

## Topical Olopatadine Hydrochloride versus Ketotifen Fumarate for Allergic Conjunctivitis

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### Abstract

**Purpose:** Allergic conjunctivitis (AC) is associated with itching, redness, tearing, pain, and burning sensation in the eyes. The inflammatory process is caused by the mechanism of immediate hypersensitivity due to direct contact with the allergen. This process triggers mast cells in the conjunctiva to activate and release mediators. The purpose of this study was to compare topical olopatadine and ketotifen in terms of effectiveness and safety for the management of AC.

**Methods:** Patients clinically diagnosed with AC were randomized into two groups of 60 patients each and received either topical olopatadine HCl 0.1% or ketotifen fumarate 0.025%. They were followed up on the 4<sup>th</sup>, 15<sup>th</sup>, and 30<sup>th</sup> days to evaluate symptoms, signs, and quality of life (QOL) scoring.

**Results:** There were a total of 120 patients (67 men and 53 women) with a mean age of 36.35 ± 11 years. Compared to baseline, scores of itching, tearing, redness, eyelid swelling, chemosis and papillae addition of all the individual scores mentioned above and QOL scores reduced significantly ( $P = 0.001$ ) by the 4<sup>th</sup> and 15<sup>th</sup> days of olopatadine and ketotifen application. Compared with ketotifen, olopatadine significantly reduced itching, tearing, hyperemia, and total AC scores by the 4<sup>th</sup> day ( $P = 0.001$ ) and conjunctival papillae by the 15<sup>th</sup> day ( $P = 0.001$ ). Adverse reactions were reported in 10% and 18% of patients treated with olopatadine and ketotifen, respectively.

**Conclusion:** Compared to ketotifen, olopatadine provided quicker relief of symptoms, and improved symptoms of AC and QOL, with fewer side effects.

**Keywords:** Allergic Conjunctivitis; Ketotifen Fumarate; Olopatadine Hydrochloride

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### INTRODUCTION

Allergic conjunctivitis (AC) is an atopic ocular condition, which is associated with itching, redness, tearing, pain,

burning sensation, and foreign body sensation.<sup>[1,2]</sup> These symptoms affect academic performance and the quality of life (QOL), resulting in a loss of productivity.<sup>[3]</sup> AC can affect both children and adults, often coexisting with other allergic diseases, such as asthma, atopic dermatitis, or food allergies.<sup>[4]</sup> According to the International Ocular Inflammation Society (IOIS), AC can be subdivided into seasonal allergic conjunctivitis (SAC) and perennial AC. It also includes atopic keratoconjunctivitis, vernal

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keratoconjunctivitis, giant papillary conjunctivitis, and contact dermatitis-conjunctivitis, which differ in their manifestations, clinical course, and treatment.<sup>[5]</sup>

AC is an inflammatory disorder of the mucous membrane that covers the sclera. It is caused by an immunoglobulin E-mediated immune or immediate hypersensitivity reaction resulting from direct contact of the allergen with the conjunctival surface in sensitized patients, which triggers mast cell activation and the release of different mediators.<sup>[6]</sup> Other mechanisms, such as neurogenic and systemic immune response may also play a role.<sup>[4]</sup>

AC can be treated by minimizing allergen contact with the conjunctiva, through a series of preventive measures (i.e., environmental control, cold compress, eye lubricants without preservatives, and contact lenses). Furthermore, the symptoms triggered by the allergic inflammatory process can be controlled by the administration of antihistamines, mast cell stabilizers, non-steroidal anti-inflammatory drugs (NSAIDs), and corticosteroids. Topical olopatadine HCl 1 mg/ml and ketotifen fumarate 250 mg/ml have mast cell stabilizing and antihistaminic properties.<sup>[7]</sup> The current study was conducted to compare the efficacy, safety profile, and cost of olopatadine HCl 0.1% and ketotifen fumarate 0.025% for AC. In addition, the QOL of patients was compared between the two groups.

## METHODS

The study was conducted for a period of 1.5 years. The study protocol was approved by Institutional Ethics Committee. Patients of either gender who were aged above 8 years, clinically diagnosed with seasonal AC by an ophthalmologist, and willing to provide written informed consent/assent were recruited. Patients with bacterial, chlamydial, viral, giant papillary, phlyctenular, purulent, and membranous conjunctivitis were excluded. The presence of dry eye syndrome, blepharitis, uveitis, keratitis, ocular trauma, or a history of ocular surgery performed in the last 3 months led to patient exclusion. Other exclusion criteria included retinal detachment, diabetic retinopathy, and progressive retinal disease; receiving either systemic or topical corticosteroids and immunosuppressants; with the use of mast cell stabilizers, NSAIDs, antihistaminics within the prior month; and a history of hypersensitivity to olopatadine and ketotifen. Pregnant and lactating women were also excluded.

