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Original Research Article

Cost variation analysis of agents used to treat hyper pigmentation available in the Indian market

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ABSTRACT

Background: Hyperpigmentation is a condition in which patches of skin become darker in colour; usually treated by various topical, oral and injectable agents. Very few studies have been done to analyse their cost variation, despite a number of agents in various dosage forms being freely available in India. Thus, this study was designed to compare cost ratio and percentage cost variation.

Methods: The maximum and minimum price of each brand of the agents used to treat hyperpigmentation, in INR per unit, was noted by using 'CIMS' 2023-24 issue, Indian Drug Review Triple I Compendium Issue 6 (2024)) and NPPA's 'Pharma Sahi Daam' website. The cost ratio and percentage cost variation for individual drug brands was calculated and compared.

Results: A total of 520 brands (207 single and 313 combination-agent) were analysed, comprising a total of 109 formulations. Across all dosage forms, the percentage cost variation and cost ratio were maximum for injection glutathione 500mg and minimum for tranexamic acid 3% gel. For topical single-agent formulations, the highest cost ratio of 8.54 and variation of 753.93% were observed for hydroquinone 2% cream (7 brands). Among combination agents with known concentrations, hydroquinone + mometasone + tretinoin 2/0.1/0.025% cream (48 brands), showed the highest cost ratio and variation of 14.06 and 1305.52% respectively.

Conclusions: Out of total 109 formulations, 48 had cost variation of more than 100%. The prescribing physicians should be aware of this disparity in cost of the agents to reduce the economic burden of treatment.

Keywords: Pigmentation, Cost ratio, Hydroquinone, Topical steroids, Melasma, Pharmacoeconomic

INTRODUCTION

Hyper-pigmentation is a common, usually harmless condition of the skin in which some patches become darker in colour than the normal surrounding skin. It is an umbrella term that includes various discoloration, pigmentation, and darkening-related dermatological disorders.¹ Melanocytes in cooperation with enzyme tyrosinase are responsible for the production and

conversion of DOPA (dihydroxyphenylalanine) to melanin. Melanosomes containing pigment are ingested by the keratinocytes, and the melanin is shed with the stratum corneum cells.²

Hyperpigmentation usually occurs due to hyper-melanosis, which is when an excess of melanin forms deposits in the skin. These changes in skin coloration can be a result of various internal and external factors including hormonal changes, inflammation, injury, acne,

eczema and drugs.¹ The commonly observed hyper-pigmentation disorders include melasma, post-inflammatory hyper-pigmentation, ephelides, lentigines and periorbital hyper-pigmentation.^{3,4}

Although hyper-pigmentation is a common cosmetic complaint in most skin types, it is often prominently found in middle-aged women and populations with Fitzpatrick III-VI skin type.⁵ The darker the skin colour, the more intense and persistent it tends to be.⁶ Studies from India reveal that more than 80% of the population presents with skin colour heterogeneity on the face, mainly resulting from hyper-pigmented spots, melasma and ill-defined pigmented macules, and dark circles.⁷

Various treatment options are available for hyperpigmentation. These include topical agents like hydroquinone, retinoids, kojic acid, niacinamide, vitamin C and alpha arbutin; along with some oral agents like glutathione and vitamins.^{4,5} A few injectable agents like glutathione are also available. In addition, various cosmeceuticals and phytochemicals like liquorice, aloe, soy, green tea extract, etc. are available in a wide variety of dosage forms, including creams, gels, lotions, serums and soaps.^{8,9} Laser and chemical peels are the other options. Further, prevention or maintenance therapy with sunscreens for UV protection remains crucial to manage hyperpigmentation in most patients.¹⁰⁻¹³

Hyperpigmentation is not considered a harmful or lethal disorder. However, it can affect the quality of life of patients by affecting their emotional and psychological health.¹ Studies reveal that melasma patients often suffer from anxiety, depression or somatoform disorder. The more severe the skin disease, the greater likelihood that patients also suffer from anxiety and depression.¹⁴

As per the latest literature search, very few studies have been done to analyse the cost variation of the various agents used for the treatment of hyperpigmentation. The knowledge regarding therapy of hyperpigmentation is lacking in the Indian context. This is despite a high number of pharmaceutical agents in various dosage forms, including cosmeceuticals and phytochemicals in various combinations, being freely available over the counter in the Indian market.¹⁵⁻¹⁷ Moreover, treatment is often long term, requiring regular follow-up over multiple visits. Therefore, the price of a product can have a great impact on the compliance towards the treatment. Thus, this study was designed with the aim to find out the variation in price, which will guide the treating doctors in selecting the agent of choice.

METHODS

The study was a cross-sectional observational study conducted in the Department of Pharmacology of H.B.T. Medical College and Dr. R.N. Cooper Municipal General Hospital over a period of 3 months. This was conducted after obtaining permission from the Institutional Ethics

Committee (IEC). A waiver was obtained for the same. All the data collected was kept strictly confidential and was used for the purpose of this study as described below. There were no deviations from the below given methods/procedure during the course of the study.

