly once	10	32.00	67	156.25%	25.6 – 65.6
	7.5mg weekly once	10	47.20	90.00	141%	18.88 – 28.5

**Table 4: Cost of NSAIDs**

Drug	Dosage	Formulation	Min. cost (INR)	Max. cost (INR)	% Cost variation	Monthly expenses of the medicines
Ibuprofen	400mg BD	10	8.89	11.33	27.44	53.34 – 67.98
Diclofenac	50mg BD	10	9.63	94.50	881	57.78 – 567
Naproxen	500mg BD	10	28.00	135	382	168 – 810
Acetaminophen	500mg BD	10	6.91	38	450	41.46 – 228
Duloxetine	20mg BD	10	43.30	91.25	110	259.8 – 547.5
Tramadol	50mg BD	10	29	102.4	251	174 – 614.4

**Table 5: Cost of Glucocorticoids**

Drug	Dosage	Formulation	Min. cost (INR)	Max. cost (INR)	% Cost variation	Monthly expenses of the medicines
Prednisolone	5mg TDS	10	4.12	156	3686%	24.72 – 936
	10 mg TDS	10	9.84	66.62	577%	29.52 – 199.86
	20 mg TDS	10	17.2	90.00	423.25%	25.8 – 41.02
	40 mg TDS	10	33.81	51.17	51.34%	13.52 – 20.68

**Table 6: Cost of Calcium Supplements**

Drug	Dosage	Formulation	Min. cost (INR)	Max. cost (INR)	% Cost variation	Monthly expenses of the medicines
Calcium Carbonate	500 mg OD	10	29.90	140	368.22	89.7 - 420

**Table 7: Cost of Vitamin D<sub>3</sub> Supplements**

Drug	Dosage	Formulation	Min. cost (INR)	Max. cost (INR)	% Cost variation	Monthly expenses of the medicines
Alfacalcidol	0.25 µg OD	10	48	169	252	144 – 507
Cholecalciferol	60k IU weekly once	4	70	116	65.71	70 - 116

**Table 8: Cost of Topical agents used for Rheumatoid arthritis**

Drug	Dosage	Formulation	Min. cost (INR)	Max. cost (INR)	% Cost variation	Monthly expenses of the medicines
Capsaicin	3gm BD or TDS	30g	35	95	171.42	140 - 380
Diclofenac diethylamine	3gm BD or TDS	30 g	70	190.46	172.08	280 – 761.84

**Table 9: Mean cost of the monthly Allopathic medicines used for the treatment of Rheumatoid arthritis**

Medicines	Mean minimum monthly cost (INR)	Mean Maximum monthly Cost (INR)
NSAIDs	125.73	476.98
Local Gel	240	1141.84
Calcium	89.70	420
Vitamin D <sub>3</sub>	107	311.5
DMARD's	173.10	284.43

**B** : Beta-blockers (e.g., atenolol),

**C**: Calcium channel blockers (e.g., amlodipine),

**D**: thiazide diuretics (e.g., hydrochlorothiazide),

**MRA**: mineralocorticoid receptor antagonist (e.g., spironolactone).

**Grade 1 hypertension** (SBP 140-159 mm, DBP 90-99mm)

**Drug therapy - A or C or D**

**Add the second drug - A+C or C+D or A+D** if a response is not adequate within 2-4 weeks,

**Add third drug - A+C+D** if response not adequate within 2-4 weeks.

**Grade 2 Hypertension** (SBP 160-179, DBP 100-109)

**Drug therapy - A or Cor D,**

**Add the second drug - A+C or C+D or A+D** if a response is not adequate within 2-4 weeks,

**Add third drug - A+C+D** if response not adequate within 2-4 weeks.

**Grade 3 Hypertension** (SBP  $\geq$ 180, DBP  $\geq$ 110)

**Use two drugs - A+C or C+D or A+D.**

**Add third drug - A+C+D** if response not adequate within 2-4 weeks.

The costs of the medicines to treat Hypertension as per Ayurveda and the mean monthly cost of the same are summarized in Table 5, Table 6 and Table 4.

