

# 동물실험에서 한약제재 경구투여가 비만에 미치는 영향에 대한 국내 연구보고 고찰 - 2010년 이후 발표된 논문을 중심으로

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## The Effect of Oral Administration at Herbal Medicines in Animal Models on Obesity: A Review of Animal Study Reports Published in Korea after 2010

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**Objectives** This study is to review the effect of herbal medicines on obesity in animal models reported in Korean domestic journals after 2010.

**Methods** The Databases (Koreantk, KISS, NDSL) are searched with terms as obesity, and animal study reports on obesity with herbal medicines after 2010 were reviewed. Animal model, intervention, and obesity indicator were extracted.

**Results** 69 articles were reviewed. 57 studies used high fat diet to induce obesity. 56 studies used complex herbal medicines. Most used herbal material for anti-obesity effect is *Ephedrae Herba*. Each study shows significant changes of obesity indicators.

**Conclusions** These results suggest that herbal medicine is effective treatment to obesity. But we need continuously agonize and research more effective and safe herbal medicine. (**J Korean Med Rehabil 2017;27(3):13-32**)

**Key words** Obesity, Herbal medicine, Animal Model, Review

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## 서론»»»»

비만은 체내에 필요한 에너지보다 과다 섭취되거나 섭취된 에너지보다 소비가 부족하여 초래되는 에너지 불균형의 상태로, 호르몬의 변화, 유전, 정신, 사회경제적 요인 등 많은 요인이 복합적으로 관련되어 있으며, 성인병과의 높은 연관성 때문에 중요한 건강문제로 대두되고 있다<sup>1)</sup>. 때문에 비만의 치료로 행동양식의 관리(식사요법, 운동요법, 행동조절요법), 의학적인 기술의 적용(치아교

정, 위절제술), 사회적 또는 정신적인 측면에서의 관리 등이 이루어지고 있으며<sup>2,3)</sup>, 더불어 약물 치료를 응용하는데, 이 중 일부 비만 치료제는 체중감소의 효과에도 불구하고 부작용으로 인해 사용이 제한되고 있다<sup>4)</sup>. 따라서 독성이 적으면서 체중감소에 효과적인 한약을 이용한 비만 치료 약물 개발에 관심이 높아지고 있다<sup>5)</sup>.

한의학에서는 비만을 肥, 肥人, 肥貴人 등으로 표현하였고<sup>6)</sup>, 기름진 음식의 과다 섭취로 인한 脾胃運化失調 및 이로 인한 濕痰瘀血과 七情所傷, 肝氣鬱滯 등을 비만의

원인으로 보았으며<sup>7)</sup>, 祛痰化濕, 疏肝理氣, 健脾利濕 등의 치법을 사용하였다<sup>8)</sup>.

현재 국내에서 비만의 예방이나 치료를 위한 한의학적 연구가 활발하게 이루어지고 있으며, 많은 실험과 임상에서의 유효성이 보고되고 있다. 그러나 유효성을 보인 많은 실험 논문들의 실험내용 및 지표에 관한 리뷰논문은 2010년 박<sup>10)</sup>의 발표 이후 전무한 실정이다. 더불어 이 발표의 경우 실험논문들 뿐만 아니라 다른 모든 비만논문들을 리뷰한 논문이기에, 실험논문들의 내용 및 지표에 관한 분석이 부족한 실정이다. 이에 저자는 최신 연구동향을 파악하기 위해 2010년 이후 국내에서 발표된 비만 관련 동물모델에 한약제재를 경구투여한 실험연구 논문들을 고찰하여 향후 연구 및 임상에서의 활용에 있어 도움이 되고자 하였다.

## 재료 및 방법»»»»

### 1. 검색방법

관련문헌 검색 사이트는 한국전통지식포털(<http://www.koreantik.com>), KISS (<http://kiss.kstudy.com>), NDSL (<http://www.ndsl.kr>)의 데이터베이스 3개를 이용하였다. 각 데이터베이스의 자료는 2010년 이후부터 2016년 12월까지 발표된 국내 한의학관련 학술지를 대상으로 하였으며, 검색어는 비만(obesity)으로 하였다. 검색 범위는 제목 및 키워드로 하였다.

### 2. 자료 추출

국내에서 발간되었으며, 비만에 대하여 한약 및 한약재를 이용한 동물실험연구를 대상으로 하였다. 자료 추출은 1명의 저자(김)에 의해 수행되었으며, 검색된 논문의 초록을 읽고 검토하였다. 다만 초록이 누락되어 있거나 내용이 모호한 경우 원문을 읽고 분석하였다. 자료추출의 선정기준과 배제기준은 다음과 같으며 최종적으로 69편을 선정하였다.

#### 1) 선정 기준

- ① 동물을 대상으로 한 실험연구
- ② 비만에 효과가 예상되는 한약, 한약재, 천연추출물의 소재를 이용한 경우
- ③ 치료 효능에 대한 지표를 측정된 경우

#### 2) 배제 기준

- ① 실험연구가 아닌 경우
- ② 대상이 사람이거나 in vitro인 경우
- ③ 주요 소재가 한약, 한약재, 천연추출물이 아닌 경우
- ④ 약물 투여방법이 경구투여가 아닌 경우

## 결과»»»»

### 1. 자료추출 결과

3개의 데이터베이스를 통해 2010년부터 2016년 12월까지 국내 한의학관련 학술지에 비만(obesity)로 검색된 논문은 185편이었다. 이를 선정기준과 배제기준을 바탕

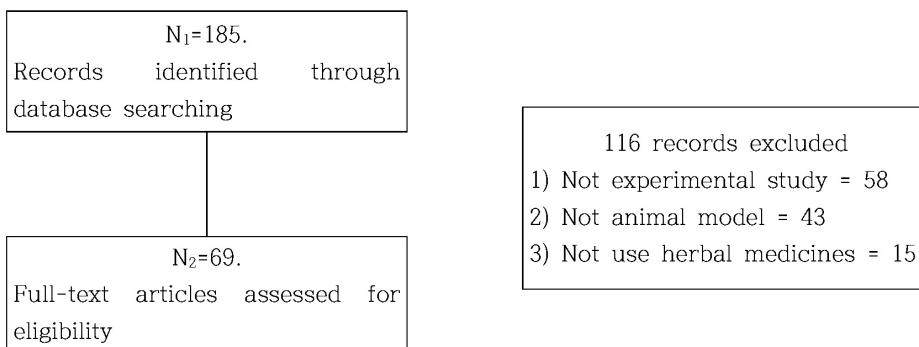


Fig. 1. Flow chart for searching strategy.

으로 추출한 결과 116편의 논문이 탈락되고 최종 69편의 논문이 선정되었다(Fig. 1).

## 2. 연도별 분류

본 연구에 선정된 69편의 논문은 각각 2010년도에 8편, 2011년도에 11편, 2012년도에 13편, 2013년도에 13편, 2014년도에 10편, 2015년도에 8편, 2016년도에 6편이 발표되었다(Fig. 2).

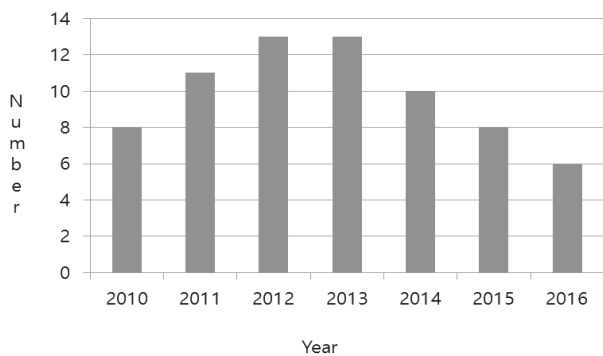


Fig. 2. Annual distribution of studies.

## 3. 학술지별 분류

선정된 69편의 논문을 학술지별로 분류한 결과는 다음과 같다(Table I). 대한본초학회지에서 14편, 대한한의학 방제학회지에서 11편, 한방재활의학과학회지에서 11편, 동의생리병리학회지에서 7편, 대한한방내과학회지에서 6편, 대한한의학학회지에서 6편, 한방비만학회지에서 5편, 대한한방소아과학회에서 4편, 대한예방한의학회지에서 3편, 대한한방부인과학회지에서 1편, 동의신경정신과학회

Table I. Classification of Academic Journals

Journals	Number
The Korea Journal of Herbology	14
Herbal Formula Science	11
The Journal of Korean Rehabilitation Medicine	11
Korean Journal of Oriental Physiology & Pathology	7
The Journal of Internal Korean Medicine	6
The Journal of Korean Oriental Medicine	6
The Journal of Korean Medicine for Obesity Research	5
The Journal of Pediatric Korean Medicine	4
The Journal of Oriental Medical Preventive	3
The Journal Of Oriental Gynecology	1
The Korean Society of Oriental Neuropsychiatry	1

Table II. Summary of Animal Model in Studies

No.	First author (year)	Subject	Age (week)	Sex	Method of induction
1	Ki et al (2016) <sup>10)</sup>	C57bl/6j	6	M	High fat diet
2	Ye et al (2016) <sup>11)</sup>	C57bl/6j	6	M	High fat diet
3	Oh et al (2016) <sup>12)</sup>	C57bl/6j	7	M	High fat diet
4	Lee et al (2016) <sup>13)</sup>	C57bl/6	6	M	High fat diet
5	Jang et al (2016) <sup>14)</sup>	Icr	4	-	High fat diet
6	Song et al (2016) <sup>15)</sup>	C57bl/6	5	M	High fat diet
7	Ma et al (2015) <sup>16)</sup>	C57bl/6	-	M	High fat diet
8	Kim et al (2015) <sup>17)</sup>	C57bl/6	5	M	High fat diet
9	Choi et al (2015) <sup>18)</sup>	Icr	5	F	High fat diet
10	Yoo et al (2015) <sup>19)</sup>	C57bl/6n	7	M	High fat diet
11	Kim et al (2015) <sup>20)</sup>	C57bl/6	4	-	High fat diet
12	Youn et al (2015) <sup>21)</sup>	Icr	6	F	High fat diet
13	Min et al (2015) <sup>22)</sup>	C57bl/6	4	-	High fat diet
14	Keum et al (2015) <sup>23)</sup>	C57bl/6j	6	M	High fat diet
15	Kee et al (2014) <sup>24)</sup>	SD	-	M	High fat diet
16	Lee et al (2014) <sup>25)</sup>	SD	-	M	High fat diet
17	Seok et al (2014) <sup>26)</sup>	C57bl/6n	7	M	High fat diet
18	Kim et al (2014) <sup>27)</sup>	C57bl/6n	7	M	High fat diet
19	Shin et al (2014) <sup>28)</sup>	SD	-	F	Estrogen deficient
20	Kang et al (2014) <sup>29)</sup>	C57bl/6	10	M	High fat diet

