

Original Article

Effects of Yu-ping-feng granules combined with loratadine tablets on treatment efficacy and immune factor levels in allergic rhinitis patients

Jinlan Song

Department of Otolaryngology, Tianjin Nankai Hospital, Tianjin 300100, China

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Abstract: Objective: This study was designed to explore the treatment efficacy of Yu-ping-feng combined with loratadine in allergic rhinitis patients. Methods: A total of 88 patients with allergic rhinitis who were admitted to our hospital from July 2017 to September 2018 were collected as research subjects, 43 of whom were enrolled in group A and treated with loratadine, and another 45 cases were enrolled in group B and treated with Yu-ping-feng combined with loratadine. The immune factors and ventilation function of the two groups were observed, as well as the treatment efficacy, adverse reactions and quality of life of the two groups of patients. Results: After treatment, the immune factor level and ventilation function in group B were better than those in group A ($P < 0.05$). The total adverse reactions and recurrence rate in group B were lower than those in group A ($P < 0.05$). The total effective rate and quality of life in group B were higher than those in group A ($P < 0.05$). Conclusion: Yu-ping-feng granules combined with loratadine tablets is effective in treating allergic rhinitis.

Keywords: Loratadine tablets, allergic rhinitis, efficacy, immune factors

Introduction

Allergic rhinitis is a kind of long-term allergic disease [1] characterized by mucosal inflammation driven by activated immune cells [2], with manifestations of nasal congestion, secretions and itching [3]. Allergic rhinitis affects 10% to 40% of the population. It can reduce the quality of life of patients and bring high medical costs [4]. Allergic rhinitis is an IgE mediated inflammation of the nasal mucosa caused by exposure to anaphylactogens. Indoor dust mites and animals are the main causes of perennial symptoms. Exposure to pollen can also give rise to seasonal symptoms [5]. Loratadine is a drug with low water solubility and high permeability [6, 7], which is often used to treat allergic symptoms [8]. It can reduce endothelial inflammation induced by oxidized low density lipoproteins and has protective effects [9]. Loratadine selectively inhibits H1 receptors located primarily on respiratory smooth muscle cells, which do not cross the blood-brain barrier. It can be utilized in a variety of situations to relieve allergic symptoms [10].

Traditional Chinese medicine has become popular all over the world. Yu-ping-feng powder, as a kind of traditional Chinese medicine, it can significantly improve specific and non-specific immune functions. Clinical studies have shown that Yu-ping-feng powder can reduce the risk of recurrent respiratory tract infections by regulating the immune system and inhibiting inflammatory cytokines and their antiallergic effects *in vivo* [11]. Moreover, Yu-ping-feng has shown anti-allergic and inflammatory effects and is used to treat allergic rhinitis [12]. This study explored the efficacy of Yu-ping-feng combined with loratadine tablets in allergic rhinitis patients.

Materials and methods

General data

A total of 88 patients with allergic rhinitis in the Tianjin Nankai Hospital from July 2017 to September 2018 were collected and divided into group A and group B. Group A consisted of 43 patients treated with loratadine, including

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23 males and 20 females. Group B was composed of 45 patients treated with Yu-ping-feng combined with loratadine, including 27 males and 18 females.

Exclusion of inclusion criteria

All patients were diagnosed with allergic rhinitis [13] to be included in this study. Patients and their families were informed and signed an informed consent, and this study was approved by the medical ethics committee of our hospital.

Patients with mental disorders, malignant tumors, severe dysfunction, severe hematological diseases and allergic to therapeutic drugs used in this study were excluded.

Methods

Patients in group A were given oral loratadine tablets (10 mg, SFDA approval number: H20020173, Sinoway Pharmaceutical Co., Ltd., Sanmenxia) once a day, one tablet at a time, for 14 consecutive days. Patients in group B were treated with Yu-ping-feng granules (5 g, SFDA approval number: Z10930036, Sinopharm Guangdong Global Pharmaceutical Co., Ltd.) in addition to treatment given to group A, with one bag at a time, three times a day, for 14 consecutive days. No other therapeutic drugs were used during treatment.