The costs of the medicines as per Modern medicine is summarized in Table 7, Table 8, Table 9, Table 10 and Table 11.

The monthly cost of the medicines used for the treatment of Hypertension in Ayurveda when treated as per the Standard Treatment Guidelines are as follows:

**Grade 1 Hypertension** - Min ₹255.64 to Max ₹789.17,

**Grade 2 Hypertension** is Min ₹511.28 to Max ₹1578.33 and

**Grade 3 Hypertension** - Min ₹683.27 to Max ₹2136.35.

**Grade 1 hypertension** (SBP 140-159 mm, DBP 90-99mm)

**Drug therapy - A or C or D,** Mean monthly cost - Min 136 to Max 394.3 or Min 56.24 to Max 208.445 or Min 42.25 to Max 126.14 respectively. Mean cost - Min 78.16 to Max 243.

**Add the second drug - A+C or C+D or A+D** if response not adequate within 2-4 weeks, Mean monthly cost Min 192.24 to Max 602.7 or Min 98.49 to Max 346.44 or Min 178.25 to Max 520.44 respectively. Mean cost - Min cost 156.33 to Max 489.86.

**Add third drug - A+C+D** if response not adequate within 2-4 weeks. Mean monthly cost - Min 234.49 to Max 772.44.

**Grade 2 hypertension** (SBP 160-179, DBP 100-109)

**Drug therapy - A or Cor D,** Mean monthly cost - Min 136 to Max 394.3 or Min 56.24 to Max 208.445 or Min 42.25 to Max 126.14 respectively.

**Add the second drug - A+C or C+D or A+D** if response not adequate within 2-4 weeks, Mean monthly cost Min 192.24 to Max 602.7 or Min 98.49 to Max 346.44 or Min 178.25 to Max 520.44 respectively.

**Add third drug - A+C+D** if response not adequate within 2-4 weeks. Mean monthly cost - Min 234.49 to Max 772.44.

**Grade 3 hypertension** (SBP  $\geq$ 180, DBP  $\geq$ 110)

**Use two drugs - A+C or C+D or A+D.** Mean monthly cost Min 192.24 to Max 602.7 or Min 98.49 to Max 346.44 or Min 178.25 to Max 520.44 respectively. Mean cost - Min cost 156.33 to Max 489.86.

**Add third drug - A+C+D** if response not adequate within 2-4 weeks. Mean monthly cost - Min 234.49 to Max 772.44.

Thus, the mean cost of Allopathic medicines for the treatment of essential Hypertension for a period of

**Table 10: Costs of Ayurveda Anti-Hypertensive medications**

Drug	Dosage	Formulation	Min. Cost (INR)	Max. Cost (INR)	% Cost variation	Monthly expenses of the medicines (INR)
Sarpagandha ghan vati	250 mg BD	60 tabs	87	199	118	174 – 380
Bhramhi Vati	250 mg OD	60 tabs	48.33	250	417.27	96.66 – 500
Prabhakar vati	250 mg BD	60 tabs	120	250	108.33	240 – 500
Arjunarishtha	30 ml BD	450 ml	75	340	353.33	300 – 1360
Pravala Pishti	125 mg BD	5 g	120	196	63	180 – 294
Shveta Parpati	250 mg BD	10 g	48	110	186	57.6 – 165
Nagarjunabhra rasa	250 mg BD	40 tabs	65	108	4.61	97.5 – 162
Hridayarnava ras	125 mg BD	60 tabs	70	182.40	160	140 – 361.8
Mukta bhasma	30 mg BD	1 g	290	485	67.24	290 – 485
Akika pishti	125 mg BD	10 g	90	112	24.44	135 – 168
Sarpagandha churna	2 g BD	100 g	180	285	58.33	432 – 684
Ashwagandha churna	6 g BD	100 g	123	210	70.73	442.8 – 756
Jatamansi churna	2g BD	100 g	185	325	75.67	222 – 390
Arjun twaka churna	3g BD	100 g	50	200	300	90 – 360