The maximum and minimum price of each brand of the agents used to treat hyperpigmentation, in INR per unit of product, was noted by using 'Current Index of Medical Specialities' Annual 2023-24 issue, Indian Drug Review Triple I Compendium Issue 6 (2024)) and National Pharmaceutical Pricing Authority's Government of India official 'Pharma Sahi Daam' website as accessed in October 2024. All dosage forms and routes mentioned on these websites were included in the analysis. However, sunscreens were not analysed in this study, since they are mainly used for prevention and not treatment of hyperpigmentation. Also, laser treatment was not analysed in the study. The cost ratio and the percentage cost variation for individual drug brands was calculated. At last, the cost ratio and percentage cost variation of various brands was compared. Appropriate descriptive statistical analysis was done using Microsoft Excel Software.

Cost ratio = Price of the costliest brand ÷ Price of the least costly brand

Percentage cost variation = [(Maximum cost per unit - Minimum cost per unit) ÷ Minimum cost per unit] × 100

RESULTS

A total of 520 brands were analysed, comprising 207 single-agent brands and 313 combination-agent brands. The analysis included 109 formulations (a formulation refers to an agent in a specific strength), out of which 43 were single-agent formulations and 66 were combination formulations. Overall, 54 agents (an agent refers to a drug/drugs in a specific dosage form) were evaluated, including 41 single agents and 13 combination agents. The number of single drugs analysed was 13 (Table 1 and Figure 1).

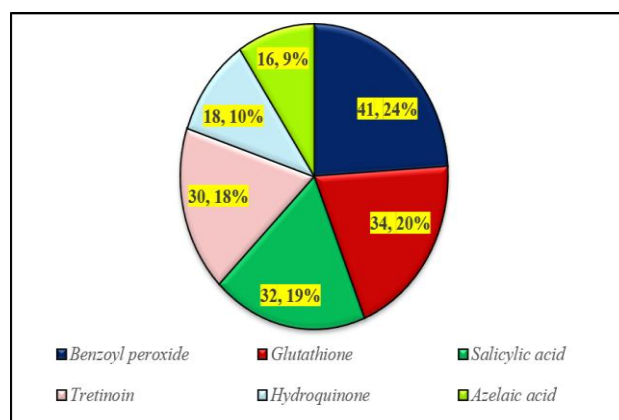


Figure 1: Single drugs for treating hyperpigmentation with more than 10 brands available in the Indian market.

The pie chart shows the distribution of single drugs with more than 10 marketed brands available in the Indian market, which were included in the cost variation analysis. Benzoyl peroxide accounted for the highest proportion (24%), followed by glutathione (20%), salicylic acid (19%), tretinoin (18%), hydroquinone (10%), and azelaic acid (9%). Values are expressed as the number of brands (n) and percentage (%).

The combination agents analysed included various combinations of tretinoin, benzoyl peroxide, glycolic acid, azelaic acid, kojic acid, arbutin, glutathione, niacinamide, vitamin C, hydroquinone, retinol, mandelic acid, salicylic acid and other miscellaneous drugs, phytochemicals and cosmeceuticals (Table 2 and 3).

Among single agents with known concentrations, the overall analysis showed that the highest cost ratio and variation were observed for injection glutathione 600 mg (16 brands), with a cost ratio of 18.93 and a variation of 1793.18%. In contrast, the lowest cost ratio and variation were noted for tranexamic acid 3% gel (2 brands), with a cost ratio of 1.01 and a variation of 0.9%. For topical single-agent formulations, the highest cost ratio and variation were observed for hydroquinone 2% cream (7 brands), with a cost ratio of 8.54 and a variation of 753.93%. Glycolic acid 6% cream (2 brands) showed the lowest cost ratio and variation among creams, with a cost ratio of 1.22 and a variation of 22.17%. For gels, adapalene 0.1% gel (8 brands) demonstrated the highest cost ratio and variation, with a cost ratio of 5.81 and a variation of 481.16%. Among acid-based formulations, azelaic acid 20% cream (9 brands) showed the highest cost ratio and variation, with a cost ratio of 6.63 and a variation of 562.86% (Table 4). Among combination agents with known concentrations, the overall analysis revealed that the highest cost ratio and variation were observed for hydroquinone + mometasone + tretinoin 2/0.1/0.025% cream (48 brands), with a cost ratio of 14.06 and a variation of 1305.52%. The lowest cost ratio and variation were observed for glycolic acid + aloe vera 1/5% liquid (2 brands), with a cost ratio of 1.06 and a variation of 6.33%.

Among combination cream formulations, the lowest cost ratio and variation were noted for hydroquinone + tretinoin + hydrocortisone 2/0.025/1% cream (2 brands), with a cost ratio of 1.26 and a variation of 25.63% (Table 4).

Among combination agents with unknown concentrations, the highest cost ratio and variation were observed for retinol + hyaluronic Acid + glutathione gel (2 brands), with a cost ratio of 5.47 and a variation of 447.06%. The lowest cost ratio and variation were observed for hyaluronic acid + glycolic acid + vitamin C liquid (2 brands), with a cost ratio of 1.01 and a variation of 1.47% (Table 4). Among combination agents with only a single known agent, the highest cost ratio and variation were observed for kojic acid combination cream (50 brands), with a cost ratio of 57.21 and a variation of 5621.52%. The lowest cost ratio and variation were observed for kojic acid combination liquid (2 brands), with a cost ratio of 1.2 and a variation of 19.88% (Table 4).