Outcome measures

(1) The ventilation function before and after treatment was detected by a lung function detector, including changes in peak expiratory flow (PEF) and diurnal variation rate of PEF.

(2) In the early morning, five ml of fasting blood of the patient was taken and let stand for 20 minutes. The serum was isolated using a centrifuge (10 ×g at 4°C for 15 min, BMH) and rapidly frozen in liquid nitrogen to store at -80°C for later use. IgE and Th1/Th2 levels before and after treatment were detected by enzyme-linked immunosorbent assay (ELISA, Shanghai Yiyuan Biological Technology Co., Ltd.).

(3) Treatment efficacy was observed according to symptoms [14]: marked response: symptoms completely disappeared. Effective response: symptoms were greatly alleviated. No response: symptoms did not changed.

(4) Patients in both groups were followed up for the recurrence rate 1 month after treatment.

(5) The physical function, vital function, mental function and quality of life of patients in both groups were scored with reference to Short Form 36-item Health Survey (SF-36) [15], with a full score of 100, and the higher the score, the higher the quality of life.

Statistical methods

Statistical analysis was performed using SPSS 21.0 (SPSS, Inc., Chicago, IL, USA). GraphPad Prism 8 (GraphPad Software, San Diego, USA) was used to illustrate the collected data. The measurement data was expressed as ($x \pm sd$), and t test was used for its comparison between groups. The enumeration data was represented by [n (%)], and the chi-square test was used for its comparison between groups. When ($P < 0.05$), the difference was statistically significant.

Results

General data

The general data of the two groups showed no significant difference in age, gender, basic information, lifestyle, and other aspects between the two groups ($P > 0.05$). More details were shown in **Table 1**.

Changes of immune factors before and after treatment

Before treatment, the total IgE levels in group A and group B were (118.39 ± 24.13) KIU/L and (119.58 ± 23.59) KIU/L, respectively. After treatment, they were (68.29 ± 13.69) KIU/L in group A and (53.64 ± 11.54) KIU/L in group B. There was no difference in total IgE levels between the two groups before treatment ($P > 0.05$), while the level decreased after treatment, and was lower in group B than group A ($P < 0.05$). Before treatment, Th1/Th2 in group A and group B was (0.75 ± 0.15), (0.77 ± 0.16), respectively. After treatment, Th1/Th2 in group A and group B was (0.93 ± 0.23), (1.24 ± 0.26), respectively. There was no difference in Th1/Th2 between the two groups before treatment ($P > 0.05$). After treatment, Th1/Th2 increased, and was higher in group B than group A ($P < 0.05$). More details were shown in **Figure 1**.

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Table 1. General data ($\bar{x} \pm sd$) [n (%)]

Classification	Group A (n = 43)	Group B (n = 45)	t/ χ^2 value	P value
Gender			0.380	0.537
Male	23 (53.49)	27 (60.00)		
Female	20 (46.51)	18 (40.00)		
Age (years)	28.79 \pm 5.39	29.54 \pm 5.45	0.648	0.518
Weight (kg)	60.25 \pm 4.63	61.67 \pm 5.23	1.346	0.181
Height (cm)	173.58 \pm 6.29	174.58 \pm 6.23	0.749	0.455
Nation			0.361	0.547
Han	33 (76.74)	32 (71.11)		
Minority	10 (23.26)	13 (28.89)		
Residence			0.901	0.342
City	36 (83.72)	34 (75.56)		
Countryside	7 (16.28)	11 (24.44)		
Education background			1.184	0.276
\geq high school	29 (67.44)	35 (77.78)		
< high school	14 (32.56)	10 (22.22)		
Economy			0.884	0.642
Poor	11 (25.58)	12 (26.67)		
Common	22 (51.63)	19 (42.22)		
Rich	10 (23.26)	14 (31.11)		
History of diabetes			0.208	0.647
With	4 (9.30)	3 (6.67)		
Without	39 (90.70)	42 (93.33)		
History of hypertension			0.058	0.808
With	5 (11.63)	6 (13.33)		
Without	38 (88.37)	39 (86.67)		
Smoking			0.438	0.508
With	25 (58.14)	23 (51.11)		
Without	18 (41.86)	22 (48.89)		
Drinking			0.499	0.479
With	28 (65.12)	26 (57.78)		
Without	15 (34.88)	19 (42.22)		
Stay up			0.330	0.565
With	32 (74.42)	31 (68.89)		
Without	11 (25.58)	14 (31.11)		
Exercise			0.476	0.490
With	27 (62.79)	25 (55.56)		
Without	16 (37.21)	20 (44.44)		