Patients were randomly assigned into one of the two groups; one group received two drops of olopatadine HCl 0.1% (Winolap, manufactured by Sun, Avesta) twice daily in both eyes, while the other was treated with two drops of ketotifen fumarate 0.025% (Albalon, manufactured by Allergan) four times daily. They were asked to maintain a diary to record the timing

of the instillation of their medication. The following was recorded on clinical examination. The patients' symptoms and signs were assessed using a scale, with scores ranging from 0 to 16.<sup>[8]</sup> Each patient's QOL was assessed using a questionnaire consisting of 15 questions, with scores ranging from 0 to 90.<sup>[9]</sup>

Assessment of symptoms and signs scoring was performed on the 1<sup>st</sup> visit (baseline), 4<sup>th</sup> day, and 15<sup>th</sup> day. If the clinical signs persisted, the participants were also evaluated on the 30<sup>th</sup> day. The QOL questionnaire was administered on the 1<sup>st</sup>, 4<sup>th</sup>, and 15<sup>th</sup> day. The participants were requested to bring their diary to each visit to check compliance. Improvement in patients' symptoms and signs were evaluated. Adverse drug reactions were recorded at each visit. Cost was calculated based on the amount spent by the patient for the complete recovery of AC.

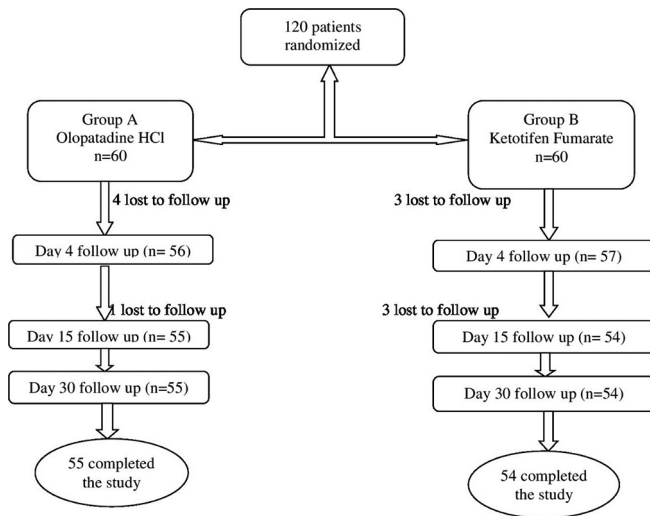
## Statistical Analysis

The sample size that was required to detect a mean difference of 0.35 in the itching score on day 4, with an effect size of 1.2,  $\alpha$ -error of 5%, 80% power, and 10% dropout rate, was 32 patients in each group. Demographic data were expressed as mean  $\pm$  standard deviation. Continuous data within and between the groups were analyzed using paired and unpaired *t*-tests, respectively. AC and QOL scores within and between the groups were analyzed using R-ANOVA and unpaired *t* test, respectively. Categorical data were analyzed using a Chi-square test. Statistical significance was set at  $P < 0.05$ .

## RESULTS

A total of 120 patients were included in the current study. Of these, 55 patients in group A and 54 patients in group B completed the study [Figure 1]. There were 67 male and 53 female participants. As demonstrated in Table 1, the demographic details between the groups were comparable. A past history of AC was present in 42 (70%) and 34 (57%) patients in groups A and B, respectively. The aggravating factors for AC were seasonal variation (summer; 25 and 16 patients, respectively) and dust (17 and 18 patients, respectively) [Figure 2].