Among all formulations (including those with at least one known agent, with concentrations either known or unknown), the cost ratio and variation analysis across certain topical dosage forms like facewash, lotion, soap, etc. showed the following findings depicted in tabular format (Table 5).

Out of a total of 109 formulations analysed in the study, 61 showed a percentage cost variation of less than or equal to 100%, while only 5 showed over 1000%. Further, 20 formulations showed 101-200%, 15 showed 201-400% and 8 showed 401-1000% of cost variation. Percentage cost variation among different strengths of hydroquinone cream available in the Indian market for the treatment of hyperpigmentation was analysed. The highest percentage cost variation was observed for hydroquinone cream 2% (753.93%), followed by hydroquinone cream 4% (197.67%), while the lowest variation was seen with hydroquinone cream 3% (63.07%). Results of further analysis of the findings of the study are depicted in the form of figures and tables given below (Table 6 and Figure 2-4).

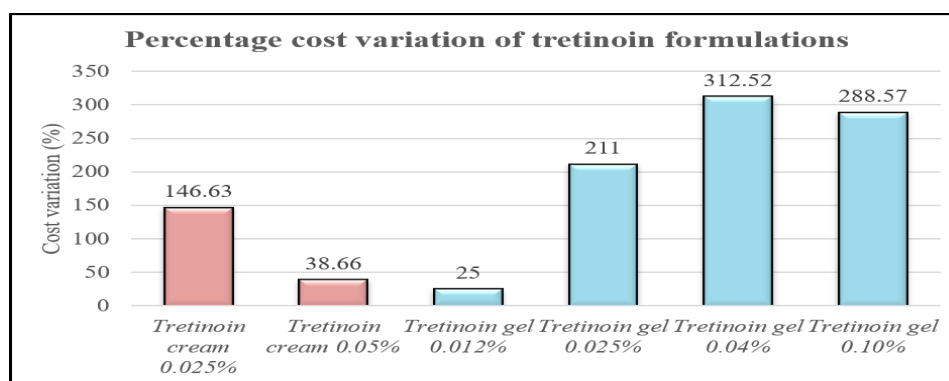


Figure 2: Cost variation of various formulations of tretinoin available in the Indian market for treatment of hyperpigmentation.

Percentage cost variation among different formulations of topical tretinoin available in the Indian market for the treatment of hyperpigmentation. The highest percentage cost variation was observed for tretinoin gel 0.04% (312.52%), followed by tretinoin gel 0.10%

(288.57%) and tretinoin gel 0.025% (211.00%), while the lowest variation was seen with tretinoin gel 0.012% (25.00%). Pink and blue bars demonstrate cream and gel dosage forms respectively.

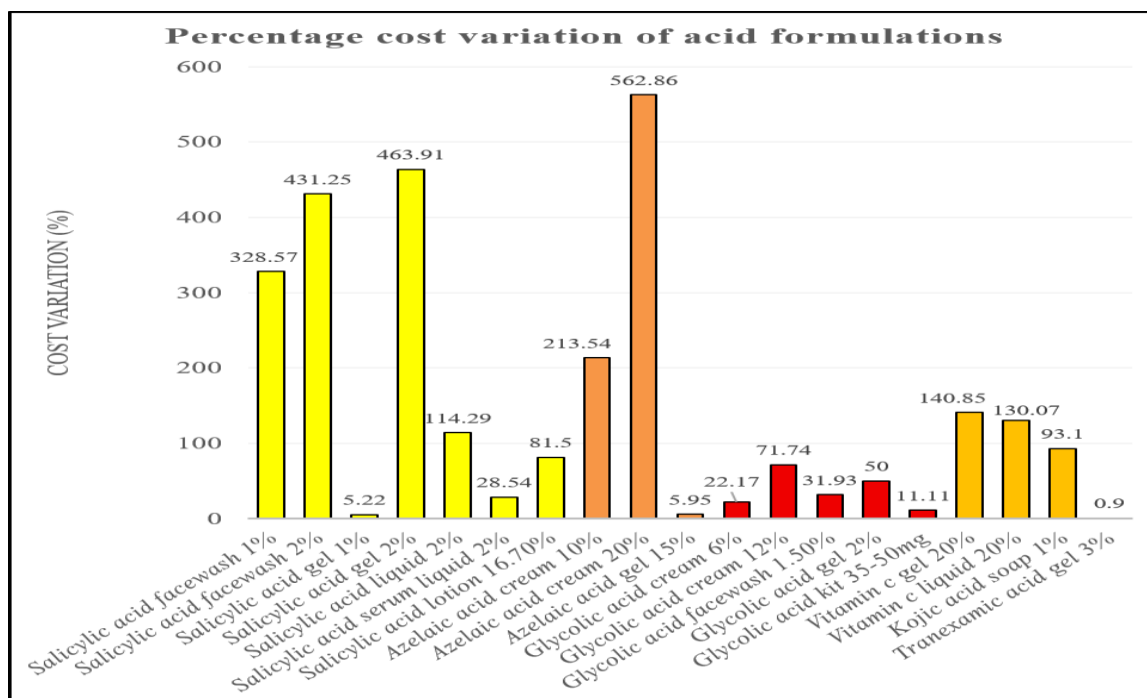


Figure 3: Cost variation of various formulations of acids available in the Indian market for treatment of hyperpigmentation.