**Table 11: Monthly cost of Ayurvedic medicines to treat Hypertension**

Hypertension Grade	Ayurvedic Medicines	Mean Min Cost (INR)	Mean Max Cost (INR)	Mean Cost for 1 month (INR)
Grade 1 Hypertension	Churna or Vati or Kadha	296.7	547.5	Min 255.64 Max 789.17
Grade 2 Hypertension	Churna + Kadha Vati + Kadha Churna+ Vati	596.7 470.22 466.92	1907.5 1820 1007.5	Min 511.28 Max 1578.33
Grade 3 Hypertension	Churna + Kadha + Rasaushadhi or Vati + Kadha + Rasaushadhi	746.71 620.32	2180.1 2092.6	Min 683.27 Max 2136.35

**Table 12: Cost of Angiotensin-Converting Enzyme Inhibitors (ACEIs)**

Drug	Dosage	Formulation	Min. cost (INR)	Max. cost (INR)	% Cost variation	Monthly expenses of the medicines
Captopril	25mg OD	10 tabs	9.07	37.50	313.45	27.21-112.5
Enalapril	5mg OD	10 tabs	28.00	99.60	255.71	84-298.8
Lisinopril	5mg OD	10 tabs	45.00	270.90	502	135-812.7
Perindopril	4mg OD	10 tabs	65.00	123.91	90.63	195-371.73
Ramipril	5mg OD	10 tabs	30.00	185.00	516.66	90-555
Fosinopril	10mg OD	10 tabs	25.00	60.00	140	75-180

**Table 13: Cost of Angiotensin Receptor Blockers (ARBs)**

Drug	Dosage	Dosage	Formulation	Min. cost (INR)	Max. cost (INR)	% Cost variation	Monthly expenses of the medicines
Losartan	50mg OD	50mg	10 tabs	19.00	67.70	256.31	57 – 203.1
Candesartan	8mg OD	8mg	10 tabs	38.00	61.80	62.63	114 – 185.4
Irbesartan	150mg OD	150mg	10 tabs	69.30	246.15	255.19	207.9 – 738.45
Telmisartan	40mg OD	40mg	10 tabs	43.50	85.33	96.16	130.5 – 255.99
Valsartan	80mg OD	80mg	10 tabs	69.00	440.00	537.68	207 – 1320

**Table 14: Cost of Beta-Blockers**

Drug	Dosage	Formulation	Min. Cost (INR)	Max. Cost (INR)	% Cost variation	Monthly expenses of the medicines
Propranolol	40mg OD	10 tabs	9.37	39.00	316.22	28.11 – 117
Atenolol	50mg OD	10 tabs	8.00	23.14	189.25	24 – 69.42
Metoprolol	50mg OD	10 tabs	18.00	89.00	394.44	54 – 267
Bisoprolol	2.5mg OD	10 tabs	16.50	40.00	142.42	49.5 – 120
Nebivolol	5mg OD	10 tabs	52.00	70.00	34.61	156 – 210
Labetalol	100mg OD	10 tabs	29.57	110.00	271.99	88.71 – 330
Carvedilol	12.5mg OD	10 tabs	22.00	86.00	290.90	66 – 258

**Table 15: Cost of Calcium channel blockers (CCBs)**

Drug	Strength	Formulation	Min. cost (INR)	Max. cost (INR)	% Cost variation	Monthly expenses of the medicines
Amlodipine	2.5 mg OD	10 tabs	9	34.6	284.44	27-103.8
	5 mg OD	10 tabs	9.00	56	522.22	27-168
	10 mg OD	10 tabs	25.03	103.04	313.1	75.9-309.12
Nifedipine	5 mg OD	10 tabs	8.50	11.34	33.41	25.5-34.02
	10 mg OD	10 tabs	1.13	30.00	2554	3.39-90
	20 mg OD	10 tabs	20	26.50	32.5	60-79.5
Cilnidipine	30 mg OD	10 tabs	18.42	102.47	456.29	55.26 – 307.41
	5 mg OD	10 tabs	25.00	88.00	252	75-264
Diltiazem	10 mg OD	10 tabs	40.00	127.10	217.75	120-381.3
	30 mg OD	10 tabs	14.75	36.57	147.93	44.25-109.71
	60 mg OD	10 tabs	29.00	74.40	156.55	87-223.2
	90 mg OD	10 tabs	30.00	107.00	256.66	90-321

