

## Influence of Maekmoondong-Tang on the respiratory aspect of the allergic asthma

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**Abstract** Maekmoondong-Tang is prescription recorded on Zang's 『Synopsis of the Golden Chamber』 for the first time. It can be used in abnormal rising of qi, asthma, swelling throat ect.

So it is observed influence of Maekmoondong-Tang on respiratory aspect of allergic asthma patient, we have significant result and report it.

We used egg-white and ovalbumin (OVA) to induce asthma in experimental animals for observe what Maekmoondong-Tang have an effect on asthma. And it is observed respiratory aspect and obtained next conclusions.

1. Number of total respiration in group that is prescribed Maekmoondong-Tang slightly increased than in control group.

2. Number of abnormal respiration in group that is prescribed Maekmoondong-Tang decreased than in control group significantly.

**Key words:** Maekmoondong-Tang, asthma, respiration

### Introduction

If foreign materials like poison, virus, and bacteria infect human body, it makes antibody to destroy them. This constitutes a part of immunity [17]. Some are profitable and others are harmful. Allergy that is resulted from a harmful antibody-antigen reaction by mechanism of immunity, is an undesirable physiological reaction by several reactions of immunity [9,14,15,20].

Asthma is one of typical type I allergy. It causes a respiratory syndrome (paroxysmal dyspnea, stridor, cough, hyperinspiration, rales etc), that is due to wide constriction of airway, edema in mucous membrane of bronchus and hypersecretion of mucus in bronchus in short time [9,21]. The reason is hypersensitive allergy by exogenous inspiration allergen, infection of the respiratory organ, psychogenic

reaction of daily stress, air pollution etc [21]. Most of them are recognized as allergenic reaction and hard to be cared. Maekmoondong-Tang is prescription recorded on Zang's [7] 『Synopsis of the Golden Chamber』 for the first time. It can be used in abnormal rising of qi, asthma, swelling throat ect. Composition of herbs is Liriodopsis Tuber, Pinelliae Rhizoma, Ginseng Radix, Glycyrrhizae Radix, Oryzae germinatus Fructus, Zizyphi inermis).

Experimental research about efficacy of oriental medical drug having effect on asthma based on is Lee [22], Jeung's [12] research thesis. Experimental research about Maekmoondong-Tang is Lee's [26] effect on smoking mouse, Choi's [3] effect on stomach and blood of mouse, Kim's [18] effect on mouse's respiratory smooth muscle, Lee's [27] effect on mouse's respiratory injury. There is no research thesis about influence of Maekmoondong-Tang on respiratory aspect of allergic asthma patient.

So we observed influence of Maekmoondong-Tang on respiratory aspect of allergic asthma patient, we have significant result and report it.

### Experiment

#### Animal and material

##### 1) Animal

Experimental animals are 18 individuals of healthy and mature male Sprague-Dawley mice, which is supplied with solid feed and water sufficiently. They fit laboratorial environment and are used for experiment.

##### 2) material

Herbs which is bought at oriental medical hospital of Dong-eui Uni. is used for experiment and composition and amount of Maekmoondong-Tang is equal to that of Dongeui internal medical department of pulmonary system. [21]

#### Method

1) Preparation of test liquid and amount of prescription  
We added 2000ml of distilled water to 360g of Maekmoondong-Tang (5dose) and boiled it for 2 hours. Then

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藥名	生藥名	學名	用量
麥門冬	Lirioepis Tuber	<i>Lirioep muscari</i> Bailey	12 g
半夏	Pinelliae Rhizoma	<i>Pinelliae ternata</i> <i>Breitenbach</i>	8 g
人蔘	Ginseng Radix	<i>Panax ginseng</i> C.A. <i>Meyer</i>	4 g
甘草	Clycyrrhizae Radix	<i>Glycyrrhiza uralensis</i> <i>Fisch</i>	2 g
粳米	Oryzae germinafus Fructus	<i>Oriza sativa</i> L.	40 g
大棗	Zizyphi inermis	<i>Zizyphus jujuba</i> Miller	6 g
Total	amount		72 g

we freeze-dried the filter liquid and obtained 6140mg/dose of abstracted material. We prescribed 102.3mg of abstracted material per 100g of mouse's weight which is 1/10 weight of human at one time.