Comparison of ventilation function between the two groups before and after treatment

The PEF before treatment in group A and group B was (56.69 \pm 5.34) L/min and (55.38 \pm 5.49) L/min, respectively. The PEF of group A and group B after treatment was (65.28 \pm 6.32) L/min and (77.94 \pm 7.23) L/min, respectively.

There was no difference between the two groups before treatment ($P > 0.05$). After treatment, PEF increased in both groups, and was higher in group B than group A ($p < 0.05$). The diurnal variation rate of PEF before treatment in group A and group B was (26.30 \pm 4.28)% and (26.29 \pm 4.29)%, respectively. The diurnal variation rate of PEF after treatment in group A and group B was (18.43 \pm 3.56)% and (13.24 \pm 2.49)%, respectively. There was no difference between the two groups before treatment ($P > 0.05$). After treatment, the diurnal variation rate decreased in both groups, and was lower in group B than group A ($P < 0.05$). More details were shown in **Figure 2**.

Comparison of time to alleviation of symptoms between the two groups of patients

The time to alleviation of nasal itching, nasal congestion, nasal leakage, and sneezing in group A were (5.28 \pm 0.89) d, (4.68 \pm 0.79) d, (4.79 \pm 0.68) d, and (6.29 \pm 0.97) d, respectively. In group B they were (3.28 \pm 0.48) d, (2.86 \pm 0.53) d, (2.68 \pm 0.24) d, and (3.32 \pm 0.28) d, respectively. The time to alleviation of symptoms in group B was shorter than that in group A ($P < 0.05$). More details were shown in **Table 2**.

Comparison of treatment efficacy between the two groups

After treatment, the total effective rate of group A was 67.44%, which was notably lower than that of group B (93.33%) ($P < 0.05$). The results suggest that the therapeutic effect of Yu-ping-feng granules combined with loratadine tablets was remarkably better than that of loratadine alone in the treatment of allergic rhinitis. More details were shown in **Table 3**.

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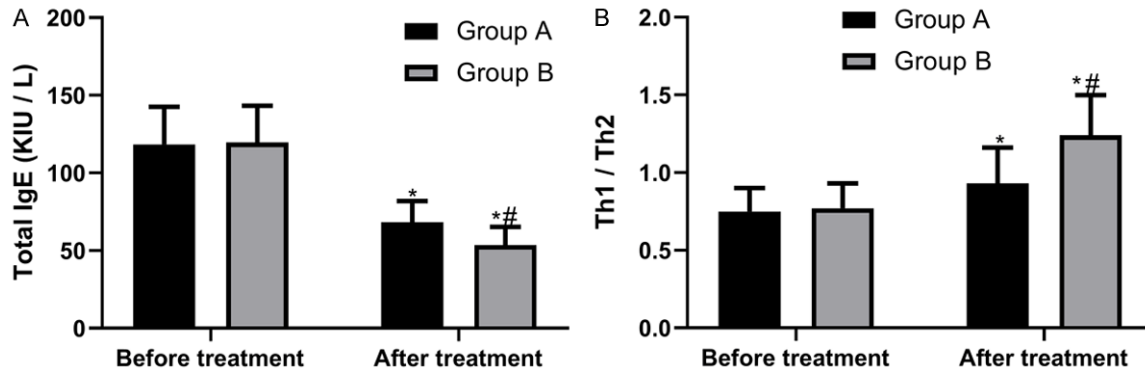