**Table II.** Continued

No.	First author (year)	Subject	Age (week)	Sex	Method of induction
21	Ha et al (2014) <sup>30)</sup>	Icr	6	M	High fat diet
22	Lee et al (2014) <sup>31)</sup>	C57bl/6j	8	M	High fat diet
23	Yoon et al (2014) <sup>32)</sup>	C57bl/6j	5	M	High fat diet
24	Shin et al (2014) <sup>33)</sup>	C57bl/6n	8	M	High fat diet
25	Heo et al (2013) <sup>34)</sup>	SD	-	M	High oxidized fat diet
26	Chun et al (2013) <sup>35)</sup>	C57bl/6j	6	M	High fat diet
27	Chun et al (2013) <sup>36)</sup>	C57bl/6j	6	M	High fat diet
28	Kim et al (2013) <sup>37)</sup>	C57bl/6jHam-ob/ob	-	M	Gene manipulation
29	Park et al (2013) <sup>38)</sup>	C57bl/6	4	-	High fat diet
30	Chang et al (2013) <sup>39)</sup>	C57bl/6	4	-	High fat diet
31	Song et al (2013) <sup>40)</sup>	SD	8	-	High fat diet
32	Jeong (2013) <sup>41)</sup>	Icr	4	-	High fat diet
33	Kwon et al (2013) <sup>42)</sup>	Icr	-	-	High fat, high carbohydrate diet
34	Oh et al (2013) <sup>43)</sup>	SD	6	M	High fat diet
35	Lee et al (2013) <sup>44)</sup>	C57bl/6n	8	M	High fat diet
36	Kang et al (2013) <sup>45)</sup>	C57bl/6	6	-	High fat diet
37	Hwang et al (2013) <sup>46)</sup>	SD	5	M	High fat diet
38	Park et al (2012) <sup>47)</sup>	C57bl/6j	4	M	High fat diet
39	Choi et al (2012) <sup>48)</sup>	Icr	-	M	High fat diet
40	Paik et al (2012) <sup>49)</sup>	Icr	4	M	High fat, high carbohydrate diet
41	Han et al (2012) <sup>50)</sup>	Icr	-	M	High fat, high carbohydrate diet
42	Kim et al (2012) <sup>51)</sup>	SD	-	-	High fat diet
43	Lee et al (2012) <sup>52)</sup>	SD	3	M	High fat diet
44	Hwang et al (2012) <sup>53)</sup>	SD	5	M	High fat diet
45	Shin et al (2012) <sup>54)</sup>	SD	-	F	Estrogen deficient
46	Kim et al (2012) <sup>55)</sup>	C57bl/6n	7	M	-
47	Shin et al (2012) <sup>56)</sup>	Icr	5	M	High fat diet
48	Yang et al (2012) <sup>57)</sup>	C57bl/6n	8	M	High fat diet
49	Kim et al (2012) <sup>58)</sup>	SD	-	-	High fat diet
50	Kim et al (2012) <sup>59)</sup>	C57bl/6n	7	M	-
51	Kong et al (2011) <sup>60)</sup>	SD	-	M	High fat diet
52	Park et al (2011) <sup>61)</sup>	C57bl/6	6	F	High fat diet
53	An et al (2011) <sup>62)</sup>	C57bl/6	8	M	High fat diet
54	Song et al (2011) <sup>63)</sup>	Icr	-	M	High fat, high carbohydrate diet
55	Park et al (2011) <sup>64)</sup>	Icr	6	M	High fat, high carbohydrate diet
56	Lee et al (2011) <sup>65)</sup>	C57bl/6	4	M	High fat diet
57	Park et al (2011) <sup>66)</sup>	C57bl/6n	4	M	High fat diet
58	Park et al (2011) <sup>67)</sup>	C57bl/6n	8	M	High fat diet
59	Lee et al (2011) <sup>68)</sup>	C57bl/6j, ob/ob	8	M	Gene manipulation
60	Song et al (2011) <sup>69)</sup>	C57bl/6	6	M	High fat diet
61	Shin et al (2011) <sup>70)</sup>	C57bl/6n	8	M	High fat diet
62	Park et al (2010) <sup>71)</sup>	C57bl/6	8	F	High fat diet
63	Tsung et al (2010) <sup>72)</sup>	C57bl/6n	8	M	High fat diet
64	Kim et al (2010) <sup>73)</sup>	C57bl/6	8	M	High fat diet
65	Hwang et al (2010) <sup>74)</sup>	C57bl/6	8	F	High fat diet
66	Park et al (2010) <sup>75)</sup>	-	8	F	High fat diet
67	Hsiao et al (2010) <sup>76)</sup>	C57bl/6j	4	M	High fat diet
68	Yoon et al (2010) <sup>77)</sup>	C57bl/6j, ob/ob	8	M	Gene manipulation
69	Yang et al (2010) <sup>78)</sup>	SD	6	M	High fat diet

SD: Spargue-Dawley.

지에서 1편이 발표되었다.

#### 4. 실험동물에 대한 분석

선정된 논문에서 연구대상으로 삼은 실험동물은 mouse를 이용한 논문이 55편이었으며 그 중 C57bl/6을 대상으로 한 논문이 17편, C57bl/6n을 대상으로 한 논문이 12편, ICR을 대상으로 한 논문이 12편, C57bl/6j를 대상으로 한 논문이 10편, C57bl/6j와 ob/ob를 혼합한 논문이 2편, C57bl/6jHam-ob/ob를 대상으로 한 논문이 1편으로 나타났다. 14편은 rat을 이용하였으며 좋은 Spargue-Dawley (SD)를 이용하였다. 나머지 1편은 mouse의 종류를 밝히지 않았다. Mouse는 3~10주령이 주로 사용되었으며 69편의 논문 중 수컷을 사용한 경우는 50편으로 암컷보다 수컷을 선호하였다. 비만을 유발한 방법으로는 High fat diet를 이용한 논문이 57편으로 가장 많았으며, Gene manipulation을 이용한 논문이 3편, High fat, high car-

bohydrate diet 및 Estrogen deficient를 이용한 논문이 각각 2편이었다(Table II).

#### 5. 중재내용 분석

중재내용은 약물의 구성 및 재료, 중재기간을 조사하였다(Table III).

동물모델에게 경구투여된 천연물질 및 한약재는 혼합제제를 이용한 논문이 56편, 단일성분을 이용한 논문이 13편으로 분석되었으며 항비만 효능의 소재로 쓰인 천연 성분, 한약재의 종류는 총 133가지였다. 사용된 용량이나 일수를 배제하고 물질별 사용 빈도수만을 보면 麻黃이 29회로 가장 많고 다음으로 甘草가 20회, 大黃이 19회, 茯苓과 薏苡仁이 각 18회 등의 순서였다(Table IV).

중재기간은 짧게는 2주일을 제공한 논문에서부터 길게는 16주일까지였으며 평균적으로 7~8주일 정도의 관찰 기간을 가졌다.

**Table III.** Summary of Intervention in Study

No.	Simple, Complex	Herb material	Period (week)
1 <sup>10)</sup>	Complex	Galgeun-tang (Puerariae Radix, Glycyrrhizae Radix, Cinnamomi Ramulus, Jujubae Fructus, Ephedrae Herba, Paeoniae Radix Alba, Zingiberis Rhizoma Crudus)	12
2 <sup>11)</sup>	Complex	Galgeun-tang (Puerariae Radix, Glycyrrhizae Radix, Cinnamomi Ramulus, Jujubae Fructus, Ephedrae Herba, Paeoniae Radix Alba, Zingiberis Rhizoma Crudus)	12
3 <sup>12)</sup>	Simple	Ephedrae Herba & Cyperi Rhizoma	5
4 <sup>13)</sup>	Complex	Gami-Handayeolso-Tang (Coicis Semen, Raphani Semen, Liriopis Tuber, Platycodi Radix, Scutellariae Radix, Armeniacae Semen, Ephedrae Herba, Castaneae Semen)	7
5 <sup>14)</sup>	Complex	Platycodi Radix, Cyperi Rhizoma	8
6 <sup>15)</sup>	Simple	Coicis Semen	16
7 <sup>16)</sup>	Simple	Phellodendri Cortex	12
8 <sup>17)</sup>	Simple	Agastachis Herba	4
9 <sup>18)</sup>	Complex	Ojeok-san (Glycyrrhizae Radix, Zingiberis Rhizoma Crudus, Cinnamomi Cortex, Platycodi Radix, Angelicae Gigantis Radix, Jujubae Fructus, Ephedrae Herba, Pinelliae Rhizoma, Angelicae Dahuricae Radix, Hoelen, Paeoniae Radix Alba, Aurantii Immaturus Fructus, Citri Pericarpium, Atractylodis Rhizoma, Cnidii Rhizoma, Cyperi Rhizoma, Magnoliae Cortex) & Bang-pung-tong-sung-san (Glycyrrhizae Radix, Platycodi Radix, Angelicae Gigantis Radix, Rhei Rhizoma, Ephedrae Herba, Natrii Sulfas, Menthae Herba, Saposhnikoviae Radix, Atractylodis Rhizoma Alba, Zingiberis Rhizoma Crudus, Gypsum, Forsythiae Fructus, Paeoniae Radix Alba, Cnidii Rhizoma, Gardeniae Fructus, Schizonepetae Spica, Talcum, Scutellariae Radix)	8
10 <sup>19)</sup>	Complex	Gangji-hwan (Ephedrae Herba, Rhei Rhizoma, Lithospermi Radix) & Gangji-hwan plus Gamisoche-hwan (Ephedrae Herba, Rhei Rhizoma, Lithospermi Radix, Glycyrrhizae Radix, Cyperi Rhizoma, Crataegi Fructus, Zingiberis Rhizoma, Hoelen, Cinnamomi Cortex, Alpiniae Officinari Rhizoma, Amomi Fructus, Aurantii Immaturus Fructus, Aucklandiae Radix, Amomi Rotundus Fructus, Zanthoxylum bungeanum Maxim, Chebulae Fructus, Atractylodis Rhizoma Alba, Piperis Longi Fructus, Agastachis Herba, Caryophylli Flos, Menthae Herba)	8