Baseline individual and total AC scores were comparable between the groups. None of the patients had chemosis. Compared to baseline, patients receiving either olopatadine or ketotifen showed a significant reduction ( $P = 0.001$ ) in both individual and total AC scores, by the 4<sup>th</sup> and 15<sup>th</sup> days [Table 2]. Between-group analysis demonstrated that by the 4<sup>th</sup> day, itching, tearing, hyperemia, and total AC scores, but not papillae, had significantly reduced with olopatadine ( $P = 0.001$ ). The eyelid swelling score was reduced to zero with both medications on the



**Figure 1.** Flowchart representing randomization and follow-up of patients.

Table 1. Demographic data			
	Olopatadine HCl (n=60)	Ketotifen fumarate (n=60)	P*
Gender			
Male (%)	38 (63.3%)	29 (48.3%)	0.098
Female (%)	22 (36.7%)	31 (51.7%)	
Age (mean±standard deviation)	36.35±11.91	36.20±12.70	0.947

HCl, hydrochloride; \*Based on t-test

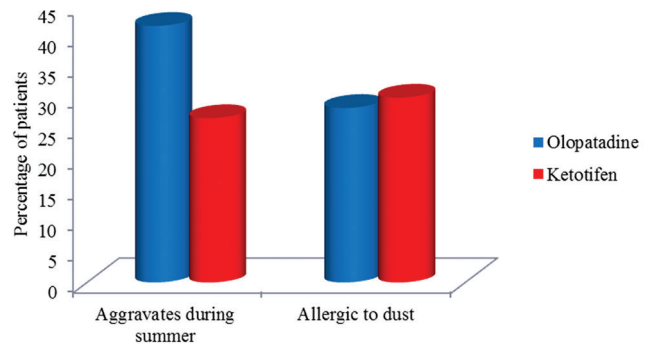
4<sup>th</sup> day [Table 2]. By the 15<sup>th</sup> day, there was a significant reduction ( $P = 0.001$ ) in itching, tearing, papillae, and total AC score in patients who received olopatadine. Hyperemia and eyelid swelling scores, however, were zero with both medications.

The baseline QOL scores were comparable between the groups. Compared to baseline, there was a significant reduction in QOL scores by the 4<sup>th</sup> and 15<sup>th</sup> days in patients receiving either of the medications. There were no significant differences in the scores on the 4<sup>th</sup> and 15<sup>th</sup> days between the groups [Table 3].

Adverse reactions were reported in 10% and 18% of patients, with olopatadine and ketotifen, respectively [Table 4]. As each patient required one olopatadine HCl vial, the cost per patient was 84 rupees. One vial of ketotifen fumarate was 57 rupees, however, and since 32 patients required two vials, the cost for these patients was 114 rupees.

## DISCUSSION

Conjunctivitis due to non-infectious stimuli includes SAC and perennial AC, which affects the individuals of all age groups, mainly children. SAC symptoms, which can affect both eyes, are aggravated due to seasonal



**Figure 2.** Percentage of patients with a history of aggravating factors.

variations or the presence of dust. Ocular symptoms and signs include itching, tearing, conjunctival hyperemia, eyelid swelling, chemosis, and foreign body sensation,<sup>[10,11]</sup> which, if left untreated, may become worse. This in turn can cause discomfort that will affect the QOL. Compared to corticosteroids, it is preferable that this condition is treated with mast cell stabilizers due to fewer side effects.

In the present study, of the 120 patients who were clinically diagnosed with AC, 56% were men and 44% were women. The male to female ratio was 1.2:1. A study conducted in Ghana demonstrated that the percentage of women (61.8%) affected with AC was higher.<sup>[12]</sup> Another study carried out in Nigeria, which included 150 students (aged 5–15 years), reported that girls comprised 59% of the cohort.<sup>[13]</sup> The increased prevalence in women has been attributed to female hormonal changes.<sup>[12,13]</sup> Other two studies, however, reported that 75.8% and 63.28% of patients with conjunctivitis were men.<sup>[14,15]</sup>

Patients in the current study had a previous history of AC. Although the percentage of patients reporting that the symptoms of AC were aggravated during summer and in the presence of dust were higher in the olopatadine group, the difference was not significant. A study by Palmares et al<sup>[16]</sup> showed that approximately 85% of the cohort had previous episodes of AC and 16% of the cohort had bronchial asthma. However, in our study, patients with bronchial asthma were excluded because they were receiving medications like systemic or inhalational steroids and mast cell stabilizers, which would have interfered with the medications in our study. A Nigerian study conducted in primary school children reported that the disease was more common during the harmattan (a dry and dusty West African trade wind) season due to the presence of dust and pollen in the atmosphere.<sup>[12]</sup>

Itching was the most common presenting complaint of the patients. Individual and total AC scores were comparable between the groups at baseline. Treatment with olopatadine 0.1% significantly reduced the itching score during follow-up and patients were completely free of the symptom by the 15<sup>th</sup> day. A similar finding was reported in a study conducted in Hungary, which