## 2) Inducing of allergic asthma

### (1) Sensitization that is induced by growth of egg's white (EW) substance

We chose de Siqueira's [18] method to cause allergic asthma. We heat it in 100°C boiling water for 30 minute, and then wash it with pure water. We dehydrated it in 100% alcohol for 48 hours and made a piece of 4×4×10mm size. We hydrate dehydrated EW piece in PBS before 2 hour of implanting mouse. After We anaesthetized it with 3.5% chloral hydrate, We implant EW piece at hypodermic tissue of mouse's back, and then waked it. We used antibiotic to prevent infection.

### (2) Dispensation

We oral-administrated abstracted material dissolved in 2ml distilled water from Maekmoondong to sample group from 1day after when Mouse are implanted with EW piece 1 per 1day, during 14days. Sample group is composed of six number of mouse. We oral-administrated same quantity of physiologic solution of salt to control group

### (3) Asthma induced by albumin [23]

Mouse is sensitized by EW, then after 14 days, we put it into inhaler that is connected to a ultra sound sprayer after 3 hour when last dispensation. We evaporated 3% ovalbimin (OVA) dissolved in 0.9% physiological solution of salt. We let mouse to inspire it through it's airway for 10 minute and induced allergic asthma.

### (4) Measurement of respiratory change

After mouse is induced Asthma. We attached a mask connected to respiratory sense (F-TCT-1R transducer, GRASS, USA) to mouse's head and neck according to nasal thermocouple method [5,26,29]. And then we record respiratory aspect with physiograph (Model 7 polygraph, GRASS, USA). We counted general aspect of respiratory, count of respiratory/minute after 10 minute and number of abnormal respiratory

induced by asthma. We calculated the ratio and use it for a individual data.

Principle of this respiratory sense perceive minute change of air temperature that experimental animal breathes in and out. When it breathes in, curve line recorded rises because air temperature goes down. When it breathes out, curve line recorded goes down because air temperature rises. According change of temperature/time is rapid, curve line recorded changes rapidly. According change of temperature/time is slow, curve line recorded changes slowly. Difficulty in breathing out like asthma (exhalation extended respiration) let descending curve be delayed or inclination be slow. Cycle of this curve is number of respiratory/time, and amplitude (quantity of changing temperature) is strong of respiration or relative value of respiratory volume. It is not significance, because individual difference of experimental animals is not revised. Thus we only observed difference of inclination and numbers of respiration in this experiment.

## Result of experiment

### Change of respiratory aspect

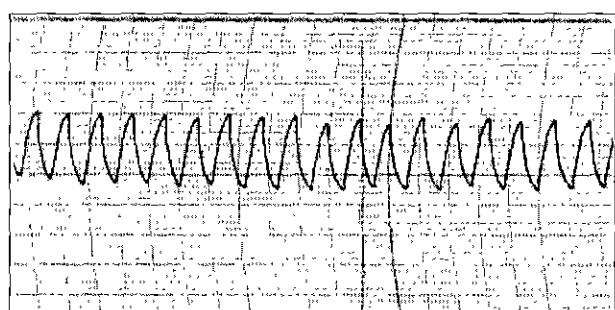
Respiratory of normal group is acute sensitive curve, represent natural exhalation and inspiration. Specially time of inspiration is longer than that of exhalation in detail. We have no difference between control group (Fig.1b) induced allergic asthma and normal group. We observed curve of exhalation represent temporary stop of respiration or clear extension of exhalation and observed curve of exhalation be a square. In a whole, number of respiration decreased and length of respiration shorten. And frequency of abnormal respiration that is difficulty in exhalation, which exhalation is extended, increased in continuous respiration. Contrast to control group, sample group of respiratory aspect that is difficulty in exhalation is same to control group of that. But frequency of abnormal respiration in sample group notable decrease than frequency of abnormal respiration in control group in sample group (Fig. 1c)