Figure 1. Comparison of changes of immune factors between the two groups before and after treatment. A. Comparison of IgE changes before and after treatment between the two groups: There was no difference in total IgE level between the two groups before treatment ($P > 0.05$). After treatment, the total IgE levels decreased significantly in both groups ($P < 0.05$), and the level in group B was significantly lower than that in group A ($P < 0.05$). Notes: * indicates comparison with the same group before treatment ($P < 0.05$). # indicates comparison with group A after treatment ($P < 0.05$). B. Comparison of Th1/Th2 before and after treatment between the two groups: There was no difference in Th1/Th2 between the two groups before treatment ($P > 0.05$). Th1/Th2 increased significantly in both groups after treatment ($P < 0.05$), and Th1/Th2 in group B was significantly higher than that in group A after treatment ($P < 0.05$). Notes: * indicates comparison with the same group before treatment ($P < 0.05$). # indicates comparison with group A after treatment ($P < 0.05$).

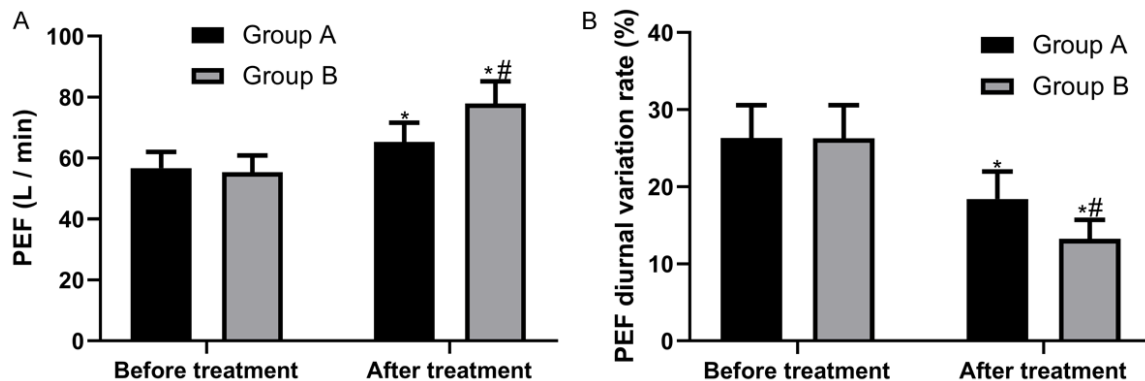


Figure 2. Comparison of ventilation function between two groups before and after treatment. A. Comparison of PEF changes before and after treatment between the two groups: There was no difference in PEF before treatment between the two groups ($P > 0.05$). After treatment, PEF increased significantly in both groups ($P < 0.05$), and PEF in group B was significantly higher than that in group A ($P < 0.05$). Notes: * indicates comparison with the same group before treatment ($P < 0.05$). # indicates comparison with group A after treatment ($P < 0.05$). B. Comparison of diurnal variation rate of PEF changes before and after treatment between the two groups: There was no difference in diurnal variation rate of PEF before treatment between the two groups ($P > 0.05$). After treatment, diurnal variation rate of PEF decreased significantly in both groups ($P < 0.05$), and diurnal variation rate of PEF in group B was significantly lower than that in group A ($P < 0.05$). Notes: * indicates comparison with the same group before treatment ($P < 0.05$). # indicates comparison with group A after treatment ($P < 0.05$).

Comparison of adverse reactions between the two groups

We calculated the incidence of adverse reactions in both groups, which was 27.91% in group A and 8.89% in group B. The incidence in group B was considerably lower than that in group A ($P < 0.05$), indicating that the combination of Yu-ping-feng granules and loratadine tablets causes less adverse reactions

than loratadine alone in the treatment of allergic rhinitis. More details were shown in **Table 4**.