Percentage cost variation among various formulations of topical acids available in the Indian market for the treatment of hyperpigmentation. Azelaic acid cream 20% showed the highest cost variation (562.86%), while tranexamic acid gel 3% showed the lowest (0.90%). Bars depict cost variation in percentage.

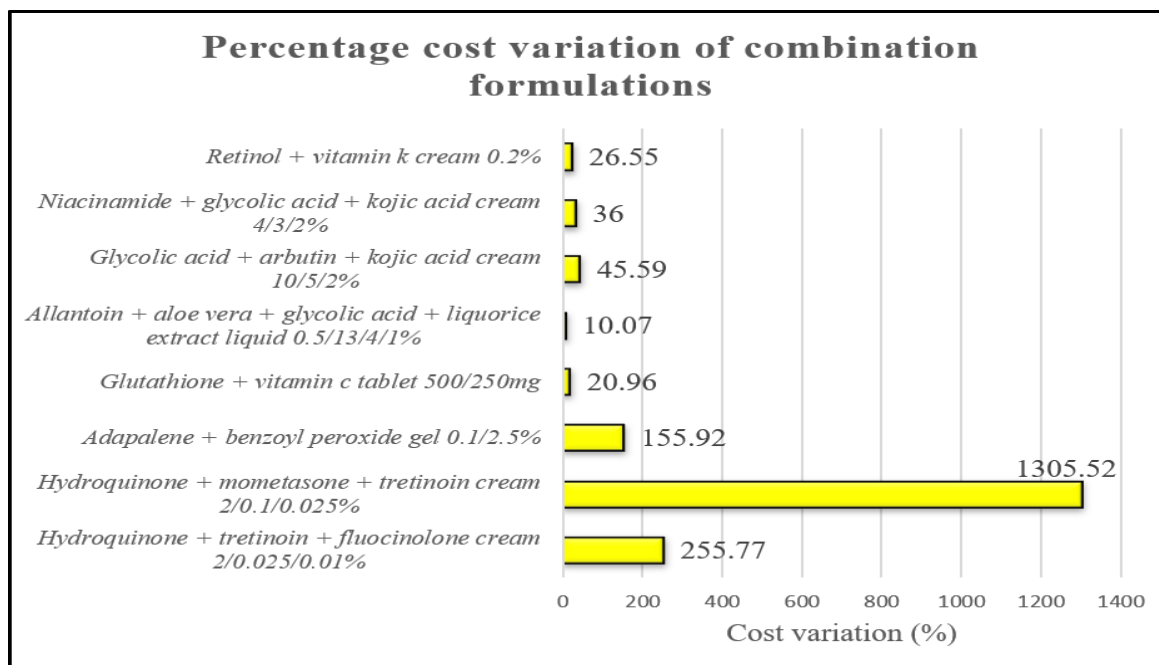


Figure 4: Cost variation of formulations of combination agents available in the Indian market for treatment of hyperpigmentation.

Percentage cost variation among formulations of some combination agents available in the Indian market for the treatment of hyperpigmentation. Bars depict cost variation in percentage.

Table 1: Single-agent brands available in the Indian market for the treatment of hyperpigmentation.

Agent (Drug/drugs in a specific dosage form)		Strength (% or mg)	Number of brands
Tretinoin	Cream	0.025%	7
		0.05%	4
	Gel	0.012%	2
		0.025%	4
		0.04%	9
		0.10%	4
Adapalene	Cream	0.10%	2
	Gel	0.10%	8
Hydroquinone	Cream	4%	8
		3%	3
		2%	7
Salicylic acid	Facewash	1%	2
		2%	15
	Gel	1%	2
		2%	6
	Liquid	2%	2
	Serum liquid	2%	2
	Lotion	16.70%	3
Azelaic acid	Cream	10%	5
		20%	9
	Gel	15%	2
Glycolic acid	Cream	6%	2
		12%	3
	Facewash	1.50%	2
	Gel	2%	3
	Kit	35-50 mg	2
Glutathione	Injection	600 mg	16
	Sachet	500 mg	2
	Tablet	500 mg	16
Benzoyl peroxide	Cream	4%	3
		5%	3
	Gel	2.50%	15
		5%	10
	Soap	2.50%	3
		5%	2
	Lotion	5%	3
	Facewash	2.50%	2
Vitamin C	Gel	20%	4
	Liquid	20%	2
Kojic acid	Soap	1%	2
Niacinamide	Cream	4%	2
Cysteamine	Cream	5%	2
Tranexamic acid	Gel	3%	2

Table 2: Combination-agent brands available in the Indian market for the treatment of hyperpigmentation (non-acid formulations).

Agent (Drug/drugs in a specific dosage form)		Strength (% or mg)	Number of brands
Hydroquinone + tretinoin + fluocinolone	cream	2/0.025/0.01%	8
		2/0.05/0.01%	2
		2/0.1/0.025%	3
		4/0.05/0.01%	3
Hydroquinone + mometasone + tretinoin	cream	2/0.1/0.025%	48

Continued.