Table III. Continued

No.	Simple, Complex	Herb material	Period (week)
11 <sup>20)</sup>	Complex	Gamikwakhyangjungkisan (Agastachis Herba, Perillae Herba, Angelicae Dahuricae Radix, Arecae Pericarpium, Hoelen, Magnoliae Cortex, Atractylodis Rhizoma Alba, Citri Pericarpium, Pinelliae Rhizoma, Platycodi Radix, Glycyrrhizae Radix, Astragali Radix, Coicis Semen, Raphani Semen, Polyporus, Alismatis Rhizoma, Corni Fructus, Lycii Fructus, Artemisiae Capillaris Herba, Curcumae Radix, Sparganii Rhizoma, Zedoariae Rhizoma)	12
12 <sup>21)</sup>	Complex	Herbal mixture powder (Raphani Semen, Coicis Semen, Hoelen, Plantaginis Semen, Theae folium) & Herbal mixture water extracts (Citri Pericarpium, Crataegi Fructus, Maydis Stigma, Maydis Stigma)	8
13 <sup>22)</sup>	Complex	Da-Chai-Hu-Tang (Bupleuri Radix, Scutellariae Radix, Paeoniae Radix Alba, Rhei Rhizoma, Aurantii Immaturus Fructus, Pinelliae Rhizoma, Zingiberis Rhizoma Crudus, Jujubae Fructus)	10
14 <sup>23)</sup>	Complex	Gami-Cheongpyesagan-Tang (Puerariae Radix, Scutellariae Radix, Angelicae Tenuissimae Radix, Raphani Semen, Platycodi Radix, Cimicifugae Rhizoma, Angelicae Dahuricae Radix, Rhei Rhizoma, Ephedrae Herba)	7
15 <sup>24)</sup>	Complex	Ephedrae Herba, Gypsum	6
16 <sup>25)</sup>	Complex	Cheunggihwadamhwan (Arisaematis Rhizoma, Pinelliae Rhizoma, Massa Medicata Fermentata, Herdei Fructus Germinatus, Citri Pericarpium, Aurantii Immaturus Fructus, Atractylodis Rhizoma Alba, Hoelen, Perillae Semen, Raphani Semen, Trichosanthis Fructus, Cyperi Rhizoma, Crataegi Fructus, Amomi Rotundus Fructus, Citri Reticulatae Viride Pericarpium, Puerariae Radix, Coptidis Rhizoma, Scutellariae Radix, Notarchi Leachii Ovum)	4
17 <sup>26)</sup>	Complex	Gangji-hwan (Ephedrae Herba, Rhei Rhizoma, Lithospermi Radix) & Gangji-hwan plus Gamisoche-hwan (Ephedrae Herba, Rhei Rhizoma, Lithospermi Radix, Glycyrrhizae Radix, Cyperi Rhizoma, Crataegi Fructus, Zingiberis Rhizoma, Hoelen, Cinnamomi Cortex, Alpiniae Officinari Rhizoma, Amomi Fructus, Aurantii Immaturus Fructus, Aucklandiae Radix, Amomi Rotundus Fructus, Zanthoxylum bungeanum Maxim, Chebulae Fructus, Atractylodis Rhizoma Alba, Piperis Longi Fructus, Agastachis Herba, Caryophylli Flos, Menthae Herba)	8
18 <sup>27)</sup>	Complex	Gangji-hwan (Ephedrae Herba, Rhei Rhizoma, Lithospermi Radix)	8
19 <sup>28)</sup>	Simple	Puerariae Radix	6
20 <sup>29)</sup>	Complex	Phyllostachyos Folium, Scutellariae Radix	5
21 <sup>30)</sup>	Simple	Ephedrae Herba	2
22 <sup>31)</sup>	Complex	Samhwangsasim-tang (Coptidis Rhizoma, Scutellariae Radix, Rhei Rhizoma)	10
23 <sup>32)</sup>	Complex	Cheongshimyeonja-tang (Nelumbinis Semen, Dioscoreae Rhizoma, Asparagi Radix, Liriopis Tuber, Polygalae Radix, Acori Graminei Rhizoma, Zizyphi Spinosa Semen, Longanae Arillus, Biotae Semen, Scutellariae Radix, Raphani Semen, Chrysanthemi Flos)	5
24 <sup>33)</sup>	Complex	Gambigyeongsinhwan (1) (Curcumae Radix, Laminariae Thallus, Amorphophallus rivieri Durieu)	8
25 <sup>34)</sup>	Complex	Jengjengamiyijin-tang (Crataegi Fructus, Cyperi Rhizoma, Pinelliae Rhizoma, Cnidii Rhizoma, Atractylodis Rhizoma Alba, Atractylodis Rhizoma, Citri Pericarpium, Hoelen, Massa Medicata Fermentata, Amomi Fructus, Herdei Fructus Germinatus, Glycyrrhizae Radix, Zingiberis Rhizoma Crudus, Jujubae Fructus)	4
26 <sup>35)</sup>	Complex	Daesihho-tang (Bupleuri Radix, Scutellariae Radix, Paeoniae Radix Alba, Rhei Rhizoma, Aurantii Immaturus Fructus, Pinelliae Rhizoma) & Yijin-tang (Pinelliae Rhizoma, Citri Pericarpium, Hoelen, Glycyrrhizae Radix, Zingiberis Rhizoma Crudus) & Gyeoneumjisil-hwan (Pharbitidis Semen, Aurantii Immaturus Fructus, Pinelliae Rhizoma, Citri Pericarpium) & Ukdam-hwan (Trichosanthis Fructus, Fritillariae Cirrhosae Bulbus, Pinelliae Rhizoma) & Sojojung-tang (Coptidis Rhizoma, Glycyrrhizae Radix, Trichosanthis Fructus, Pinelliae Rhizoma, Zingiberis Rhizoma Crudus)	7
27 <sup>36)</sup>	Complex	Samhwangsasim-tang (Coptidis Rhizoma, Scutellariae Radix, Rhei Rhizoma) & Hwangryeonhaedok-tang (Coptidis Rhizoma, Scutellariae Radix, Phellodendri Cortex, Gardeniae Fructus) & Ukgan-san (Angelicae Gigantis Radix, Atractylodis Rhizoma Alba, Hoelen, Uncariae Ramulus et Uncus, Cnidii Rhizoma, Bupleuri Radix, Glycyrrhizae Radix) & Onjunghwadam-hwan (Citri Reticulatae Viride Pericarpium, Citri Pericarpium, Alpiniae Officinari Rhizoma, Zingiberis Rhizoma) & Samul-tang (Rehmanniae Radix Preparata, Paeoniae Radix Alba, Angelicae Gigantis Radix, Cnidii Rhizoma)	7