Comparison of recurrence rates between the two groups after 1 month of treatment

The recurrence rate of group A was 37.21% after 1 month of treatment, while that of group B was 15.56%. The recurrence rate of group B was markedly lower than that of group A ($P <$

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Table 2. Comparison of time to alleviation of symptoms between the two groups of patients ($\bar{x} \pm sd$)

Time (d)	Group A (n = 43)	Group B (n = 45)	T	P
Nasal itching	5.28 ± 0.89	3.28 ± 0.48	13.20	< 0.001
Nasal congestion	4.68 ± 0.79	2.86 ± 0.53	12.74	< 0.001
Nasal leakage	4.79 ± 0.68	2.68 ± 0.24	19.58	< 0.001
Sneezing	6.29 ± 0.97	3.32 ± 0.28	19.70	< 0.001

Table 3. Comparison of treatment efficacy between the two groups

Efficacy	Group A (n = 43)	Group B (n = 45)	χ^2	p
Markedly effective	9 (20.93)	16 (35.56)	-	-
Effective	20 (46.51)	23 (51.11)	-	-
Ineffective	14 (32.56)	3 (6.67)	-	-
Total effective rate	29 (67.44)	42 (93.33)	9.457	0.002

Table 4. Comparison of adverse reactions between the two groups

Adverse reactions	Group A (n = 43)	Group B (n = 45)	χ^2	p
Nausea	2 (4.65)	1 (2.22)	-	-
Thirst	3 (6.98)	1 (2.22)	-	-
Tongue dryness	2 (4.65)	1 (2.22)	-	-
Diarrhea	3 (6.98)	0 (0.00)	-	-
Dizzy	1 (2.33)	1 (2.22)	-	-
Weakness	1 (2.33)	0 (0.00)	-	-
Total incidence	12 (27.91)	4 (8.89)	5.346	0.020

Table 5. Comparison of recurrence rate between the two groups [n (%)]

Group	Number of cases of follow-up	Recurrence rate
Group A	43	16 (37.21)
Group B	45	7 (15.56)
χ^2	-	5.341
p	-	0.02

0.05), indicating that the combination of Yu-ping-feng granules and loratadine tablets can effectively reduce the recurrence of allergic rhinitis. More details were shown in **Table 5**.

Comparison of quality of life between two groups after treatment

The physical function of group A and group B was (78.28 ± 4.53) and (88.39 ± 5.29), respec-

tively. The vital function of group A and group B was (82.47 ± 3.68) and (90.38 ± 2.59), respectively. The mental function of group A and group B was (9.12 ± 4.96) and (91.29 ± 4.85), respectively. The quality of life in group A and group B was (82.47 ± 5.24) and (95.27 ± 3.59), respectively. The related quality of life scores in group B were higher than those in group A (P < 0.05). More details were shown in **Table 6**.

Discussion

The existence of circulating self-reactive IgE in patients with autoimmune diseases has long been known [16]. IgE antibody is an important mediator of allergy [17], and its abnormal production can lead to allergic diseases [18]. IgE is an antibody that binds allergen with high affinity that can mediate life-threatening allergic reactions [19]. In addition to allergens acting as classic IgE inducers, viral infection and air pollution may also trigger the IgE pathway [20]. In this experiment, we also observed the secretion of IgE before and after treatment in both groups, and the results showed that the secretion of IgE was reduced in both groups after treatment, and was lower in group B than group A. There is a study showing that abnormal airway reactivity and excessive production of nitric oxide are found in the small airway branches in

asthma, and the study provided evidence of peripheral airway dysfunction in patients with allergic rhinitis [21]. It is suggested that allergic rhinitis may affect the patient's ventilation function, so we tested the ventilation function of the two groups of patients. The results indicated that Yu-ping-feng combined with loratadine reduces the dysfunction of the patient's ventilation function. It is reported that Yu-ping-feng granules can improve the pathological changes of nasal mucosa tissue through ovalbumin, and can reduce the production and release of immune factors in the immune process of allergic rhinitis, which may be an important cure mechanism for allergic rhinitis [22]. All of the above demonstrates that Yu-ping-feng combined with loratadine can reduce the release of immune factors, alleviate the dysfunction of ventilation, and promote the cure of allergic rhinitis. We also found that patients