Agent (Drug/drugs in a specific dosage form)	Strength (% or mg)	Number of brands
	Ointment	2/0.1/0.025%
	Cream	4/0.1/0.025%
Hydroquinone + tretinoin	Cream	2/0/0.125%
Hydroquinone + tretinoin + hydrocortisone	Cream	2/0.025/1%
Adapalene + benzoyl peroxide	Gel	0.1/2.5%
Arbutin + avobenzone + d panthenol + lactic acid + niacinamide + vitamin c + vitamin e	Gel	NA ^a
Arbutin + liquorice + propanediol	Liquid sr	NA/40/NA%
	Liquid	NA/40/NA%
Retinol + hyaluronic acid + glutathione	Cream	NA
	Gel	NA
	Serum	NA
	Tablet	500/250 mg
Glutathione + vitamin c	Tablet	500/250 mg
ALA + astaxanthin + grape seed extract + l-glutathione	Tablet	250/4/100/500 mg
Sorbitol + niacinamide + chlorhexidine	Facewash	NA
Diacetyl boldine + tocopheryl acetate + niacinamide + tetrahydropiperine + dexapanthenol	Cream	NA
Cetyl alcohol + light liquid paraffin + stearyl alcohol + glycerine + niacinamide + propylene glycol	Cream	NA
Allantoin + glycerine + niacinamide + dimethicone + methylparaben + propylparaben + glycerine	Cream	NA
Hydroquinone combination	Cream	NA
	Lotion	NA
	Gel	NA
	Ointment	NA
Retinol + vitamin k	Cream	0.2%
Soy isoflavones + liquorice extract + tetrahydro curcumin + avobenzone	Cream	NA
	Facewash	NA
Tea tree oil + propylene glycol + sodium lauryl sarcocinate	Facewash	NA
Aloe vera + salicylic acid + tea tree oil + vitamin e	Facewash	NA
Jojoba oil + glycerine + vitamin e	Cream	NA

*NA^a refers to information not available regarding the strength of the component

Table 3: Combination-agent brands available in the Indian market for the treatment of hyperpigmentation (acid formulations).

Agent (Drug/drugs in a specific dosage form)	Strength (% or mg)	Number of brands
Azelaic acid + pterowhite + alpha arbutin + niacinamide	Cream	NA
Niacinamide + glycolic acid + kojic acid	Cream	4/3/2%
	Gel	gel
Glycolic acid + arbutin + kojic acid	Cream	10/5/2%
Glycolic acid + aloe vera + salicylic acid	Spray	1/5/2%
	Facewash	1/5/2.5%
	Facewash	NA
Glycolic acid + aloe vera	Facewash	1/5%
	Liquid	1/5%

Continued.

Agent (Drug/drugs in a specific dosage form)		Strength (% or mg)	Number of brands
	Gel	NA	2
Aloe vera + vitamin e + glycolic acid	Facewash	5/NA/1%	3
Aloe vera + glycolic acid + niacinamide + salicylic acid	Facewash	NA	2
Allantoin + aloe vera + glycolic acid + liquorice	Liquid	0.5/13/4/1%	2
Kojic acid + vitamin c	Facewash	NA	2
	Lotion	NA	2
	Cream	NA	4
Phosphatase + kojic acid + niacinamide	Cream	NA	3
Kojic acid combination	Cream	NA	50
	Facewash	NA	2
	Lotion	NA	6
	Gel	NA	18
	Liquid	NA	2
Arbutin + avobenzone + d panthenol + lactic acid + niacinamide + vitamin c + vitamin e	Cream	NA	2
Hyaluronic acid + glycolic + vitamin c	Liquid	NA	2
Vitamin c combinations	Facewash	NA	3
Vitamin c + dimethicone + glycerine + vitamin e cream	Cream	NA	2
Vitamin c + hyaluronic acid	Liquid	NA	4
Aloe vera + d panthanol + glycerine + mandelic acid + triclosan + vitamin e	Facewash	NA	2
Sabiwhite + terowhite + liquorice	Cream	NA	3
Salicylic acid + capryloyl glycine	Gel	NA	2
Salicylic acid + glycerine	Soap	NA	2
Salicylic acid + tea tree oil beads + vitamin e	Facewash	NA	2

Table 4: Comparison of cost ratio and percentage cost variation of agents available in the Indian market for treatment of hyperpigmentation.

	Formulation			Cost ratio	Cost variation (%)	Number of brands
Single agent	Overall	Highest	Injection glutathione 600 mg	18.93	1793.18%	16
		Lowest	Tranexamic acid 3% gel	1.01	0.9%	2
	Cream/ Topical	Highest	Hydroquinone 2% cream	8.54	753.93%	7
		Lowest	Glycolic acid 6% cream	1.22	22.17%	2
	Gel	Highest	Adapalene 0.1% gel	5.81	481.16%	8
	Acids	Highest	Azelaic acid 20% cream	6.63	562.86%	9
Combination agent	Overall	Highest	Hydroquinone + mometasone + tretinoin 2/0.1/0.025% cream	14.06	1305.52%	48
		Lowest	Glycolic acid + aloe vera 1/5% liquid	1.06	6.33%	2
	Cream	Lowest	Hydroquinone + tretinoin +	1.26	25.63%	2

Continued.