**Table 16: Cost of Diuretics**

Drug	Strength	Formulation	Min. cost (INR)	Max. cost (INR)	% Cost variation	Monthly expenses of the medicines
Hydrochlorothiazide	12.5mg OD	10 tabs	6.00	13.00	116.66	18 – 39
Indapamide	2.5mg OD	10 tabs	24.10	88.70	268.04	72.3 – 266.1
Torsemide	10mg OD	10 tabs	19.50	36.74	88.41	58.5 – 110.82
Furosemide	40mg OD	10 tabs	4.21	13.60	223.04	12.63 – 40.8
Acetazolamide	12.5mg OD	10 tabs	16.60	58.00	249.39	49.8 - 174



30 days when given as per the STGs is as follows:

In the case of Grade I Hypertension, the monthly cost of drug therapy with a single drug viz. A - Min ₹136 to Max ₹394.3 or C - Min ₹56.24 to Max ₹208.445 or D - Min ₹42.25 to Max ₹126.14 respectively. Thus, the mean monthly cost of medicines ranged from ₹78.16 to ₹243. The addition of a second drug raised the monthly costs which depended on the drug added, for example, A+C - mean monthly cost ranged from ₹192.24 to ₹602.7 or C+D - ₹98.49 to ₹346.44 or A+D - ₹178.25 to ₹520.44 respectively. Thus, the mean cost varied from ₹156.33 to ₹489.86. Addition of a third drug - A+C+D if response was not adequate within 2-4 weeks increased the mean monthly cost to a range from ₹234.49 to ₹772.44. (Table 12, Table 13, Table 14, Table 15, and Table 16)

The same trend was seen in the case of Grade 2 & Grade 3 Hypertension. Use of two drugs - A+C or C+D or A+D gave a mean monthly cost varying from ₹192.24 to ₹602.7 or ₹98.49 to ₹346.44 or ₹178.25 to ₹520.44 respectively. Thus, the mean cost varied from ₹156.33 to ₹489.86. The addition of a third antihypertensive drug - A+C+D in case of poor response within 2-4 weeks increased the mean monthly cost to ₹234.49 to ₹772.44.

## DISCUSSION

Ayurveda being a holistic system of medicine, views the body as a whole and tries to improve or modify the body's healing ability *via* its immune system. Herbal medicines are prescribed as personalized medications such that the treatment is tailored as per the requirement of the individual patient. On the other hand, Allopathy is a reductionist system of medicine wherein the treatment of a particular disease or disorder is based on its signs and symptoms, rarely taking into consideration the psychological and emotional aspects of the patient and rarely individualizes the therapy.

Thus, although Allopathy has been the most acceptable system of medicine over the years, people are gradually shifting back to alternative systems of medicine, mainly due to the side effect profile of allopathic medicines and the costs, especially for chronic medical conditions. Herbal medicine like Ayurveda and Homeopathy are preferred in these types of settings mainly because of the belief in the minds of people that these medicines are less expensive and more reasonable, more accessible and acceptable, time-tested, considered natural and safer and with less or no side effects [13, 14].

Our study thus aimed to compare the monthly costs of Ayurvedic and Allopathic medicines used in 2

chronic medical disorders viz. Rheumatoid arthritis (RA) and Essential Hypertension to determine which treatment is more cost-effective when used for a prolonged duration.

The comparison of the monthly medicine cost for Rheumatoid Arthritis in Ayurveda and Allopathy, when treated as per Standard Treatment Guidelines, showed that the medicine cost for Ayurveda medicine ranged from ₹993.16 to ₹1994 while that of Allopathic medicines ranged from ₹735.53 to ₹2634.57, which is comparable. The cost of medical treatment of RA has varied with time and the use of biologics. Tiwari et al. [15] estimated the monthly direct medical cost of treatment of RA to be ₹623±31 with DMARDs in 2007.