Table III. Continued

No.	Simple, Complex	Herb material	Period (week)
28 <sup>37)</sup>	Complex	Yookmijihwang-tang-gamibang (Rehmanniae Radix Preparata, Puerariae Radix, Trichosanthis Radix, Lycii Radicis Cortex, Dioscoreae Rhizoma, Corni Fructus, Hoelen, Moutan Cortex Radicis, Alismatis Rhizoma, Liriodis Tuber, Schisandrae Fructus, Gardeniae Fructus, Scutellariae Radix, Coptidis Rhizoma, Phellodendri Cortex, Anemarrhenae Rhizoma, Testudinis Plastrum)	4
29 <sup>38)</sup>	Complex	Mori Folium, Corni Fructus, Dioscoreae Rhizoma, Aurantii Immaturus Fructus	12
30 <sup>39)</sup>	Complex	Gamiygin-tang (Coicis Semen, Ginseng Radix, Massa Medicata Fermentata, Pinelliae Rhizoma, Hoelen, Citri Pericarpium, Glycyrrhizae Radix, Polygonati Rhizoma, Polygoni Multiflori Radix, Lycii Fructus, Hovenia Semen, Dolichoris Semen, Corni Fructus, Herdei Fructus Germinatus, Mori Folium, Aucklandiae Radix)	16
31 <sup>40)</sup>	Complex	Fermented Samjung-hwan (Mori Fructus, Atractylodis Rhizoma, Lycii Fructus)	8
32 <sup>41)</sup>	Simple	Alismatis Rhizoma	8
33 <sup>42)</sup>	Simple	Platycodi Radix	8
34 <sup>43)</sup>	Complex	Jowiseungcheung-tang (Coicis Semen, Castanae Semen, Raphani Semen, Ephedrae Herba, Platycodi Radix, Liriodis Tuber, Schisandrae Fructus, Acori Graminei Rhizoma, Polygalae Radix, Asparagi Radix, Zizyphi Spinosae Semen, Longanae Arillus)	4
35 <sup>44)</sup>	Complex	Gambigyeongsinhwan (4) (Curcuma Radix, Japanese alder, Massa Medicata Fermentata)	8
36 <sup>45)</sup>	Complex	Imperatae Rhizoma, Citri Reticulatae Viride Pericarpium, Evodiae Fructus	10
37 <sup>46)</sup>	Complex	Plantaginis Semen, Hoelen	8
38 <sup>47)</sup>	Complex	Euiiin-tang (Glycyrrhizae Radix, Angelicae Gigantis Radix, Paeoniae Radix Alba, Atractylodis Rhizoma Alba, Coicis Semen, Cinnamomi Ramulus, Ephedrae Herba)	6
39 <sup>48)</sup>	Simple	Salviae Miltiorrhizae Radix	8
40 <sup>49)</sup>	Simple	Massa Medicata Fermentata	8
41 <sup>50)</sup>	Complex	Corni Fructus, Dioscoreae Rhizoma, Aurantii Immaturus Fructus, Mori Folium	8
42 <sup>51)</sup>	Complex	Pear extracts containing herbal medicine (Lycii Fructus & Coicis Semen & Alismatis Rhizoma & Astragali Radix)	4
43 <sup>52)</sup>	Simple	Mori Folium	4
44 <sup>53)</sup>	Complex	Plantaginis Semen, Hoelen	8
45 <sup>54)</sup>	Simple	Puerariae Radix	6
46 <sup>55)</sup>	Complex	Banggihwanggi-Tang (Stephaniae Tetrandrae Radix, Astragali Radix, Atractylodis Rhizoma, Glycyrrhizae Radix, Jujubae Fructus, Zingiberis Rhizoma Crudus)	4
47 <sup>56)</sup>	Complex	Natural Mixture Supplementation (Glycine Semen, Laminariae Thallus, Glycinis Semen, Coicis Semen, Sesami Semen Nigrum, Allii Bulbus, Lentinula edodes, Engraulis japonicus)	6
48 <sup>57)</sup>	Complex	Injecheonggeumdan (Pharbitidis Semen, Talcum, Rhei Rhizoma, Scutellariae Radix)	8
49 <sup>58)</sup>	Complex	Pear extracts containing herbal medicine (Lycii Fructus & Coicis Semen & Alismatis Rhizoma & Astragali Radix)	4
50 <sup>59)</sup>	Complex	Mahangeuigam-Tang (Ephedrae Herba, Armeniacae Semen, Coicis Semen, Glycyrrhizae Radix)	4
51 <sup>60)</sup>	Complex	Ojeoksangamibang (Atractylodis Rhizoma, Ephedrae Herba, Citri Pericarpium, Magnoliae Cortex, Platycodi Radix, Aurantii Immaturus Fructus, Angelicae Gigantis Radix, Zingiberis Rhizoma, Paeoniae Radix Alba, Hoelen, Cnidii Rhizoma, Angelicae Dahuricae Radix, Pinelliae Rhizoma, Cinnamomi Cortex, Glycyrrhizae Radix, Zingiberis Rhizoma Crudus, Coicis Semen, Raphani Semen, Akebiae Caulis, Alismatis Rhizoma, Plantaginis Semen, Citri Reticulatae Viride Pericarpium)	4
52 <sup>61)</sup>	Complex	Wolbi-tang (Gypsum, Ephedrae Herba, Jujubae Fructus, Zingiberis Rhizoma Crudus, Glycyrrhizae Radix)	5
53 <sup>62)</sup>	Complex	Wolbigachul-tang (Gypsum, Ephedrae Herba, Jujubae Fructus, Atractylodis Rhizoma Alba, Zingiberis Rhizoma Crudus, Glycyrrhizae Radix)	12
54 <sup>63)</sup>	Complex	Supungsunkihwan-gagambang (Corni Fructus, Dioscoreae Rhizoma, Aurantii Immaturus Fructus, Platycodi Radix)	8
55 <sup>64)</sup>	Complex	Supungsunki-hwan Partitioned Prescriptions (Corni Fructus, Dioscoreae Rhizoma, Aurantii Immaturus Fructus)	8

Table III. Continued

No.	Simple, Complex	Herb material	Period (week)
56 <sup>(65)</sup>	Complex	Choweseuncheng-tang (Coicis Semen, Castanae Semen, Raphani Semen, Ephedrae Herba, Platycodi Radix, Liriopis Tuber, Schisandrae Fructus, Acori Graminei Rhizoma, Polygalae Radix, Liriopis Tuber, Zizyphi Spinosae Semen, Longanae Arillus)	4
57 <sup>(66)</sup>	Complex	Yagwan-cheungyeoltang (Herba of Lespedeza cuneata, Hovenia Semen, Lycii Fructus, Alismatis Rhizoma, Crataegi Fructus, Cassiae Semen, Polygoni Multiflori Radix)	8
58 <sup>(67)</sup>	Complex	GGEx18 (Ephedrae Herba, Laminariae Thallus, Rhei Rhizoma)	9
59 <sup>(68)</sup>	Complex	GGEx15 (Ephedrae Herba, Rhei Rhizoma) & GGEx16 (Ephedrae Herba, Laminariae Thallus) & GGEx17 (Rhei Rhizoma, Laminariae Thallus) & GGEx18 (Ephedrae Herba, Laminariae Thallus, Rhei Rhizoma)	11
60 <sup>(69)</sup>	Complex	Yukeugambi-tang (Cinnamomi Cortex, Coicis Semen, Hoelen, Carthami Flos, Glycyrrhizae Radix)	6
61 <sup>(70)</sup>	Complex	Gambigyeongsinhwan (2) (Curcumae Radix, Cassiae Semen, Amorphophallus rivieri Durieu)	8
62 <sup>(71)</sup>	Complex	So-yangin Biman-bang (Rehmanniae Radix Preparata, Corni Fructus, Hoelen, Alismatis Rhizoma, Oryzae Semen, Plantaginis Semen, Osterici Radix, Schizonepetae Spica, Saposhnikoviae Radix, Menthae Herba)	8
63 <sup>(72)</sup>	Simple	Glycine Semen Germinatum	9
64 <sup>(73)</sup>	Complex	SSEx1 (Rhei Rhizoma, Plantaginis Semen, Pruni Semen, Arecae Semen, Cannabis Semen, Cuscutae Semen, Achyranthis Radix, Dioscoreae Rhizoma, Corni Fructus, Aurantii Immaturus Fructus, Saposhnikoviae Radix, Angelicae Pubescentis Radix) & SSEx2 (Rhei Rhizoma, Plantaginis Semen, Pruni Semen, Arecae Semen, Cuscutae Semen, Achyranthis Radix, Dioscoreae Rhizoma, Corni Fructus, Aurantii Immaturus Fructus, Saposhnikoviae Radix, Angelicae Pubescentis Radix)	12
65 <sup>(74)</sup>	Complex	Gambi-bang <sup>4</sup> (Ephedrae Herba, Coicis Semen, Atractylodis Rhizoma, Hoelen, Polyporus, Akebiae Caulis, Alismatis Rhizoma, Liriopis Tuber, Asparagi Radix, Gypsum)	8
66 <sup>(75)</sup>	Complex	Gambejaeseup-tang (Atractylodis Rhizoma, Coicis Semen, Lithospermi Radix, Hoelen, Pinelliae Rhizoma, Atractylodis Rhizoma Alba, Citri Pericarpium, Forsythiae Fructus, Polyporus, Trichosanthis Radix, Platycodi Radix, Perillae Herba, Aurantii Immaturus Fructus, Mori Cortex Radidus, Psoraleae Semen, Mume Fructus, Glycyrrhizae Radix, Zingiberis Rhizoma Crudus)	8
67 <sup>(76)</sup>	Complex	Taeumjowee-tang-gagambang (Coicis Semen, Ephedrae Herba, Platycodi Radix, Acori Graminei Rhizoma, Polygalae Radix, Zizyphi Spinosae Semen, Typhae Pollen, Camellia sinensis O. Kuntze, Mori Cortex Radidus, Trichosanthis Radix)	10
68 <sup>(77)</sup>	Complex	GGEx15 (Ephedrae Herba, Rhei Rhizoma) & GGEx16 (Ephedrae Herba, Laminariae Thallus) & GGEx17 (Rhei Rhizoma, Laminariae Thallus) & GGEx18 (Ephedrae Herba, Laminariae Thallus, Rhei Rhizoma)	11
69 <sup>(78)</sup>	Complex	Taeyeumjowee-tang (Coicis Semen, Castanae Semen, Raphani Semen, Schisandrae Fructus, Liriopis Tuber, Acori Graminei Rhizoma, Platycodi Radix, Ephedrae Herba)	7

average of period : 7.67

GGEx: Gyeongshingangjeehwan, SSEx: Sopungsungi-won.

## 6. 약물효과의 측정, 결과분석 및 유의한 지표

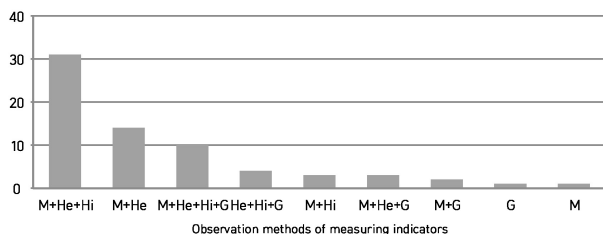
동물모델에 항비만 효과를 나타내는 약물을 중재로 제공한 후 효과를 평가하는 방법으로는 크게 육안적 관찰 (macroscopy), 혈액학적 분석(hematological analysis), 조직학적 분석(histological analysis), 유전자 분석(gene analysis)으로 나뉘었다. 육안적 관찰과 혈액학적 분석, 조직학적 분석을 함께 사용한 논문이 총 31편이었고 육안적 관찰과 혈액학적 분석을 함께 사용한 논문은 총 14편이었으며 4가지 평가법 모두 사용한 논문은 총 10편 등으

로 나타났다(Fig. 3). 육안적 관찰로 body weight, food intake, feeding efficiency ratio (FER), liver weight 등이 측정되었다. 혈액학적으로는 glucose, insulin, TC (total cholesterol), HDL (high density lipoprotein), LDL (low density lipoprotein), TG (triglyceride) 등이 분석되었다. 조직학적으로는 epididymal adipocytes (number and size), hepatic lipid accumulation 등을 분석하였다. 유전자 분석은 지표가 다양하여 따로 기재하지 않았다. 평가 방법의 구체적인 항목은 Table V와 같으며 각 논문에서 유의한 지표의 구체적인 항목은 Table VI과 같다.