### Change of abnormal respiration ratio

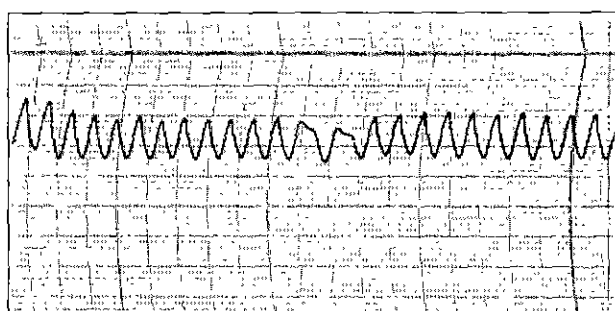
Number of respiration/minute is  $112 \pm 9$  in normal group, number of respiration/minute is  $75 \pm 5$  in control group. Namely number of respiration of control group decreased than that of normal group clearly and number of respiration which is difficult in exhalation is  $55 \pm 5$  and  $73.6 \pm 5.7\%$  in total number of respiration. Number of respiration/minute is  $96 \pm 10$  in sample group and number of abnormal respiration is 48.9 and 48.9% of total number of respiration, so ratio of abnormal respiration in sample group decreased than in normal group significantly ( $p < 0.02$ ). (table 1)

## Consideration

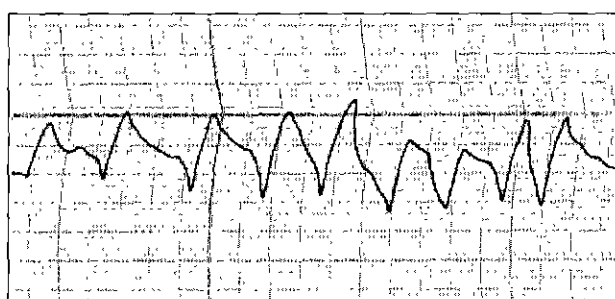
Asthma is a disease that have idiosyncrasy of air-way hy-



a. Normal group



b. Control group



c. Sample group

Fig. 1(a,b,c). Changes of the respiratory pattern.

Table 1. Inhibitory Effect of Maekmoondong-Tang on Abnormal Respiration Rate Induced by Ovalbumin inspiration Following Egg-White Implantation in Rats

Group	No. of total respiration per minute	No. of abnormal respiration per minute	Abnormal respiration rate (%)
Normal	112 ± 9	-	-
Control	75 ± 5	55 ± 5	73.6 ± 5.7
Sample	96 ± 10	48 ± 9	48.9 ± 6.3**

Normal; Sham operation group for egg-white implantation.  
 Control; Group of sensitized with 0.3% ovalbumin inspiration 14 days after egg-white implantation.

Sample; Group of sensitized with 0.3% ovalbumin inspiration 14 days after egg-white implantation and daily administration of Maekmoondong-Tang for 14 days.

\*\*; Statistical significance with Student T-test (p<0.02)

persensitivity to some stimulus, and recognized as a disease that bedside symptoms of wide stenosis on air-way improve in natural or by medical treatments. The latest definition of Asthma, syndrome that have character - fitful dyspnea, stridor, cough and rales is a disease that have symptom of reversible air-way closing, air-way hypersensitivity, inflammatory reaction on air-way in pathology [30].

The causes of asthma paroxysm involve hypersensitivity to exogenous inhalant allergen, infection of respiratory organs, mind-cause physiological reaction to daily stresses, and air pollution, in addition, reflex, autonomic nerve disharmony, inherent disposition, and internal secretion failure. In these causes, the theory of allergy is influential [22,35].

The croup and asthma is chronic respiratory disease that divided into two aspect, the dyspnea breath is too loud and rapid, and the wheezing which involves dyspnea, stridor [10,13,35,36]. The cause in oriental medicine involve the cold theory [45], mind-cause theory[45], phlegm theory [4,33,40,41,44], disposition theory [8,36], infection theory [34], hypersensitive reaction [11,13,43], and respiratory distress of lung and kidney [21].