Another study by Shini et al. [16] has shown the mean monthly cost to be ₹696.57±218.39. A study conducted at a tertiary care hospital at Mumbai, India, in 2011 estimated the mean total cost per prescription as ₹763.39 [17], while another study conducted at AIMS, Kochi, India, estimated the direct drug cost for the treatment of RA with sDMARDs in 2013 to be ₹737.49 per month [18]. A recent study conducted in 2016 by Syngle et al. [19] has reported the mean monthly medicine cost of RA to be ₹997.05.

However, considerable cost variation difference was found among the different brands of the same anti-rheumatoid arthritis and antihypertensive drugs both in Ayurveda and Allopathy. The percent cost variation difference (%CVD) for anti-rheumatoid arthritis ayurvedic medicines was 166.33% for Deepan drugs, 164% for Vati and Guggulu and 105% for kadhas.

A literature search did not find any other similar publications on the same topic with respect to Ayurvedic medicines. In the case of Allopathic anti-rheumatoid arthritis drugs, the percent difference in cost variation was 182% for DMARDs, 350% for NSAIDs and 1184.39% for Corticosteroids.

In the case of Anti-hypertensive Ayurveda medicine, the Percent Cost Variation Difference was 214.53% for Vati, 353.33% for Arishta, 84.21% for Rasaushadhi and 126.18% for Churna. As there is no other cost variation analysis of the anti-hypertensive drugs in Ayurveda, we could not compare the costs with previous literature.

The Mean Cost Variation Difference of Allopathic anti-hypertensive drugs were found out to be 150.70% for ACE inhibitors, 241.59% for ARB, 234.23% for Beta Blockers, 269.85% for Calcium channel blockers and 189.10% for Diuretics.

Karve and Chattar; Kamath and Satish [20, 21] found

that the percentage price variation of the commonly used anti-hypertensive drugs was above 100% viz. amlodipine (2.5 & 5 mg), Atenolol (12.5 & 50 mg), Enalapril & Ramipril (10mg) and Telmisartan (20 & 40 mg). Mir [22] showed that the cost variation was as high as 2337.50 % for Hydralazine.

Similarly, [23, 24] showed that of 32 drugs most commonly prescribed, the percentage price variation was very wide, with Amlodipine (5 mg) showing a maximum price variation of 1128.57% and Olmesartan (10 mg) showing a minimum variation of 25.64%. Similar findings were observed with the combination form of antihypertensive drugs.

The monthly cost of treating Hypertension ranged from ₹255.64 to 2136.35 depending on the grade of Hypertension for Ayurvedic medicines and ₹312.65 to ₹631.15 for Allopathic medicines. Thus, it can be seen that the monthly cost of medicines in Ayurveda is much higher than in Allopathy. Thus, although the belief is that Ayurvedic medicines are cost-effective, our results show that this is not the case in both Rheumatoid arthritis and essential hypertension, 2 chronic medical conditions which need prolonged therapy.

## CONCLUSIONS

Based on the results of the findings, we can conclude that there is a wide difference in the percentage price variation of various brands of the same oral antihypertensive drugs and Anti-Rheumatoid arthritis drugs available in both Ayurveda and modern Medicine in the Indian market. Switching to alternative modes of treatment has gained popularity nowadays, the main reason being the belief that these medicines are safe with fewer adverse effects. However, the prices of the monthly cost of medicines used in both Ayurveda and Allopathy are more or less similar or sometimes the Ayurvedic medicine cost is higher. For the successful treatment of chronic disorders like hypertension and Rheumatoid arthritis, compliance plays a major role. Increased adherence to the treatment can be ensured only by decreasing the cost of therapy and increasing awareness among physicians regarding switching to more cost-effective medicines to decrease the economic burden on patients.

## Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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