**Table IV.** Frequency of Herbal Materials for Anti-Obesity Effect

Frequency	Herb material
29	Ephedrae Herba
20	Glycyrrhizae Radix
19	Rhei Rhizoma
18	Hoelen, Coicis Semen
14	Scutellariae Radix, Platycodi Radix
13	Pinelliae Rhizoma, Zingiberis Rhizoma Crudus
11	Citri Pericarpium
10	Atractylodis Rhizoma Alba, Corni Fructus, Raphani Semen
9	Laminariae Thallus, Alismatis Rhizoma, Paeoniae Radix Alba
8	Dioscoreae Rhizoma, Aurantii Immaturus Fructus, Jujubae Fructus
7	Aurantii Immaturus Fructus, Plantaginis Semen, Atractylodis Rhizoma, Liriopis Tuber, Puerariae Radix, Cyperi Rhizoma
6	Lycii Fructus, Angelicae Gigantis Radix, Crataegi Fructus, Cnidii Rhizoma, Coptidis Rhizoma
5	Gypsum, Acori Graminei Rhizoma, Massa Medicata Fermentata, Cinnamomi Cortex
4	Zingiberis Rhizoma, Agastachis Herba, Menthae Herba, Saposhnikoviae Radix, Angelicae Dahuricae Radix, Zizyphi Spinosae Semen, Mori Folium, Schisandrae Fructus, Curcumae Radix, Polygalae Radix, Lithospermi Radix, Asparagi Radix, Citri Reticulatae Viride Pericarpium, Astragali Radix, Castaneae Semen
3	Alpiniae Officinari Rhizoma, Trichosanthis Fructus, Herdei Fructus Germinatus, Aucklandiae Radix, Amomi Rotundus Fructus, Amomi Fructus, Rehmanniae Radix Preparata, Bupleuri Radix, Longanae Arillus, Polyporus, Trichosanthis Radix, Gardeniae Fructus, Phellodendri Cortex, Magnoliae Cortex, Cinnamomi Ramulus
2	Chebulae Fructus, Cassiae Semen, Angelicae Pubescentis Radix, Amorphophallus rivieri Durieu, Akebiae Caulis, Arecae Semen, Zanthoxylum bungeanum Maxim, Mori Cortex Radidus, Perillae Herba, Forsythiae Fructus, Achyranthis Radix, Pruni Semen, Caryophylli Flos, Phyllostachyos Folium, Hovenia Semen, Cuscutae Semen, Piperis Longi Fructus, Schizonepetae Spica, Talcum, Armeniacae Semen
1	Chrysanthemi Flos, Osterici Radix, Oryzae Semen, Pharbitidis Semen, Angelicae Tenuissimae Radix, Testudinis Plastrum, Arisaematis Rhizoma, Camellia sinensis O. Kuntze, Theae folium, Salviae Miltiorrhizae Radix, Glycine Semen Germinatum, Arecae Pericarpium, Cannabis Semen, Natrii Sulfas, Moutan Cortex Radicis, Stephaniae Tetrandrae Radix, Imperatae Rhizoma, Biotae Semen, Dolichoris Semen, Polygoni Multiflori Radix, Zedoariae Rhizoma, Sparganii Rhizoma, Mori Fructus, Glycinis Semen, Perillae Semen, Cimicifugae Rhizoma, Herba of Lespedeza cuneata, Allium Skin, Nelumbinis Semen, Mume Fructus, Evodiae Fructus, Maydis Stigma, Allii Bulbus, Ginseng Radix, Artemisiae Capillaris Herba, Japanese alder, Polygoni Multiflori Radix, Uncariae Ramulus et Uncus, Lycii Radicis Cortex, Anemarrhenae Rhizoma, Psoraleae Semen, Fritillariae Cirrhosae Bulbus, Typhae Pollen, Notarchi Leachii Ovum, Carthami Flos, Polygonati Rhizoma, Glycine Semen, Sesami Semen Nigrum, Pharbitidis Semen



**Fig. 3.** The number of published studies is analyzed by the observation methods of measuring indicator. M: macroscopy, He: hematological analysis, Hi: histological analysis, G: gene analysis.

### 고찰»»»»

비만은 서구화된 식생활과 급변하는 현대인의 생활습 관으로 인해 하나의 성인병으로 대두되고 있으며, 이러한 현상은 젊은 층 뿐 아니라 노인 및 어린이에게도 나타나 고 있다. 본래 단순한 비만은 체내 지방세포의 양적, 질 적 비정상적인 과다 상태를 말하는 것으로 배고픔에 대비 하여 당장 필요하지 않은 에너지를 저장하려는 인체의 방 어수단이다<sup>79)</sup>. 하지만 현대사회에서는 음식이 풍족해지면 서 과도한 음식섭취와 유전적 원인, 스트레스, 과음, 운동 부족 등으로 인해 본래의 의미를 잃고 과체중을 유발시켜 병의 원인이 되고있는 실정이다. 이러한 비만은 당뇨, 고 혈압, 순환기장애, 고요산혈증, 간담도질환, 호흡장애 및

**Table V.** Summary of Measuring Indicators

No.	Measuring Indicators			
	Macroscopy	Hematological analysis	Histological analysis	Gene analysis
1 <sup>10)</sup>	Body, total fat, liver	Glucose, insulin, OGTT, TC, TG, HDL, AST, ALT	Liver	○
2 <sup>11)</sup>	Body, total fat, liver	Glucose, insulin, OGTT, TC, TG, HDL, AST, ALT	Liver	○
3 <sup>12)</sup>	Body, food intake, food efficiency, (periepididymal, perirenal) adipose tissue	adiponectin, leptin, insulin, TC, TG, HDL	Liver	-
4 <sup>13)</sup>	Body, food intake, food efficiency, liver, abdominal fat, white adipose tissue	TC, TG, HDL, LDL, GOT, GPT, leptin, adiponectin	Liver, white adipose tissue	○
5 <sup>14)</sup>	Body, food intake, liver, adipose tissue	AST, ALT, TC, TG, HDL, LDL, glucose, adiponectin, leptin, AI	Liver, adipose tissue	-
6 <sup>15)</sup>	Body, food intake, food efficiency, liver	Glucose, OGTT, insulin, TC, TG, LDL, HDL, GOT, GPT	Liver, pancreas, skeletal muscle, epididymal tissue	-
7 <sup>16)</sup>	Body, epididymal fat, liver	Glucose, insulin, HOMA-IR, OGTT	ATM, CD45+, ratio of ATM/CD45+	○
8 <sup>17)</sup>	Body, food intake, food efficiency, epididymal adipose tissue	Leptin	Epididymal adipose tissue, liver	○
9 <sup>18)</sup>	Body, liver, (perirenal, gonadal, mesenteric) adipose tissue	-	-	-
10 <sup>19)</sup>	Body, adipose tissue, FER	Leptin, adiponectin, TG, free fatty acid, glucose, insulin	Liver, inguinal adipocyte, epididymal adipocyte	-
11 <sup>20)</sup>	Body	TC, HDL, LDL, TG	-	-
12 <sup>21)</sup>	Body, liver, abdominal fat	TC, TG, HDL, LDL, glucose, GOT, GPT	-	-
13 <sup>22)</sup>	Body	TC, HDL, LDL, TG, fructosamine, glucose	-	-
14 <sup>23)</sup>	Body, food efficiency, white adipose tissue, liver	TC, HDL, LDL, TG, leptin, adiponectin, GOT, GPT	Fat mass, liver	○
15 <sup>24)</sup>	Body, food intake, epididymal adipose tissue	AST, ALT, T-BIL, BUN, RBC, Hb, HCT, TC, HDL, LDL, TG, leptin	Liver	-
16 <sup>25)</sup>	-	TC, HDL, LDL, TG, TBARS, GOT, GPT, IL-1 $\beta$ , IL-6, TNF- $\alpha$ , IL-10, NO	Liver	○
17 <sup>26)</sup>	Body, FER, (mesenteric, epididymal, retroperitoneal, inguinal, brown) adipose tissue	TG, glucose, free fatty acid, insulin, leptin, adiponectin	(Inguinal, epididymal) adipose tissue, liver	-
18 <sup>27)</sup>	Body, (mesenteric, epididymal, retroperitoneal, inguinal, brown) adipose tissue, FER	leptin, adiponectin, free fatty acid, TG, insulin, glucose	(Inguinal, epididymal) adipose tissue, liver	-
19 <sup>28)</sup>	Body	TC, TG, HDL	-	○
20 <sup>29)</sup>	Body, food intake, FER, liver, visceral adipose	AST, ALT, BUN, creatinine, TC, HDL, LDL, TG, glucose	Liver, epididymal adipose tissue	-
21 <sup>30)</sup>	Body, food and water uptake	TC, HDL, LDL, TG, glucose, AST, ALT	Liver	○
22 <sup>31)</sup>	Body	TC	-	○
23 <sup>32)</sup>	Body, food intake, FER, liver, pancreas, thymus, spleen, testis, kidney, abdominal fat	TG, TC, LDL, HDL, CRF, AI, insulin, leptin, ALT, AST, LDH, SOD, LPO	Liver, (epididymal, perirenal) adipose tissue	-