**Table 2. Individual and total allergic conjunctivitis scores at follow-up visits**

Symptoms and signs	Olopatadine HCl			P**	Ketotifen fumarate			P**
	Mean±standard deviation				Mean±standard deviation			
	Day 0	Day 4	Day 15		Day 0	Day 4	Day 15	
Itching	3.9±0.30	1.98±0.83*	0#	0.001	3.72±0.45	2.37±0.73*	0.40±0.49#	0.001
Tearing	2.82±0.39	1.13±0.74*	0#	0.001	2.85±0.40	1.63±0.68*	0.05±0.22#	0.001
Hyperemia	2.60±0.52	0.73±0.68*	0	0.001	2.52±0.50	1.25±0.62*	0	0.001
Lid swelling	0.23±0.42	0	0	0.001	0.13±0.34	0	0	0.005
Papillae	1±0.00	0.85±0.36	0#	0.001	1.00±0.00	0.95±0.22	0.37±0.48#	0.001
Total Score	10±1.04	4.72±2.10*	0#	0.001	10.23±1.01	6.13±1.8*	0.82±0.87#	0.001

\*P & #P Based on t test. \*P=0.001 comparison between groups on 4<sup>th</sup> day; #P=0.001 comparison between groups on 15<sup>th</sup> day. \*\* Based on RANOVA

**Table 3. Quality of life score at follow-up visits**

	Day 0	Day 4	Day 15	P*
Olopatadine HCl	35.73±8.55	12.90±5.17	0	0.001
Ketotifen fumarate	32.98±7.41	12.93±5.10	0	0.001
P**	0.10	0.81	1.00	

HCl, hydrochloride; \*Based on RANOVA test (Repeated measure ANOVA). \*\*Based on t-test

**Table 4. Adverse drug reactions to medications**

	Headache	Burning sensation in the eyes
Olopatadine HCl	4 (7%)	2 (3%)
Ketotifen fumarate	8 (13%)	3 (5%)

HCl, hydrochloride

included both adults and children; the itching scores reduced from 1.6 to 0 and from 2.5 to 0.2, respectively, at the end of 14 days [17]. The study also concluded that the use of olopatadine in children was safe. [17] In a conjunctival allergen challenge human model, olopatadine 0.1% and 0.2% were compared, with no significant difference in the itching score between doses [18]. Additionally, a significant reduction was observed at 24 h, with both dosages, when compared to the placebo. [18] A study on Japanese patients with SAC demonstrated that pretreatment with olopatadine significantly reduced itching scores. The authors attributed this finding to the mast cell stabilizing property of the drug. [19] Olopatadine 0.1% also significantly reduced the tearing score at all follow-up visits, when compared with sodium cromoglycate 2%. [20] Olopatadine also significantly reduced hyperemia in our patient cohort. A similar result was reported by Yaylali et al [21] when they used olopatadine and ketorolac to treat SAC.

Eyelid swelling causes a lot of discomfort to the patient. Compared to cromolyn sodium 2%, olopatadine 0.1% reduced eyelid swelling by the 4<sup>th</sup> day of treatment. [22] Papillae is also a sign of AC, which was significantly reduced by the 4<sup>th</sup> day of olopatadine treatment. A complete reduction in symptom and sign score was observed only in 15% of the patients by 4<sup>th</sup> day, but by 15<sup>th</sup> day reduction was observed in all the patients.

A reduction in the individual and total AC score was observed at each follow-up visit in patients receiving ketotifen. The score reduced to zero by the 15<sup>th</sup> day only in 46.6% of the patient cohort. Another study demonstrated that ketotifen 0.05% reduced itching, stinging, and tearing after 10 days in 60–80% of the patients. [23] When compared with levocabastine and placebo, ketotifen was the most effective during the first four days in reducing itching, hyperemia, and the tearing score [24]. Although the eyelid swelling score was also reduced, this was not statistically significant. [24] Our observation was that reduction in papillae score took longer with ketotifen, with only 63% of the patient cohort showing complete reduction by the 15<sup>th</sup> day.