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Table 6. Comparison of quality of life after treatment between the two groups ($x \pm sd$)

Group	n	Physical function	Vital function	Mental function	Quality of life
Group A	43	78.28 ± 4.53	82.47 ± 3.68	79.12 ± 4.96	82.47 ± 5.24
Group B	45	88.39 ± 5.29	90.38 ± 2.59	91.29 ± 4.85	95.27 ± 3.59
t		9.609	11.700	11.640	13.420
p		< 0.001	< 0.001	< 0.001	< 0.001

treated with combined drugs had shorter symptom alleviated time and better outcomes. A similar study shows that Yu-ping-feng granules reduce the frequency of recurrent respiratory tract infections and improves the overall symptom improvement efficiency, suggesting that its beneficial effects may be related to its immunomodulatory effects [23]. Such results prove that the combination of the two drugs can shorten the symptom alleviation time and improve the effective rate. Our results also indicate that Yu-ping-feng granules combined with loratadine can reduce the recurrence rate and the occurrence of adverse reactions. Relevant studies show that Yu-ping-feng granules combined with conventional western medicine can improve the total effective rate, immune function and body immunity in the treatment of recurrent respiratory tract infections, and has no serious adverse reactions [24]. Besides, Yu-ping-feng granules can improve the total remission rate, reduce the recurrence rate and infection rate, and its beneficial effects may be related to its immunoregulation [25]. Allergic rhinitis is one of the most common diseases affecting adults, it is considered to be a major chronic respiratory disease, which, due to its high incidence, and it has a substantial economic impact on patients' quality of life and work/school performance [26]. The results of our study also exhibited a better quality of life score of patients after combined treatment. All of the above reasons indicate that the addition of Yu-ping-feng to loratadine as an adjuvant treatment has an important effect on allergic rhinitis. Besides, more and more studies have proven that Yu-ping-feng has beneficial immunoregulatory activity [27].

There are still some deficiencies in this study. For example, we have not studied the changes of inflammatory factors related to patients, nor have we observed the prognosis of patients. We will continue to carry out research and update the results.

To sum up, Yu-ping-feng combined with loratadine can exert good treatment efficacy by regulating immune activity, with less recurrence rate and low adverse reactions.

Disclosure of conflict of interest

None.

Address correspondence to: Jinlan Song, Department of Otolaryngology, Tianjin Nankai Hospital, 6 Changjiang Road, Nankai District, Tianjin 300100, China. Tel: +86-13920013629; E-mail: songjinlan3629@163.com

References

- [1] Mastrorilli C, Posa D, Cipriani F and Caffarelli C. Asthma and allergic rhinitis in childhood: what's new. *Pediatr Allergy Immunol* 2016; 27: 795-803.
- [2] Steelant B, Seys SF, Van Gerven L, Van Woensel M, Farré R, Wawrzyniak P, Kortekaas Krohn I, Bullens DM, Talavera K, Raap U, Boon L, Akdis CA, Boeckxstaens G, Ceuppens JL and Hellings PW. Histamine and T helper cytokine-driven epithelial barrier dysfunction in allergic rhinitis. *J Allergy Clin Immunol* 2018; 141: 951-963, e958.
- [3] Cardell LO, Olsson P, Andersson M, Welin KO, Svensson J, Tennvall GR and Hellgren J. TOTAL: high cost of allergic rhinitis-a national Swedish population-based questionnaire study. *NPJ Prim Care Respir Med* 2016; 26: 15082.
- [4] Brożek JL, Bousquet J, Agache I, Agarwal A, Bachert C, Bosnic-Anticevich S, Brignardello-Petersen R, Canonica GW, Casale T, Chavannes NH, Correia de Sousa J, Cruz AA, Cuello-Garcia CA, Demoly P, Dykewicz M, Etxeandia-Ikobaltzeta I, Florez ID, Fokkens W, Fonseca J, Hellings PW, Klimek L, Kowalski S, Kuna P, Laisaar KT, Larenas-Linnemann DE, Lødrup Carlsen KC, Manning PJ, Meltzer E, Mullol J, Muraro A, O'Hehir R, Ohta K, Panzner P, Papadopoulos N, Park HS, Passalacqua G, Pawankar R, Price D, Riva JJ, Roldán Y, Ryan D, Sadeghirad B, Samolinski B, Schmid-Grendelmeier P, Sheikh A, Togias A, Valero A, Valiulis A,