Table V. Continued

No.	Measuring Indicators			
	Macroscopy	Hematological analysis	Histological analysis	Gene analysis
24 <sup>33)</sup>	Body, (epididymal, retroperitoneal, inguinal, brown) adipose tissue, FER, liver	Leptin, AST, ALT, TC, HDL, LDL, free fatty acid, TG, glucose, insulin	Liver, epididymal white adipose tissue	-
25 <sup>34)</sup>	-	free fatty acid, TG, TC, HDL, LDL, TBARS, GOT, GPT, cytokines, NO, ceruloplasmin, $\alpha$ 1-acid glycoprotein	Liver	○
26 <sup>35)</sup>	Body, FER, blood pressure, liver, abdominal subcutaneous fat	TC, TG, HDL, LDL, AST, ALT, creatinine	-	-
27 <sup>36)</sup>	Body, FER, liver, abdominal subcutaneous fat	TC, TG, HDL, LDL, AST, ALT, creatinine	-	-
28 <sup>37)</sup>	Body, food consumption	leptin, adiponectin, glucose, insulin	Pancreatic islet	-
29 <sup>38)</sup>	Body	TC, HDL, LDL, TG	-	-
30 <sup>39)</sup>	Body, epididymal fat, brown fat, liver fat	TC, HDL, LDL, TG, BUN, creatin, glucose	-	-
31 <sup>40)</sup>	Body	TC, HDL, glucose	-	-
32 <sup>41)</sup>	Food intake, body, liver, total fat	AST, ALT, TC, TG, HDL, LDL, HDL/LDL ratio, adiponectin	Fat tissue	○
33 <sup>42)</sup>	Body	glucose, OGTT, TC, HDL, LDL, TG, leptin	Liver, epididymal fat pad, ATM	-
34 <sup>43)</sup>	-	free fatty acid, TG, TC, LDL, HDL, TBARS, AST, ALT	Liver	○
35 <sup>44)</sup>	Body, adipose tissue, FER	AST, ALT, TC, HDL, LDL, free fatty acid, TG, glucose, insulin	Liver, epididymal white adipose tissue	-
36 <sup>45)</sup>	Body, liver, adipose tissue	TG, TC, HDL, glucose	Fat tissue	-
37 <sup>46)</sup>	Body, liver	-	Liver, epididymal fat pad, pancreas	-
38 <sup>47)</sup>	Body, liver, kidney, adipose tissue	AST, ALT, $\gamma$ -GTP, BUN, TC, HDL, LDL, TG, insulin, leptin	-	-
39 <sup>48)</sup>	Body	glucose, OGTT, TC, HDL, fructosamine, LDL, TG, adipokines	Epididymal fat pad, liver, epididymal adipocyte	-
40 <sup>49)</sup>	Body, liver, fat	glucose, fructosamine, TC, TG, LDL, HDL, leptin	ATM	-
41 <sup>50)</sup>	Body, fat, liver	glucose, OGTT, TC, HDL, LDL, TC, fructosamine, leptin	White adipocyte, ATM	-
42 <sup>51)</sup>	Body, food intake, FER	TC, HDL, LDL, TG, free fatty acid, TNF- $\alpha$ , IL-1 $\beta$ , IL-6	-	-
43 <sup>52)</sup>	Body	TG, TC, LDL, HDL, total lipid, phospholipid, AST, ALT, BUN, creatinine	Liver	-
44 <sup>53)</sup>	Body, food intake, FER, adipose tissue	TC, TG, HDL, LDL	Hypothalamus	-
45 <sup>54)</sup>	Body	-	-	○
46 <sup>55)</sup>	Body	-	Gastric, pancreas, diencephalon, mesencephalon	-
47 <sup>56)</sup>	Body, liver	AST, ALT	Liver, epididymal fat pad, pancreas	-
48 <sup>57)</sup>	Body, (epididymal, retroperitoneal, inguinal, brown) adipose tissue, FER	Leptin, AST, ALT, HDL, LDL, TG, free fatty acid	Liver, (epididymal, inguinal) white adipose tissue	-

**Table V.** Continued

No.	Measuring Indicators			
	Macroscopy	Hematological analysis	Histological analysis	Gene analysis
49 <sup>58)</sup>	Body, food intake, FER	TC, HDL, LDL, TG, free fatty acid, TNF- $\alpha$ , IL-1 $\beta$ , IL-6	-	-
50 <sup>59)</sup>	Body	-	Gastric, pancreas, diencephalon, mesencephalon	-
51 <sup>60)</sup>	-	TC, TG, LDL, HDL, free fatty acid, TBARS, AST, ALT, cytokines	Liver	○
52 <sup>61)</sup>	Body, food intake	ALT, AST, glucose, creatinine, TC, TG, HDL, LDL, leptin	Adipocyte, liver	-
53 <sup>62)</sup>	Body, FER, (epididymal, retroperitoneal, inguinal, brown) adipose tissue, liver, heart, spleen, kidney, pancreas	AST, ALT, TG, TC, HDL, LDL, free fatty acid, glucose, insulin, BUN, leptin, creatinine	Liver, epididymal white adipose tissue	○
54 <sup>63)</sup>	Body, liver, epididymal fat pad	glucose, OGTT, fructosamine, TG, TC, LDL, HDL, TC/HDL ratio, TG/HDL ratio	White adipose tissue	-
55 <sup>64)</sup>	Body, liver, epididymal fat pad	glucose, OGTT, TC, HDL, LDL, TG, fructosamine	White adipocyte	-
56 <sup>65)</sup>	Body	total cholesterol, LDL, HDL, TG, total lipid, phospholipid, insulin, leptin	-	-
57 <sup>66)</sup>	Body, liver, kidney, spleen, food intake, water intake, perirenal fat, epididymal fat, visceral fat	AST, ALT, glucose, TC, HDL, LDL, TG, leptin	Liver	-
58 <sup>67)</sup>	Body, FER, (epididymal, retroperitoneal, inguinal, brown) adipose tissue, liver, heart, spleen, kidney, pancreas	AST, ALT, HDL, LDL, TC, TG, free fatty acid, glucose, insulin, leptin	Epididymal white adipose tissue, liver	-
59 <sup>68)</sup>	-	-	-	○
60 <sup>69)</sup>	Body	Leptin, TC, HDL, LDL, TG	-	-
61 <sup>70)</sup>	Body, adipose tissue, FER	Leptin, AST, ALT, TC, HDL, LDL, free fatty acid, TG, glucose, insulin	Epididymal white adipose tissue, liver	-
62 <sup>71)</sup>	Body, liver, adipocyte tissue	Glucose, TC, TG, LDL, HDL, leptin	-	○
63 <sup>72)</sup>	Body, adipose tissue, FER	Leptin, AST, ALT, TC, HDL, LDL, free fatty acid, TG, glucose, insulin	Epididymal white adipose tissue, liver	-
64 <sup>73)</sup>	Body, FER, (epididymal, retroperitoneal, inguinal, brown) adipose tissue, liver, heart, spleen, kidney, pancreas	TG, HDL, LDL, TC, glucose, insulin, leptin, AST, ALT, free fatty acid, BUN, creatinine	Liver, epididymal white adipose tissue	-
65 <sup>74)</sup>	Body, liver, adipocyte tissue	Glucose, TC, LDL, HDL, TG, leptin	Adipose tissue, liver	○
66 <sup>75)</sup>	Body, mesenteric fat, retroperitoneal fat, caloric intakes, indirect calorimetry	Leptin, glucose, insulin, HOMA-IR, OGTT, TC, LDL, HDL, TG	Liver	-
67 <sup>76)</sup>	Body	Glucose, TC, TG,	Liver	○
68 <sup>77)</sup>	Body, FER, rectal temperature	GOT, GPT, TG, TC, HDL, LDL, free fatty acid, glucose, insulin, leptin	Subcutaneous fat, visceral fat, total fat, epididymal white adipose tissue, liver	-

Table V. Continued

No.	Measuring Indicators			
	Macroscopy	Hematological analysis	Histological analysis	Gene analysis
69 <sup>78)</sup>	Body	TC, HDL, LDL, TG, free fatty acid, total lipid, phospholipid, WBC, RBC, Hb, platelet	-	-

OGTT: oral glucose tolerance test, TC: total cholesterol, TG: triglyceride, HDL: high density lipoprotein, AST: aspartate aminotransferase, ALT: alanin aminotransferase, LDL: low density lipoprotein, GOT: glutamic oxaloacetic transaminase, GPT: glutamic pyruvic transaminase, AI: atherogenic index, ATM: adipose tissue macrophage, FER: feeding efficiency ratio, T-BIL: total bilirubin, BUN: blood urea nitrogen, RBC: red blood cell, Hb: hemoglobin, HCT: hematocrit, TBARS: thiobarbituric acid reactive substance, NO: nitric oxide, CRF: cardiac risk factor, LDH: lactate dehydrogenase, SOD: superoxide dismutase, LPO: lipid peroxide,  $\gamma$ -GTP:  $\gamma$ -glutamyl transpeptidase, TNF: tumor necrosis factor, IL: interleukin.

관절염 등의 다양한 합병증을 유발시키는 요인이 되기 때문에 더욱 위험하게 인식되어지고 있다<sup>80)</sup>.

서양의학에서 일반적으로 비만치료에 사용되는 약물들은 부작용과 중독성이 밝혀져 장기간 사용이 불가하고, Food and Drug Administration에서 장기간 사용이 인정된 치료제인 Xenical (orlistat), Reductil (sibutramine) 등도 지방 축적을 억제하는 작용과 체중을 감소시키는 효과가 있으나 부작용으로 기름이 섞인 변, 복부팽만감, 질박성 대변, 두통, 변비, 구갈, 구역, 현기증 및 불면증 등이 보고되고 있다<sup>81,82)</sup>. 이 때문에 장기간 복용하여도 부작용이 없이 비만을 치료하거나 합병증을 개선시킬 수 있으며 더 나아가 비만을 예방할 수 있는 안전한 한약제제의 개발이 필요하며, 이에 부응하여 많은 연구 및 노력이 이루어지고 있다.

이에 저자는 비만에 대한 최신 동물실험 경향을 파악하고 향후의 연구 및 임상에서의 활용에 도움이 되고자 2010년 이후 국내에서 발표된 비만 관련 동물모델에 한약제제를 경구투여한 실험연구 논문들을 고찰하였다.