The therapy is divided two part in generally. one is the deficiency syndrome, it's symptom involve slowness in the condition of disease, non-continual respiration, rapid inspiration, weighting in case of moving, weak voice and blood pulse. The other is the excess syndrome, it's symptom involve rapidity in the condition of disease, deep and long breath, rapid expiration, loud and rough voice, powerful blood pulse. In treatment, the deficiency syndrome is divided lung deficiency syndrome and kidney deficiency syndrome, and the excess syndrome is divided phlegm syndrome due to wind and phlegm turbid [21,35,36].

The croup and asthma induces bronchial asthma [19,24,42], pulmonary emphysema [6,24,42] which causes irreversable choking, chronic obliterative bronchitis, asthmatic bronchitis [6], and others, pulmonary hydrops and pulmonary congestion induced by cardiac failure, right cardiac hypofunction, hyperkinemia in thorax. Syndrome of the croup and asthma is orthopneam, moist rales, prune juice expectoration etc and includes cardiac asthma [21,24].

In Oriental medicine, the fact related with allergy is to be same the next. So [38] told that "Having the immune power is preventing the diseases", he explained that in sensitive appearance, it have a constitutional differance. Jang [8] told that "Asthma was produced by the coolness and the fatigue" means special internal cause which falling ill, when body was touched with cold or fatigue. namely it is considered as allergy constitution.

Allergic asthma is induced by I-type allergic reaction. It is related with IgE reaction. when antigen come into airway, specific antigenic antibody is made. this specific antigenic antibody stick to surface receptor of mast cell, basocyte, etc. after that when exposed to same antigen, this cell is activated. many intercellular chemical transfer

material isolated [14,15].

Mechanism of typical exogenous asthma is when antigen come into airway, assistant of phagocyte and helper-T-cell, specific antigenic antibody (IgE, IgG..) is made from B-cell. this specific antigenic antibody surface stick to receptor of mastcell, basophil. after that when exposed same antigen, this cells are activated. intercellular many chemical transfer materials are isolated to out of cell. within these, As material which already made and saved or newly made, histamine (as bronchoconstrictor), PGD2 (prostaglandin D2) and slow reacting substance (leukoterien C4, leukoterine D4) are bring out early stage asthma reaction which cause bronchoconstriction within a few minute, and after 30-60min disappeared. Chemical mediated materials secreted by mastcell and cytokine secreted by other phagocyte, mastcell, helper T-cell, multiply and activate inflammatory cell and induces the latter reaction of bronchial asthma. Contraction reaction of bronchus appears after 3-4hours and reaches maximum after 4-8hour, and disappears 12-24 hour in the latter reaction of bronchial asthma [23,32,39].

Asthma is recognized that composed of hypersensitive reaction of airway and cellular inflammation, and stimulus of trachea is classified the early reaction and the latter reaction. The latter reaction is related to increase of hypersensitive reaction in airway and cellular inflammation composed of eosinophil and neutrophil [39].

Ophiopogon Decco, Maekmoondong-Tang, was originally written in Zang's [7] 『Synopsis of the Golden Chamber』 and used in the abnormal rising of qi, asthma, swelling throat and so on. Its componants are ophiopogon root, pinellia tuber, ginseng, liquorice and fructus oryzae. Their action is as follows. Ophiopogon is sweet and bitter in flavor and slighty cool in nature. It cures cough with dyspnea, cough with sticky sputum, swelling throat and so on, because it can remove heat, promote secretion of body fluid and resolve phlegm. Pinellia tuber can be used when cough with adverse ascending of the lung energy is caused by the damp-phlegm. Ginseng can invigorate premordial energy, reinforce the spleen and replenish qi. Liquorice can clear away antipyretic and detoxicant heat and toxic materials, reinforce the spleen, replenish qi, moisten the lung, and arrest cough. Fructus oryzae can reinforce the spleen, replenish qi, nourish the stomach and quench thirst [25,37].

Author has observed the efficacy of Ophiopogon Decco experimentally that influences the breathing pattern of allergic asthma. As the result, the exhalation-curve showed temporary breathing stop after inhalation or the tendency that its shape became quadrilateral since exhalation was remarkably extended in the control group that was taken with allergic asthma compared with the normal group. And general respiratory rate was decreased and respiratory length was shortened. Also abnormal breathing appeared which showed exhalation-dyspnea with extended exhalation in the continuous respiration.