Formulation			Cost ratio	Cost variation (%)	Number of brands	
			hydrocortisone 2/0.025/1% cream			
	Concentrations unknown	Highest	Retinol + hyaluronic Acid + glutathione gel	5.47	447.06%	2
		Lowest	Hyaluronic Acid + glycolic + vitamin C liquid	1.01	1.47%	2
	Only single ingredient known	Highest	Kojic acid combination cream	57.21	5621.52%	50
		Lowest	Kojic acid combination liquid	1.2	19.88%	2

Table 5: Comparison of cost ratio and percentage cost variation of agents available in the Indian market for treatment of hyperpigmentation across certain dosage forms.

Dosage form	Formulation		Cost ratio	Cost variation (%)	Number of brands
Facewash	Highest	Salicylic acid 1% facewash	4.29	328.57%	2
	Lowest	Aloe Vera + glycolic acid + niacinamide + salicylic acid facewash	1.15	15.09%	2
Lotion	Highest	Kojic acid combination lotion	4.04	304.37%	6
	Lowest	Benzoyl peroxide 5% lotion	1.12	12.37%	3
Soap	Highest	Benzoyl peroxide 2.5% soap	2.58	158.06%	3
	Lowest	Salicylic acid + glycerine soap	1.06	6.02%	2

Table 6: Cost variation and price per unit of product of other single agents available in the Indian market for treatment of hyperpigmentation.

Agent		Strength (% or mg)	Number of brands	Lowest cost per unit (INR)	Highest cost per unit (INR)	Cost variation (%)
Adapalene	cream	0.10%	2	5.5	18.5	236.36
	gel	0.10%	8	4.99	29	481.16
Glutathione	injection	600 mg	16	132	2499	1793.18
	sachet	500 mg	2	49.5	72.5	46.46
	tablet	500 mg	16	20	173.27	766.35
Benzoyl peroxide	cream	4%	3	2.74	5.65	106.20
	cream	5%	3	2.08	5.75	176.44
	gel	2.50%	15	0.8	4.2	425.00
	gel	5%	10	3	9.6	220.00
	soap	2.50%	3	0.93	2.4	158.06
	soap	5%	2	2.13	2.57	20.66
	lotion	5%	3	2.83	3.18	12.37
	facewash	2.50%	2	1.5	2.5	66.67
Niacinamide	cream	4%	2	21.65	29.9	38.11
Cysteamine	cream	5%	2	24.75	33	33.33

DISCUSSION

The treatment of hyperpigmentation involves a variety of therapeutic agents, each with distinct cost implications. The present study analysed 520 brands across 109 formulations, consisting of 207 single-agent and 313 combination-agent products. These included tretinoin, adapalene, hydroquinone, salicylic acid, azelaic acid, glycolic acid, glutathione, benzoyl peroxide, vitamin C, kojic acid, niacinamide, cysteamine, tranexamic acid, mandelic acid, retinols and arbutin, as single agents and their varying combinations with other cosmeceuticals and phytochemicals. The results show striking price variability across both single and combination therapies for hyperpigmentation, with cost ratios ranging from 1.01 to 57.21, highlighting substantial disparities in patient expenditure for therapeutically similar products. These findings align well with existing pharmacoeconomic and dermatology literature. Given the prevalence of hyperpigmentation in Indian populations, understanding the cost variation of different treatment modalities is crucial.

Topical agents such as hydroquinone, kojic acid, and niacinamide are among the most commonly prescribed treatments for hyperpigmentation. For treating conditions like melasma and post-inflammatory hyperpigmentation, hydroquinone remains the gold standard. However, the cost of hydroquinone-based agents often varies significantly, with branded formulations often priced higher than the generic alternatives. In the present study, hydroquinone 2% cream exhibited the highest cost variation among topical single agents, with a cost ratio of 8.54 and a percentage cost variation of 753.93% across seven brands. The wide cost variation observed in this study particularly for agents like glutathione injections [which demonstrated the highest overall cost ratio among single agents (18.93; 1793.18%)] and hydroquinone-based combinations, reflects a well-documented lack of price standardization in dermatological therapies. Prior pharmacoeconomic analyses done in the Indian market have similarly reported substantial inter-brand cost differences in topical treatments, especially in developing markets where regulatory price control is limited for cosmeceuticals and combination formulations.¹⁸ The finding of extremely high-cost ratios in kojic acid combinations and triple-drug creams (hydroquinone, tretinoin, corticosteroids) reinforces concerns raised in earlier studies about the commercialization and branding of commonly used depigmenting agents.^{8,13}

From a therapeutic perspective, hydroquinone, tretinoin, azelaic acid, and glycolic acid remain cornerstone treatments for hyperpigmentation, as consistently highlighted in reviews 1,5,11. However, the data suggests that despite similar efficacy profiles, their market prices

vary dramatically depending on formulation and branding. For example, azelaic acid 20% cream showed a cost ratio of 6.63 (562.86%) across nine brands, while adapalene 0.1% gel demonstrated a cost ratio of 5.81 (481.16%) across eight brands, indicating substantial pricing disparities among commonly prescribed topical therapies. Conversely, glycolic acid 6% cream showed one of the lowest cost variations among topical agents (cost ratio 1.22; 22.17%), suggesting relatively stable pricing in formulations with fewer competing brands. Relatively low-cost variation was seen with tranexamic acid gel 3% gel which demonstrated a cost ratio of 1.01 and a percentage variation of only 0.9%. However, this could be because of only 2 brands available to analyse in the current study.