본 연구는 비만에 치료효과가 예상되는 약물들을 탐색하여 그 효능을 관찰한 논문들을 분석하였다. 동물을 대상으로 하여 천연물 및 한약재의 성분을 중재로 삼고 항비만에 적절한 평가도구를 사용한 논문 69편을 선정하고 연도별 및 학술지별로 분류하였으며, 실험동물, 중재내용, 평가법, 측정지표 및 유의한 결과를 분석하였다.

연도별로는 2010년부터 2016년까지 비만에 대한 실험연구가 꾸준히 이루어지고 있음을 알 수 있었으며 이는 현대사회에서 비만이 가지는 중요성에 맞추어 앞으로

지속적으로 이루어질 것으로 보인다.

학술지별 분류를 보면 한약제제를 이용한 실험연구이 니만큼 대한본초학회지 및 대한한의학 방제학회지에서 주로 많이 이루어지고 있었고, 한방재활학회지에서도 비만에 대한 연구가 많이 이루어지고 있었다.

동물모델에게 경구투여된 천연물질 및 한약재는 혼합제제를 이용한 논문이 56편으로 높은 비율을 차지했다. 중재약물로 쓰인 소재는 총 133가지였고, 가장 높은 빈도수를 보이는 약재는 총 29회 사용된 麻黃이었다.

한의학적으로 麻黃은 味辛性溫하고 發汗解表, 平喘止咳, 溫散寒邪의 효능을 가져 여러 병증에 응용할 수 있는 약재로, 肺氣를 開宣하여 發汗하고 水道를 通調케 하여 膀胱으로 利水하는 효능이 있지만<sup>83)</sup>, 최근 임상에서는 비만 치료의 목적에 자주 사용되고 있다. 마황의 주성분인 ephedrine, pseudoephedrine 등은 식욕을 감소시키고, 소장에서 콜레스테롤 흡수를 저해하며, 지방조직에서 에너지 소비를 증가(산소포화도를 높임)시켜 체지방분해를 가속화시킨다<sup>84)</sup>. 그러나 마황은 대표적인 偏性을 가진 약재로, 현재까지 麻黃의 사용과 그 용량에 대한 문제가 꾸준히 제기되고 있고, 이에 따라 한의사로 구성된 전문가 군에 의한 麻黃의 임상투약지침이 개발되었으며<sup>85,86)</sup>, 麻黃의 부작용을 억제하기 위한 연구가 지속되고 있다. 이에 따라 향후 麻黃의 사용에 있어 안전한 사용을 더욱 확고히 해야 할 것으로 생각된다.

다음으로 많이 사용된 약재는 총 20회 사용된 甘草였다. 甘草는 性平味甘하고 諸藥을 調和하는 효능이 있어 熱藥과 같이 사용하면 그 熱性을 緩和하고, 寒藥과 같이

**Table VI.** Summary of Significant Indicators

No.	Significant Indicators
1 <sup>10)</sup>	Body weight, total fat weight, liver weight, TG, HDL, AST, hepatic lipid accumulation, gene expression
2 <sup>11)</sup>	Body weight, gene expression
3 <sup>12)</sup>	Body weight, food intake, (periepididymal, perirenal) adipose tissue weight, adiponectin, leptin, insulin, TC, TG, HDL
4 <sup>13)</sup>	Body weight, food intake, food efficiency, liver weight, abdominal fat weight, white adipose tissue weight, TC, TG, HDL, LDL, GOT, GPT, leptin, adiponectin, hepatic content (total lipid, TG), gene expression
5 <sup>14)</sup>	Body weight, liver weight, adipose tissue weight, AST, ALT, TC, TG, AI, HDL, LDL, adiponectin, cell number of adipose tissue
6 <sup>15)</sup>	Body weight, food intake, liver weight, glucose, insulin, TC, HDL, GOT, GPT, size of epididymal adipocyte
7 <sup>16)</sup>	Glucose, OGTT, ATM, gene expression
8 <sup>17)</sup>	Body weight, food intake, food efficiency, adipose tissue weights, adipose tissue size, gene expression
9 <sup>18)</sup>	Body weight, weights of liver and adipose tissue
10 <sup>19)</sup>	Body weight, adipose tissue weights, FER, leptin, TG, glucose, insulin, hepatic lipid accumulation, number and size of (inguinal, epididymal) adipocytes
11 <sup>20)</sup>	Body weight, HDL, LDL
12 <sup>21)</sup>	Body weight, liver and abdominal fat weight, total cholesterol, TG, HDL, LDL, glucose, GOT, GPT
13 <sup>22)</sup>	Body weight, glucose, total cholesterol, LDL
14 <sup>23)</sup>	Body weight, food efficiency, white adipose tissue and liver weight, TG, total cholesterol, LDL, leptin, adiponectin, fat volume, hepatic lipid accumulation, hepatic content (total lipid, TG, total cholesterol), gene expression
15 <sup>24)</sup>	Body weight, food intake, epididymal adipose tissue weight, AST, ALT, TG, total cholesterol, LDL, HDL, leptin, liver tissue
16 <sup>25)</sup>	Free fatty acid, TG, total cholesterol, LDL, HDL, TBARS, IL-1 $\beta$ , IL-6, TNF- $\alpha$ , IL-10, NO, liver content (total cholesterol, TG, TBARS, GSH-Px, SOD, CAT), gene expression
17 <sup>26)</sup>	Body weight, adipose tissue weights, FER, leptin, TG, glucose, insulin, cell number and size of (inguinal, epididymal) adipose tissue, liver fibrosis
18 <sup>27)</sup>	Body weight, adipose tissue weights, FER, TG, glucose, cell number and size of (inguinal, epididymal) adipose tissue, liver fibrosis
19 <sup>28)</sup>	Body weight, total cholesterol, TG, HDL, gene expression
20 <sup>29)</sup>	Body weight, FER, liver weight, total cholesterol, LDL, HDL, glucose, ALT, creatinine, visceral adipose, liver tissue, epididymal adipose tissue
21 <sup>30)</sup>	Total cholesterol, glucose, gene expression
22 <sup>31)</sup>	Body weight, total cholesterol, gene expression
23 <sup>32)</sup>	Body weight, food intake, FER, liver weight, abdominal fat weight, epididymal and perirenal adipose tissue weight, total cholesterol, LDL, TG, CRF, AI, insulin, leptin, ALT, LDH, LPO, liver tissue (total lipid, TG), epididymal adipose tissue (total lipid, TG)
24 <sup>33)</sup>	Body weight, adipose tissue weight, liver weight, FER, ALT, HDL, LDL, TG, glucose, epididymal adipose tissue (size, number), hepatic lipid accumulation
25 <sup>34)</sup>	Free fatty acid, total cholesterol, HDL, LDL, TG, TBARS, GPT, IL-6, TNF- $\alpha$ , NO, ceruloplasmin, $\alpha$ 1-acid glycoprotein, liver content (total cholesterol, TG, TBARS, GSH-Px, SOD, CAT, gene expression)
26 <sup>35)</sup>	Body weight, FER, blood pressure, liver and fat weight, TG, LDL, AST, ALT
27 <sup>36)</sup>	Body weight, FER, fat and liver weight, TG, HDL, ALT
28 <sup>37)</sup>	Body weight, food consumption, leptin, adiponectin, glucose, insulin, pancreatic islet
29 <sup>38)</sup>	Body weight, LDL
30 <sup>39)</sup>	Body weight, epididymal fat weight, total cholesterol, LDL, HDL, TG, glucose, BUN
31 <sup>40)</sup>	Body weight, total cholesterol, glucose
32 <sup>41)</sup>	Body weight, liver weight, total fat relative weight, AST, ALT, TG, total cholesterol, HDL, LDL, HDL/LDL ratio, adiponectin, adipocyte number and size, gene expression
33 <sup>42)</sup>	Body weight, fat weight, glucose, OGTT, fructosamine, ATM
34 <sup>43)</sup>	Free fatty acid, TG, total cholesterol, LDL, HDL, TBARS, IL-1 $\beta$ , IL-6, TNF- $\alpha$ , IL-10, liver content (total cholesterol, TG, TBARS, GSH-Px, SOD, CAT, IL-6, IL-10), gene expression
35 <sup>44)</sup>	Body weight, adipose tissue weight, FER, leptin, ALT, total cholesterol, LDL, free fatty acid, TG, glucose, epididymal adipocytes (number and size), hepatic lipid accumulation
36 <sup>45)</sup>	Body weight, adipose tissue weight, TG, HDL, total cholesterol, AMPK phosphorylation in fat tissue
37 <sup>46)</sup>	Body weight, liver weight, liver tissue (fatty changed region, diameters of hepatocytes), diameters of adipocytes, epididymal fat pad (size), pancreas tissue (zymogen granule)