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- Valovirta E, Ventresca M, Wallace D, Wasserman S, Wickman M, Wiercioch W, Yepes-Nuñez JJ, Zhang L, Zhang Y, Zidarn M, Zuberbier T and Schünemann HJ. Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines-2016 revision. *J Allergy Clin Immunol* 2017; 140: 950-958.
- [5] Watts AM, Cripps AW, West NP and Cox AJ. Modulation of allergic inflammation in the nasal mucosa of allergic rhinitis sufferers with topical pharmaceutical agents. *Front Pharmacol* 2019; 10: 294.
- [6] Wang J, Chang R, Zhao Y, Zhang J, Zhang T, Fu Q, Chang C and Zeng A. Coamorphous loratadine-citric acid system with enhanced physical stability and bioavailability. *AAPS PharmSci-Tech* 2017; 18: 2541-2550.
- [7] Ilesce MR, Lavorgna M, Russo C, Piscitelli C, Passananti M, Temussi F, DellaGreca M, Cermola F and Isidori M. Ecotoxic effects of loratadine and its metabolic and light-induced derivatives. *Ecotoxicol Environ Saf* 2019; 170: 664-672.
- [8] Armakovic S, Armakovic SJ and Abramovic BF. Theoretical investigation of loratadine reactivity in order to understand its degradation properties: DFT and MD study. *J Mol Model* 2016; 22: 240.
- [9] Zhou Y, Gao C, Wang H, Liu L, Huang Z and Fa X. Histamine H1 type receptor antagonist loratadine ameliorates oxidized LDL induced endothelial dysfunction. *Biomed Pharmacother* 2018; 106: 1448-1453.
- [10] Kim JY, Kim KS, Kim IS and Yoon S. Histamine receptor antagonists, loratadine and azelastine, sensitize P-gp-overexpressing antimitotic drug-resistant KBV20C cells through different molecular mechanisms. *Anticancer Res* 2019; 39: 3767-3775.
- [11] Ma J, Zheng J, Zhong N, Bai C, Wang H, Du J, Li F, Chen Y, Shi Z, Li X and Chen P. Effects of YuPingFeng granules on acute exacerbations of COPD: a randomized, placebo-controlled study. *Int J Chron Obstruct Pulmon Dis* 2018; 13: 3107-3114.
- [12] Lee M, Kim Y and Lee JA. Okbyungpoongsan (Yupingfeng) for treating allergic rhinitis: a protocol for the systematic review of controlled trials. *Medicine (Baltimore)* 2018; 97: e13227.
- [13] Klimek L, Bergmann KC, Biedermann T, Bousquet J, Hellings P, Jung K, Merk H, Olze H, Schlenter W, Stock P, Ring J, Wagenmann M, Wehrmann W, Mosges R and Pfaar O. Visual analogue scales (VAS): measuring instruments for the documentation of symptoms and therapy monitoring in cases of allergic rhinitis in everyday health care: position paper of the German society of allergology (AeDA) and the German society of allergy and clinical immunology (DGAKI), ENT section, in collaboration with the working group on clinical immunology, allergology and environmental medicine of the German society of otorhinolaryngology, head and neck surgery (DGHNOKHC). *Allergo J Int* 2017; 26: 16-24.
- [14] Small P, Keith PK and Kim H. Allergic rhinitis. *Allergy Asthma Clin Immunol* 2018; 14: 51.