While topical treatments dominate the first-line approach, more intensive therapies such as laser treatments and chemical peels are gaining popularity for their rapid results in cases of persistent hyperpigmentation. However, these treatments usually cost significantly higher which makes them less accessible for a major chunk of patients in India. Also, they have costs that can accumulate over multiple sessions. Therefore, these procedures, while effective, present a dilemma for low-income individuals who may benefit from them but cannot afford them.¹⁹

Tranexamic acid and oral glutathione are the oral agents which have emerged as viable alternatives for treating of melasma and other forms of hyperpigmentation. The study by Minni et al demonstrated that oral tranexamic acid, while relatively affordable, can be highly effective in reducing pigmentation when used in conjunction with topical therapies.²⁰ Tranexamic acid's oral formulations are generally considered more affordable than procedural interventions like lasers. Additionally, oral glutathione, which has gained popularity for its skin-brightening effects, has not been conclusively proven to be as effective as topical agents like hydroquinone, and its cost may not justify its benefits in the Indian context.²¹

Combination therapies, particularly triple combinations, are widely recommended for melasma and post-inflammatory hyperpigmentation due to synergistic effects.^{4,6} However, the observation of high-cost variation in these combinations highlights a key issue that, while clinically effective, these regimens may not always be economically accessible. In the present study, the hydroquinone + mometasone + tretinoin (2/0.1/0.025%) cream, represented by 48 brands, showed the highest cost variation among combination formulations with known concentrations, with a cost ratio of 14.06 and percentage variation of 1305.52%. Similarly, kojic acid-based combination creams demonstrated the greatest overall variation, with a cost ratio of 57.21 and percentage variation of 5621.52% across 50 brands, indicating the profound influence of branding and market competition on pricing. This is especially relevant given the chronic and relapsing nature of pigmentary disorders, which require long-term treatment adherence.¹⁰ High price variability may therefore directly impact compliance and outcomes.

Formulations with fewer brands (e.g., glycolic acid + aloe vera or hyaluronic acid combinations) showed minimal price variation, supporting the idea that market competition is a major driver of cost disparity. This trend is consistent with broader pharmaceutical economic principles and has been noted in dermatology-specific analyses.²²

The findings of this study also reflect the growing influence of cosmeceuticals and natural or adjunct ingredients such as aloe vera, vitamin C, and hyaluronic acid. While these are increasingly incorporated into treatment regimens evidence for their cost-effectiveness remains limited and the data suggests that their inclusion does not necessarily correspond to higher price variability.^{9,17} Interestingly, retinol + hyaluronic acid + glutathione gel demonstrated a cost ratio of 5.47 and a percentage variation of 447.06% despite being represented by only two brands, suggesting that even niche cosmeceutical formulations may exhibit substantial pricing disparities.

The economic burden of hyperpigmentation treatment in India is influenced by a variety of factors, including the patient's socio-economic status, access to healthcare facilities, and availability of affordable generic drugs. The present study found that certain formulations commonly used in dermatology practice, including face washes, lotions, and soaps, also exhibited considerable price differences. For example, salicylic acid 1% face wash showed a cost ratio of 4.29 (328.57%), while kojic acid combination lotion demonstrated a cost ratio of 4.04 (304.37%). However, while the availability of generic drugs has reduced the cost burden for many, the accessibility of newer, more expensive treatment options like laser therapies remains limited to urban centres, creating a disparity in treatment access across the country. A study done by Li G et al placed emphasis on how increasing the market competition among topical dermatologic generic drugs eventually leads to long term price reductions.²² This could be especially beneficial in the low-income population in India. Also, while newer therapies such as oral glutathione may be effective, their high costs could limit their widespread use.

Overall, this study highlights a critical gap between clinical efficacy and economic accessibility in the treatment of hyperpigmentation as a disorder. While the therapeutic choices are well-established, as supported by multiple analyses, the notable cost variation across brands and formulations emphasizes the need for greater price regulation, awareness, and rational prescription. In the Indian context, pigmentary disorders are highly prevalent and have significant psychosocial impact. Thus, ensuring that the treatment choices available have a minimal cost variation among different brands is particularly of importance.^{3,14}

CONCLUSION

In conclusion, a wide variety of dosage forms for the treatment of hyperpigmentation are available in the Indian

market. This includes creams, gels, ointments, liquids, lotions, tablets, injections, sachets, kits, facewashes, soaps, serum liquids, nanogels and sprays. They are available as single ingredients as well as varying combinations of multiple ingredients. Information about the exact percentage composition of many is unavailable despite a thorough search. This study highlights the disparity in their cost, which is mainly observed in agents with more than 2 brands available. Out of total 109 formulations, 48 had a remarkable cost variation of more than 100%. Thus, the treating physician should be aware of this disparity in the cost of agents when prescribing, especially since hyperpigmentation requires long-term treatment and the costs can accumulate over time, which can place an avoidable economic burden on the patients.