**Table VI.** Continued

No.	Significant Indicators
38 <sup>47)</sup>	Body weight, liver, kidney and adipose tissue weights, ALT, AST, $\gamma$ -GTP, BUN, total cholesterol, TG, LDL, HDL, leptin, liver content (AST, ALT, $\gamma$ -GTP, BUN, total cholesterol, LDL, TG, HDL)
39 <sup>48)</sup>	Epididymal fat pad weight, OGTT, fructosamine, HDL, adiponectin, leptin, epididymal adipocyte size
40 <sup>49)</sup>	Body weight, fat weight, OGTT, fructosamine, TG, ATM
41 <sup>50)</sup>	Fat weight, OGTT, fructosamine, LDL, TG, white adipocyte size, ATM
42 <sup>51)</sup>	Body weight, food intake, total cholesterol, LDL, free fatty acid, IL-1 $\beta$
43 <sup>52)</sup>	TG, hepatic fat accumulation
44 <sup>53)</sup>	Body weight, food intake, weight of adipose tissue, total cholesterol, TG, HDL, LDL, hypothalamus content (pAMPK, ACC, PPAR $\gamma$ , PPAR $\alpha$ , NPY, LR)
45 <sup>54)</sup>	Body weight, gene expression
46 <sup>55)</sup>	Body weight, gastric and pancreas content (gastrin, CGRP, ghrelin, GLP-1 and insulin immunoreactive cells), diencephalon and mesencephalon content (orexin, leptin, serotonin and NPY immunoreactive cells)
47 <sup>56)</sup>	Body weight, ALT, liver tissue (fatty changed region, diameters of hepatocytes), diameters of adipocytes, epididymal fat pad (size), pancreas tissue (zymogen granule)
48 <sup>57)</sup>	Body weight, adipose tissue weight, leptin, HDL, LDL, TG, free fatty acid, size of white adipose tissues, hepatic lipid accumulation
49 <sup>58)</sup>	Body weight, food intake, total cholesterol, HDL, free fatty acid, IL-1 $\beta$
50 <sup>59)</sup>	Body weight, gastric and pancreas content (gastrin, CGRP, ghrelin, GLP-1 and insulin immunoreactive cells), diencephalon and mesencephalon content (orexin, leptin, serotonin and NPY immunoreactive cells)
51 <sup>60)</sup>	TG, total cholesterol, HDL, LDL, TBARS, IL-6, IL-10, TNF- $\alpha$ , liver content (TG, TBARS, GSH-Px, SOD, CAT), gene expression
52 <sup>61)</sup>	Body weight, total cholesterol, LDL, HDL, TG, glucose, leptin, adipocyte size, liver tissue (adipose vacuoles)
53 <sup>62)</sup>	Body weight, FER, adipose tissue weight, ALT, TG, total cholesterol, LDL, leptin, BUN, white adipose tissue (number and size), hepatic lipid accumulation, gene expression
54 <sup>63)</sup>	Glucose, OGTT, fructosamine, HDL, total cholesterol/HDL ratio, TG/HDL ratio, white adipose tissue size
55 <sup>64)</sup>	Body weight, epididymal fat pad weight, OGTT, fructosamine, HDL, total cholesterol/HDL ratio, TG/HDL ratio, white adipocyte size
56 <sup>65)</sup>	Body weight, HDL, total cholesterol/HDL ratio, leptin
57 <sup>66)</sup>	Body weight, visceral fat weight, AST, ALT, glucose, leptin, HMG-CoA reductase inhibitor, liver content (catalase, TBARS)
58 <sup>67)</sup>	Body weight, FER, adipose tissue weight, organ weight (liver, heart, spleen, kidney, pancreas), HDL, total cholesterol, TG, free fatty acid, glucose, insulin, leptin, white adipose tissue size, hepatic lipid accumulation
59 <sup>68)</sup>	Gene expression
60 <sup>69)</sup>	Body weight, leptin, total cholesterol, TG
61 <sup>70)</sup>	Body weight, adipose tissue weight, FER, leptin, TG, glucose, epididymal white adipose tissue (number and size), hepatic lipid accumulation
62 <sup>71)</sup>	Body weight, glucose, total cholesterol, TG, LDL, HDL, gene expression
63 <sup>72)</sup>	Body weight, adipose tissue weight, FER, leptin, ALT, total cholesterol, HDL, LDL, free fatty acid, TG, glucose, insulin, epididymal white adipose tissue (number and size), hepatic lipid accumulation
64 <sup>73)</sup>	Body weight, FER, adipose tissue weight, TG, ALT, free fatty acid, epididymal white adipose tissue (number and size), hepatic lipid accumulation
65 <sup>74)</sup>	Body weight, adipose tissue weight, glucose, LDL, HDL, TG, leptin, adipose tissue size, liver tissue (adipose vacuoles), gene expression
66 <sup>75)</sup>	Body weight, adipose tissue weight, indirect calorimetry, leptin, insulin, HOMAIR, total cholesterol, LDL, TG, liver tissue (TG)
67 <sup>76)</sup>	Glucose, total cholesterol, hepatic lipid accumulation, gene expression
68 <sup>77)</sup>	Body weight, FER, GOT, GPT, epididymal white adipose tissue (number and size), hepatic lipid accumulation
69 <sup>78)</sup>	Body weight, total cholesterol, HDL, TG, free fatty acid, phospholipid

GSH-Px: glutathione peroxidase, CAT: catalase, AMPK: AMP-activated protein kinase, ACC: acetyl-CoA carboxylase, NPY: neuropeptide Y, LR: leptin receptor, GLP: glucagon like peptide.

쓰면 그 寒性을 緩和하며, 補性을 급하게 이르지 않게 하고, 寫性을 급하게 이르지 않게 한다<sup>83)</sup>. 상기 언급하였듯이 동물모델에게 혼합제제를 투여한 논문이 높은 비율을 차지했고, 이에 따라 甘草가 많은 비율로 적용된 것이고, 실제 한의학적인 의미는 크게 없을 것으로 사료된다.

세번째로 많이 사용된 약제는 총 19회 사용된 大黃이었다. 大黃은 性寒味苦하고 沈降하며 力孟善行하여 下焦에 直達하므로 腸胃의 積滯를 蕩滌하고, 實熱을 清熱瀉火하는 血分의 효능을 도와 血로 들어가 降泄시키며, 또한 活血逐瘀의 효능이 있어 攻積, 瀉火, 逐瘀의 要藥이 된다<sup>83)</sup>. 이에 다용된 것이라 생각하고, 향후 임상에서의 적용에도 脾胃虛寒人을 제외한다면 肥滿人의 痰飲, 積滯를 해소하기 위한 목적으로 다용될 수 있을 것이라 본다.

실험평가를 위한 방법은 크게 육안적 관찰, 혈액학적 분석, 조직학적 분석 및 유전자분석으로 나눌 수 있었다. 육안적 관찰은 비만에 있어 실제 체중의 변화 및 식이섭취량, 지방 무게 등을 측정한다는 점에서 의의가 있으며, 혈액학적 분석은 실제 혈장 내 콜레스테롤 및 혈당, 인슐린 등을 측정하여 비만과 고지혈증 및 당뇨와의 연관성을 파악하는데 있어서 중요하다고 생각된다. 또한 한약제제의 부작용에 대해 안전성을 확보하기 위한 AST, ALT 등을 측정하는 것은 앞으로의 연구에 있어서도 필수적인 사항이라고 생각된다. 조직학적 분석의 경우 실제 장기 내의 지방 축적 정도 및 지방세포의 수와 크기를 파악하여 비만의 호전도를 파악할 수 있다는 면에서 의미가 있다고 보인다. 유전자 분석의 경우는 비만의 치료보다는 비만의 예방에 있어 그 가치가 큰 분야라고 생각되며, 유전자 분석을 사용한 실험연구들의 지표가 굉장히 다양하여 이를 다 파악할 순 없었으나, 향후 유전자 분석은 점점 더 큰 의미를 가지게 될 것으로 생각된다.

이상 2010년 이후 국내에서 발표된 비만 관련 동물모델에 한약제제를 경구투여한 실험연구 논문들을 고찰하였다. 비만은 서구화된 식이습관 및 영양의 풍족함, 신체활동의 부족으로 말미암아 현대인들에게 가장 중요한 문제로 대두되고 있다. 많은 사람들이 체중감량을 위해 식이요법과 운동을 병행하지만 실패를 거듭하게 되고, 이에 점점 더 강하고 자극적인 방법을 선택하게 되며 이로 인해 많은 부작용들도 수반되고 심리적으로도 불안감과 우울감을 갖게 된다. 더불어 비만은 다양한 합병증까지 동반하게 되는 무서운 질병이다. 이러한 필요성에 따라 현

재까지 다양한 신약들이 개발되고 있지만, 수반되는 부작용까지 막을 수는 없는 실정이다. 이에 저자는 비만을 보다 효과적으로 치료하면서 부작용은 나타나지 않는 안전하고 건강한 한약에 대한 연구가 지속적으로 필요하고, 실험을 통해 안전성을 입증하며, 이후 임상에서 적용해나가야 한다고 보았다. 이에 향후 비만에 관련된 실험연구 및 임상에서의 적용에 있어 최신의 경향성을 파악할 수 있고, 유용한 기초 자료가 될 수 있도록 69편의 논문을 고찰하였다. 추후 많은 연구 및 임상에서의 활용을 바란다.

## 결론»»»»

2010년 이후 국내에서 발표된 비만 관련 동물모델에 한약제제를 경구투여한 실험연구 논문 69편을 분석한 결과 다음과 같은 결론을 얻었다.

1. 2010년부터 2016년까지 꾸준히 실험연구 논문이 보고되었고, 학술지별로는 대한본초학회지 및 대한한의학방제학회지, 한방재활의학과학회지에서 대부분을 차지하였다.
2. 실험동물은 3~10주령의 C57bl/6 수컷 mouse가 많이 사용되었으며, 비만을 유발한 방법으로는 high fat diet가 많이 사용되었다.
3. 동물모델에게 경구투여된 천연물질 및 한약제는 혼합제제를 이용한 논문이 높은 비율을 차지했고, 중재약물로 쓰인 소재 중 가장 높은 빈도수를 보이는 약제는 麻黃이었다. 중재기간은 평균적으로 7~8주 정도였다.
4. 약물 효과의 평가방법으로는 육안적 관찰, 혈액학적 분석, 조직학적 분석, 유전자 분석이 사용되었다. 이 중 육안적 관찰과 혈액학적 분석, 조직학적 분석을 함께 사용한 논문이 가장 많았다. 육안적 관찰의 지표로는 body weight, food intake, feeding efficiency ratio (FER), liver weight 등이 측정되었고, 혈액학적으로는 glucose, insulin, TC, TG, HDL, LDL 등이 분석되었다. 조직학적으로는 epididymal adipocytes (number and size), hepatic lipid accumulation 등이 분석되었다.
5. 각각의 실험연구들은 항비만 효과에 있어서 유의성을 나타냈다.



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