- [15] Zare R, Jafari P and Ghanizadeh A. Do Adult Attention Deficit Hyperactivity Disorder Quality-Of-Life (AAQoL) scale and the SF-36 scale measure the same construct of health-related quality of life? *Atten Defic Hyperact Disord* 2017; 9: 39-45.
- [16] Sanjuan MA, Sagar D and Kolbeck R. Role of IgE in autoimmunity. *J Allergy Clin Immunol* 2016; 137: 1651-1661.
- [17] Aranda CJ and Curotto de Lafaille MA. The secret life of IgE-producing cells. *Immunity* 2019; 50: 285-287.
- [18] Haniuda K, Fukao S, Kodama T, Hasegawa H and Kitamura D. Autonomous membrane IgE signaling prevents IgE-memory formation. *Nat Immunol* 2016; 17: 1109-1117.
- [19] He JS, Subramaniam S, Narang V, Srinivasan K, Saunders SP, Carbajo D, Wen-Shan T, Hidayah Hamadee N, Lum J, Lee A, Chen J, Poidinger M, Zolezzi F, Lafaille JJ and Curotto de Lafaille MA. IgG1 memory B cells keep the memory of IgE responses. *Nat Commun* 2017; 8: 641.
- [20] Froidure A, Mouthuy J, Durham SR, Chanez P, Sibille Y and Pilette C. Asthma phenotypes and IgE responses. *Eur Respir J* 2016; 47: 304-319.
- [21] Haccuria A, Van Muylem A, Malinovsky A, Doan V and Michils A. Small airways dysfunction: the link between allergic rhinitis and allergic asthma. *Eur Respir J* 2018; 51: 1701749.
- [22] Tong L, Liu JL, Wang JX, Sun LL, Song YL, Tian GY, He S and Gao YJ. [Effect of Yupingfeng granule on cytokines of allergic rhinitis induced by OVA in rats]. *Zhongguo Zhong Yao Za Zhi* 2016; 41: 728-730.
- [23] Song T, Hou X, Yu X, Wang Z, Wang R, Li Y, Hu D, Wang X, Xiao Z, Sui Y, Zhu C and Wang J. Adjuvant treatment with yupingfeng formula for recurrent respiratory tract infections in children: a meta-analysis of randomized controlled trials. *Phytother Res* 2016; 30: 1095-1103.
- [24] Zhang LD, Lyu J, Xie YM and Sun MH. [Systematic evaluation and Meta-analysis on effectiveness and safety of Yupingfeng Granules on recurrent respiratory tract infection]. *Zhongguo Zhong Yao Za Zhi* 2019; 44: 4379-4386.
- [25] Shi X, Zhong X and Ding J. Adjuvant treatment with Yupingfeng formula for primary nephrotic syndrome in children: a PRISMA systematic re-

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- view and meta-analysis of randomized controlled trials. *Medicine (Baltimore)* 2018; 97: e11598.
- [26] Luo Q, Zhang CS, Yang L, Zhang AL, Guo X, Xue CC and Lu C. Potential effectiveness of Chinese herbal medicine Yu ping feng san for adult allergic rhinitis: a systematic review and meta-analysis of randomized controlled trials. *BMC Complement Altern Med* 2017; 17: 485.
- [27] Sun H, Ni X, Song X, Wen B, Zhou Y, Zou F, Yang M, Peng Z, Zhu H, Zeng Y, Wang H, Fu X, Shi Y, Yin Z, Pan K, Jing B, Zeng D and Wang P. Fermented Yupingfeng polysaccharides enhance immunity by improving the foregut microflora and intestinal barrier in weaning rex rabbits. *Appl Microbiol Biotechnol* 2016; 100: 8105-8120.