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REFERENCES

1. Nautiyal A, Wairkar S. Management of hyperpigmentation: current treatments and emerging therapies. *Pigment Cell Melanoma Res.* 2021;34(6):1000-14.
2. Nieuweboer-Krobotova L. Hyperpigmentation: types, diagnostics and targeted treatment options. *J Eur Acad Dermatol Venereol.* 2013;27 Suppl 1:2-4.
3. Nouveau S, Agrawal D, Kohli M, Bernerd F, Misra N, Nayak CS. Skin hyperpigmentation in Indian population: insights and best practice. *Indian J Dermatol.* 2016;61(5):487-95.
4. Ortonne JP, Passeron T, Srinivas C. Pigmentary disorders, prevention, treatment and cosmetics contributions. In: Srinivas C, Verschoore M, editors. *Basic Science for Modern Cosmetic Dermatology.* New Delhi: Jaypee Brothers Medical Publishers; 2015. p.75-90.
5. Woolery-Lloyd H, Kammer JN. Treatment of hyperpigmentation. *Semin Cutan Med Surg.* 2011;30(3):171-5.
6. Lawrence E, Syed HA, Al Aboud KM. Postinflammatory hyperpigmentation. [Updated 2024 Nov 25]. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2024. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK559150/> Accessed on 10 July 2026.
7. Hourblin V, Nouveau S, Roy N, de Lacharrière O. Skin complexion and pigmentary disorders in facial

- skin of 1204 women in 4 Indian cities. *Indian J Dermatol Venereol Leprol.* 2014;80(5):395-401.
8. Sarkar R, Arora P, Garg KV. Cosmeceuticals for hyperpigmentation: what is available? *J Cutan Aesthet Surg.* 2013;6(1):4-11.
 9. Hollinger JC, Angra K, Halder RM. Are natural ingredients effective in the management of hyperpigmentation? A systematic review. *J Clin Aesthet Dermatol.* 2018;11(2):28-37.
 10. Moolla S, Miller-Monthrope Y. Dermatology: how to manage facial hyperpigmentation in skin of colour. *Drugs Context.* 2022;11:2021-11-2.
 11. Desai SR. Hyperpigmentation therapy: a review. *J Clin Aesthet Dermatol.* 2014;7(8):13-7.
 12. Pérez-Bernal A, Muñoz-Pérez MA, Camacho F. Management of facial hyperpigmentation. *Am J Clin Dermatol.* 2000;1(5):261-8.
 13. Rendon MI, Gaviria JL. Review of skin-lightening agents. *Dermatol Surg.* 2005;31(7 Pt 2):886-889; discussion 889.
 14. Dabas G, Vinay K, Parsad D, Kumar A, Kumaran MS. Psychological disturbances in patients with pigmentary disorders: a cross-sectional study. *J Eur Acad Dermatol Venereol.* 2020;34(2):392-9.
 15. Shimshak SJE, Tolaymat LM, Haga CB, Dawson NL, Gillis MS, Yin M, et al. A review of oral therapies for the treatment of skin hyperpigmentation. *J Cutan Med Surg.* 2022;26(2):169-75.
 16. Halder RM, Richards GM. Topical agents used in the management of hyperpigmentation. *Skin Therapy Lett.* 2004;9(6):1-3.
 17. Jafry M, Guan LL, Mohammad TF. A practical guide to over-the-counter treatments for hyperpigmentation. *JEADV Clin Pract.* 2024;3:433-47.
 18. Kurle DG, Bedrekar MS, Jadhav AY, Sarkate PV, Kanase HR. Pharmacoeconomic study of topical dermatological products available in Indian market. *Saudi J Med Pharm Sci.* 2018;4(6):687-92.
 19. Sowash M, Alster T. Review of laser treatments for post-inflammatory hyperpigmentation in skin of color. *Am J Clin Dermatol.* 2023;24(3):381-396.
 20. Minni K, Poojary S. Efficacy and safety of oral tranexamic acid as an adjuvant in Indian patients with melasma: a prospective, interventional, single-centre, triple-blind, randomized, placebo-control, parallel group study. *J Eur Acad Dermatol Venereol.* 2020;34(11):2636-44.
 21. Sarkar R, Yadav V, Yadav T, P J, Mandal I. Glutathione as a skin-lightening agent and in melasma: a systematic review. *Int J Dermatol.* 2025;64(6):992-1004.
 22. Li DG, Joyce C, Mostaghimi A. Association between market competition and prices of generic topical dermatology drugs. *JAMA Dermatol.* 2018;154(12):1441-6.
 23. Thawabteh AM, Jibreen A, Karaman D, Thawabteh A, Karaman R. Skin pigmentation types, causes and treatment-a review. *Molecules.* 2023;28(12):4839.
 24. Frey C, Grimes P, Callender VD, Alexis A, Baldwin H, Elbuluk N, et al. Thiamidol: a breakthrough innovation in the treatment of hyperpigmentation. *J Drugs Dermatol.* 2025;24(6):608-16.
 25. Kumari B, Dixit AK. Efficacy of formulations for treating hyperpigmentation: a systematic review and meta-analysis. *Arch Dermatol Res.* 2025;317(1):379.

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