Compared to ketotifen, olopatadine significantly reduced the itching, tearing, hyperemia and total AC scores by 4<sup>th</sup> day, and eyelid swelling and papillae by the 15<sup>th</sup> day. This shows that olopatadine provided quicker relief from the symptoms than ketotifen. Similar findings were reported in another study where 42.5–62.5% of patients receiving olopatadine showed improvement of the symptoms and signs at 30 min compared to 20–27.5% receiving ketotifen. [25] Furthermore, by the 7<sup>th</sup> day, olopatadine reduced symptoms by 80–87.5%, while ketotifen reduced them by 60–75%. [25] Two other studies have reported that olopatadine 0.1% was more effective than ketotifen. [26,27]

QOL, the other parameter that was assessed, also improved from the baseline in both groups to a similar extent. A study conducted by Scoper et al [28] demonstrated that patients receiving olopatadine 0.2% had a significant improvement in the QOL. Olopatadine was also preferred by patients in another. [29]

In the current study, a total of 10% and 18% of patients reported adverse reactions with olopatadine and ketotifen, respectively, the most common of which was a headache, followed by a burning sensation in the eyes. In another study, which included 100 patients, 98% of the patients receiving ketotifen reported a burning sensation in the eyes. [29] A stinging sensation in the eyes was also observed in 22.5% of patients receiving ketotifen. [25] A study monitoring adverse drug reactions (ADRs) to different drugs, found that

olopatadine 0.1% and ketotifen caused ADRs in 4.65% of cases, respectively.<sup>[30]</sup> In our study 4 and 8 patients, who were treated with olopatadine and ketotifen, respectively, reported headache, while 2 and 3 patients, respectively, reported a burning sensation.

In the present study olopatadine provided quicker relief of symptoms and signs and was cost effective than ketotifen.

In conclusion, allergic conjunctivitis can be treated by topical antihistaminics, mast cell stabilizers, NSAIDs, and steroids. The findings of the current study revealed that patients receiving olopatadine HCl 0.1% had quicker relief of AC symptoms than ketotifen fumarate 0.025%. Finally, both medications improved the QOL to a similar extent.

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Nil.

## Conflicts of Interest

There are no conflicts of interest.