The breathing pattern with exhalation-dyspnea was not greatly different between the sample group that was prescribed with ophiopogon decco (Maekmoondong-Tang) and control group, but it could be observed that the frequency of abnormal breathing had a tendency to be obviously decreased.

Change of respiratory ratio and ratio of abnormal breathing was observed and the result was that the control group showed remarkable decrease of abnormal breathing ratio in respiratory ratio per minute compared with normal group, and the ratio of abnormal breathing with exhalation-dyspnea was  $55 \pm 5$  times ( $73.6 \pm 5.7\%$ ). Respiratory ratio per minute increased in sample group compared with control group. The abnormal breathing ratio of them was  $48 \pm 9$  times ( $48.9 \pm 6.3\%$ ) and it showed the significant decrease ( $p < 0.02$ ) in result.

Reversible obstruction of respiratory tract, characteristic clinical symptoms of asthma, is caused by the contraction of bronchial smooth muscle, mucous airway obstruction, and bronchomucosal and submucous edema and inflammation. It grows worse with exhalation. Since the inhaled air cannot come out by airway obstruction, lungs inflate excessively and work of breathing increase. And it causes dyspnea and use of respiratory assistant-muscle [30].

Spastic contraction of bronchiolar smooth muscle by asthma causes interception of airflow and it changes Volume of lung, peak flow rate and mechanics of thorax etc. Also it influences distribution of ventilation-distribution of flow and function of the cardiovascular system. Interception of airflow can occur both in large and small respiratory tract. Airway constriction become more severe, air flow to distal parts is more restricted. and it causes increase of airflow's resistance and exhalational time [16].

The adjustment of nerve and autonomic nervous system (ANS) distributed in respiratory tract is so complicated that it isn't elucidated perfectly yet. Nerve distributed in respiratory tract can be divided into ANS and afferent nerve. Autonomic nerve's function to respiratory tract is as follows. It participates in basal tone of airway smooth muscle, maintains the inside diameter of respiratory tract, and take part in ability of secretion of submucous glands. Also it takes part in epithelial function of respiratory tract, tone and permeability of bronchial vessels, and participates in release of chemical media in mast cells and other inflammation cells. Afferent nerves is usually known as sensory nerve and has been found to participate in breathing pattern [2].

Extention of exhalational time, decrease of respiratory ratio and occurrence of abnormal breathing in control group are thought to be the result of airway obstruction. (Reversible) obstruction of respiratory tract is caused by the contraction of bronchial smooth muscle, mucous airway obstruction, and bronchomucosal and submucous edema and inflammation. It is the symptom generated by the complex mechanism

composed of basal tone of airway smooth muscle, ANS and afferent nerve participating in breathing pattern and body inflammation cells etc. Increase of respiratory ratio and decrease of respiratory ratio observed in sample group is thought to be due to the virtue of Ophiopogon Decco that alleviates obstruction of respiratory tract, but consistent study will be required to know the accurate mechanism of Ophiopogon Decco to asthma.

Human inflammatory cells are divided into circulating cells (circulating cell) - neurocyte, acidocyte, basophil and plasmacyte- and noncirculating cells (non circulating cell) - mast cell, macrophage and endotheliocyte. Among them, acidocyte is very important in host immunity in allergic response like vermiculous infestation and bronchial asthma. Appropriate stimulus induces degranulation of acidocyte and accumulations of released granuloprotein cause several illness of early injury like bronchial asthma, vermiculous infestation and so on [31].

It could be concluded on the basis of the above results that Ophiopogon Decco can stabilize the abnormal breathing by allergic asthma and be used as prophylactic or therapeutic medicine if used during considerable period.

## Conclusion

We used egg-white and ovalbumin (OVA) to induce asthma in experimental animals for observe what Maekmoondong-Tang have an effect on asthma. And we observed respiratory aspect and obtained next conclusions.

1. Number of respiration in group that is prescribed Maekmoondong-Tang increased than in control group, but there is no significance.
2. Number of respiration in group that is prescribed Maekmoondong-Tang decreased than in control group significantly.

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