## REFERENCES

- Abokyi S, Koffuor GA, Ntodie M, Kyei S, Gyanfosu L. Epidemiological profile and pharmacological management of allergic conjunctivitis: A study in Ghana. *Int J Pharm Biomed Res* 2012;3:195-201.
- Uchio E. Treatment of allergic conjunctivitis with olopatadine hydrochloride eye drops. *Clin Ophthalmol* 2008;2:525-531.
- Epstein AB, Hoven PTV, Kaufman A, Carr WW. Management of allergic conjunctivitis: An evaluation of perceived comfort and therapeutic efficacy of olopatadine 0.2% and azelastine 0.05% from two prospective studies. *Clin Ophthalmol* 2009;3:329-336.
- Sanchez MC, Parra BF, Matheu V, Navarro A, Ibanez MD, Davila I, et al. Allergic Conjunctivitis. *J Investig Allergol Clin Immunol* 2011;2:1-19.
- Leonardi A, Dominicus DC, Motterle L. Immunopathogenesis of ocular allergy: A schematic approach to different clinical entities. *Curr Opin Allergy Clin Immunol* 2007;7:429-435.
- Bielory L. Allergic Diseases of the Eye. *Med Clin N Am* 2006;90:129-148.
- Chigbu DI. The management of allergic eye disease in primary care. *Contact Lens and Anterior Eye* 2009;32:260-272.
- Kidd M, McKenzie SH, Steven I, Cooper C, Lanz R; Australian Ketotifen Study Group. Efficacy and safety of ketotifen eye drops in the treatment of allergic conjunctivitis. *Br J Ophthalmol* 2003;87:1206-1211.
- Juniper EF, Guyatt GH. Development and testing of a new measure of health status for clinical trials in rhinoconjunctivitis. *Clin Exp Allergy* 1991;21:77-83.
- Dykewicz MS, Fineman S. Executive summary of joint task force practice parameters on diagnosis and management of rhinitis. *Ann Allergy Asthma Immunol* 1998;81:463-468.
- Katellaris C. Ocular allergy pacific in the Asia Pacific region. *Asia Pacific Allergy* 2011;1:108-114.
- Abokyi S, Koffuor GA, Ntodie M, Kyei S, Gyanfosu L. Epidemiological profile and pharmacological management of allergic conjunctivitis: A study in Ghana. *Int J Pharm Biomed Res* 2012; 3:195-201.
- Ahuama OC, Emereole CG. The influence of climatic and socioeconomic factors on the occurrence of allergic conjunctivitis amongst Primary school pupils in owerri urban, Nigeria. *JNOA* 2005;12:17-19.
- Choi H, Lee SB. Nonseasonal allergic conjunctivitis in the tropics: Experience in a tertiary care institution. *Ocul Immunol Inflamm* 2008;16:141-145.
- Marback PM, de Freitas D, Paranhos AJ, Belfort RJ. Epidemiological and clinical features of allergic conjunctivitis in a reference center. *Arq Bras Oftalmol* 2007;70:312-316.
- Khaled NA, Pearce N, Anderson HR, Ellwood P, Montefort S, Shah J, et al. Global map of the prevalence of symptoms of rhinoconjunctivitis in children: The International Study of Asthma and Allergies in Childhood (ISAAC) Phase Three. *Allergy* 2009;64:123-148.
- Endre L, Hidasi V. First Hungarian report of olopatadine eye drop therapy in children and adults suffering from seasonal allergic conjunctivitis. *Oro Hetil* 2006;147:1741-1743.
- Abelson MB, Spangler DL, Epstein AB, Mah FS, Crampton HJ. Efficacy of once-daily olopatadine 0.2% ophthalmic solution compared to twice-daily olopatadine 0.1% ophthalmic solution for the treatment of ocular itching induced by conjunctival allergen challenge. *Curr Eye Res* 2007;32:1017-1022.
- Shimura M, Yasuda K, Miyazawa A, Otani T, Nakazawa T. Pre-seasonal treatment with topical olopatadine suppresses the clinical symptoms of seasonal allergic conjunctivitis. *AJO* 2011;151:698-702.
- Aima U, Faruque GM, Aqmo S. A comparison of the efficacy of olopatadine hydrochloride 0.1% ophthalmic solution and sodium chromoglycate ophthalmic solution in the treatment of allergic conjunctivitis. *J Dhaka Med Coll* 2009;18:136-139.
- Yaylali V, Demirlenk I, Tatlipinar S, Ozbay D, Esme A, Yildirim C, et al. Comparative study of 0.1% olopatadine hydrochloride and 0.5% ketorolac tromethamine in the treatment of seasonal allergic conjunctivitis. *Acta Ophthalmol Scand* 2003;81:378-382.
- Kateleris CH, Ciprandi G, Missotten L, Turner DE, Bertin D, Berdeaux G. A comparison of the efficacy and tolerability of olopatadine hydrochloride 0.1% ophthalmic solution and cromolyn sodium 2% ophthalmic solution in seasonal allergic conjunctivitis. *Clin Ther* 2002;24:1561-1575.
- Haicl P, Cerna H. Ketotifen fumarate (Zaditen) eye drops in the treatment of seasonal allergic conjunctivitis. *Cesk Slov Oftalmol* 2004;60:362-367.
- Kidd M, McKenzie SH, Steven I, Cooper C, Lanz R. Efficacy and safety of ketotifen eye drops in the treatment of seasonal allergic conjunctivitis. *Br J Ophthalmol* 2003;87:1206-1211.
- Aguilar AJ. Comparative study of clinical efficacy and tolerance in seasonal allergic conjunctivitis management with 0.1% olopatadine hydrochloride versus 0.05% ketotifen fumarate. *Acta Ophthalmol Scand* 2000;78:52-55.
- Sarker SJ, Chowdhury AN, Hussain Z, Hossain AKMM, Chowdhury H. Comparison of the therapeutic efficacy of 0.1% olopatadine hydrochloride and 0.025% ketotifen fumarate in allergic conjunctivitis. *Therapy* 2011;8:545-553.
- Rodríguez VME, Lopez HA, Rde GDL. Comparison of olopatadin and ketotifen in the treatment of allergic conjunctivitis. *Rev Med Inst Mex Seguro Soc* 2009;47:399-404.
- Scoper SV, Berdy GJ, Lichtenstein SJ, Rubin JM, Bloomenstein M, Prouty RE, et al. Perception and Quality of Life Associated With the Use of Olopatadine 0.2%(Pataday) in Patients With Active Allergic Conjunctivitis. *Adv Ther* 2007;24:1221-1232.
- Artal MN, Luna JD, Discepola M. A forced choice comfort of olopatadine hydrochloride 0.1% versus ketotifen fumarate 0.05%. *Acta Ophthalmol Scand Suppl* 2000;230:64-65.
- Jain VK, Shrivastava B, Agarwal M. Adverse drug monitoring study of azelastine, epinastine, ketotifen and olopatadine ophthalmic solution in patients diagnosed with seasonal and perennial allergic conjunctivitis. *AJPSR* 2012;2:16-31.