

한국에서 비만 치료에 쓰이는 한약에 대한 연구 동향 보고: 2015년부터 2019년까지의 국내외 논문을 중심으로

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Research Trends of Herbal Medicines for Obesity: Mainly since 2015 to 2019

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RECEIVED September 8, 2020

ACCEPTED September 25, 2020

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Objectives This study has been conducted to verify frequently used herbs and herbal formulas to treat obesity in Korea during 2015 to 2019.

Methods Publications related to treatment of obesity using herbal medicines from 2015 to 2019 were retrieved from 12 databases (PubMed, EMBASE, Scopus, China National Knowledge Infrastructure [CNKI], Koreanstudies Information Service System [KISS], National Digital Science Library [NDSL], Research Information Sharing Service [RISS], DBPIA, KMBASE, KoreaMed, KoreanTK, Oriental Medicine Advanced Searching Integrated System [OASIS]). Extracted articles were analyzed in terms of publication year, journal, and type of herbs.

Results A total of 136 studies have been included in this study. 33 herbal formulae and 129 herbs have been analyzed. *Taeyejumjowui-tang* was the most frequently studied herbal formulae and *Ephedrae Herba* was the most frequently studied herb. *Ginseng Radix* was the most frequently studied single herb in isolation from herbal formulae.

Conclusions These results suggest that various herbs and herbal formulae can be used to treat obesity. Since this study includes every type of study, additional studies based on clinic are thought to be necessary. (*J Korean Med Rehabil* 2020;30(4):89-103)

Key words Obesity, Herbal medicine, Herbal, Weight loss

서론»»»»

비만은 체내에 지방조직이 과다하게 축적되어 있는 상태로 유전 및 환경적 요소 등 다양한 원인으로 발병하며 고혈압, 고지혈증, 제2형 당뇨병 등의 다양한 합병증을 수반하는 질환이다¹⁾. 비만의 전 세계적인 유병률은 1975년엔 1% 미만이었으나 2016년에는 6-8%로 지

난 40년간 지속적으로 증가하고 있다. 남성의 유병률은 같은 기간 내에 3%에서 11%로 증가했고, 여성은 6%에서 15%로 증가하였다²⁾.

비만의 양방 치료는 크게 생활 방식 치료, 약물적 치료, 수술로 나눌 수 있는데 신체적 활동, 인지 행동 치료, 식이 조절 등의 생활 방식 치료가 실패하게 될 경우 약물 혹은 수술적 치료도 고려해볼 수 있다³⁾. 하지만 1997

년 미국 식품의약국(Food and Drug Administration) 승인 후 널리 쓰였던 sibutramine (reductil)과 같이 심장마비나 뇌졸중의 위험을 높인다는 것이 밝혀진 후 2010년 판매 중단되는 경우와 같이 양약의 부작용이 많이 보고되는 시점에서 약물적 사용은 한계가 있을 수 있다⁴⁾. 수술과 관련된 합병증 또한 10%에서 17%의 발생 확률이 있으며 재수술의 비율은 7% 가량이다⁵⁾.

국내에서는 1997년 대한한방비만학회가 창립되고 2001년부터 한방비만학회지가 발간되는 등 비만에 대한 꾸준한 연구가 이루어지고 있으며, 지속적으로 비만과 관련한 연구가 진행되고 있는 추세이다. 한약에 관련된 기존 연구 중 2006년에 발표된 논문에서는 비만에 쓰이는 한약 및 본초의 빈도를 계산한 Hang 등⁶⁾의 연구가 있으며, 이후 이와 동일한 방식으로 진행된 연구는 없다. 한의학계 전체의 연구 동향을 분석하거나⁷⁾, 성인 비만의 한약 치료에 대한 체계적 고찰⁸⁾ 등 한약을 활용한 다양한 임상 시험과 실험 연구가 진행되고 있으나 최신 경향을 반영하여 분석한 연구는 부족한 것으로 생각되어 본 연구에서는 2015년부터 2019년까지 최근 5개년동안 한국에서 비만의 한약 치료에 대한 한의학에서의 연구 동향을 파악, 분석하고자 하였다.

연구대상 및 방법»»»

1. 검색 방법

2015년 1월 1일부터 2019년 12월 31일까지 발표된 논문을 대상으로 해외 문헌은 PubMed, EMBASE, Scopus, China National Knowledge Infrastructure, 국내 문헌은 한국학술정보(Koreanstudies Information Service System), 과학기술정보통합서비스(National Digital Science Library), 학술연구정보서비스(Research Information Sharing Service), DBPIA, KMBASE, KoreaMed, 한국전통저서포털(KoreanTK), 전통의학정보포털(Oriental Medicine Advanced Searching Integrated System)을 이용하여 검색하였다.

자료 수집을 위한 주요 검색어는 “(Herbal or Herb) AND (Obesity)”, “(Herbal or Herb) AND (Obese)”, “(Herbal or Herb) AND (Weight loss)”, “(Herbal or Herb) AND (Weight control)”, “(비만 OR 체중 감소 OR 체중 조절) AND (한

약 OR 본초)” 이었다⁸⁾.

2. 선정 기준 및 배제 기준

검색된 논문은 제목과 초록을 통해 1차로 확인하고, 이후 논문의 원문을 검토하여 다음의 기준을 충족시킬 때 포함하였다. (1) 국내/외 학회지에 발표된 국내에서 진행된 연구, (2) 2015년 1월 1일부터 2019년 12월 31일까지 발표된 연구, (3) 비만에 대하여 한약 치료를 시행하여 항비만 효과를 본 연구, (4) 대한민국약전 및 대한민국약전 외 한약 생약 규격집에 포함된 한약을 대상으로 한 연구, (5) 실험 논문, 임상 연구, 증례 보고가 포함되었다. 반면 다음의 기준에 해당될 경우 배제하였다. (1) 한약을 포함하지 않은 치료를 시행한 연구, (2) 한국에서 진행되지 않은 연구, (3) 대사증후군, 당뇨병 등의 비만 이외의 만성 대사 질환만 대상으로 한 연구, (4) 원문을 구할 수 없는 연구, (5) 논문 내에 처방 구성 약물이 정확하게 명시되지 않아 사용된 본초를 분석할 수 없는 연구, (6) 프로토콜 논문, 학위 논문 등의 회색 문헌은 제외하였다.

검색된 논문은 중복된 논문을 제외하고 총 2,004편이었으며, 논문 제목과 초록을 확인하여 비만치료와 관련성이 없는 경우와 대사증후군 및 당뇨병, 고지혈증 등 다른 질병을 가진 사람들을 대상으로 한 경우, 한약 치료를 포함하지 않은 경우, 국내에서 시행되지 않은 연구의 경우를 제외하여 230편의 논문이 선정되었다. 이후 원문을 확보하지 못하거나 본문을 확인하여 본 연구의 취지에 맞지 않는 경우 등 배제 기준에 해당하는 논문들을 제외하여 총 136편의 논문이 선정되었다(Fig. 1, Appendix I~V).

3. 연구 방법

임상연구논문, 실험논문, 증례 보고를 포함한 논문을 대상으로 하였으며 연구에서 사용된 한약을 위주로 분석하였다. 한약 치료와 함께 침 등 기타 치료법을 사용한 경우도 포함하였다. 사용된 복합 처방 및 본초의 빈도를 분석 시에는 한 연구에서 여러 처방이 사용된 것은 개별적으로 포함시켰으며, 단미의 형태로 사용된 경우와 복합 처방에 사용된 본초는 각각 개별적으로 분석하였다.

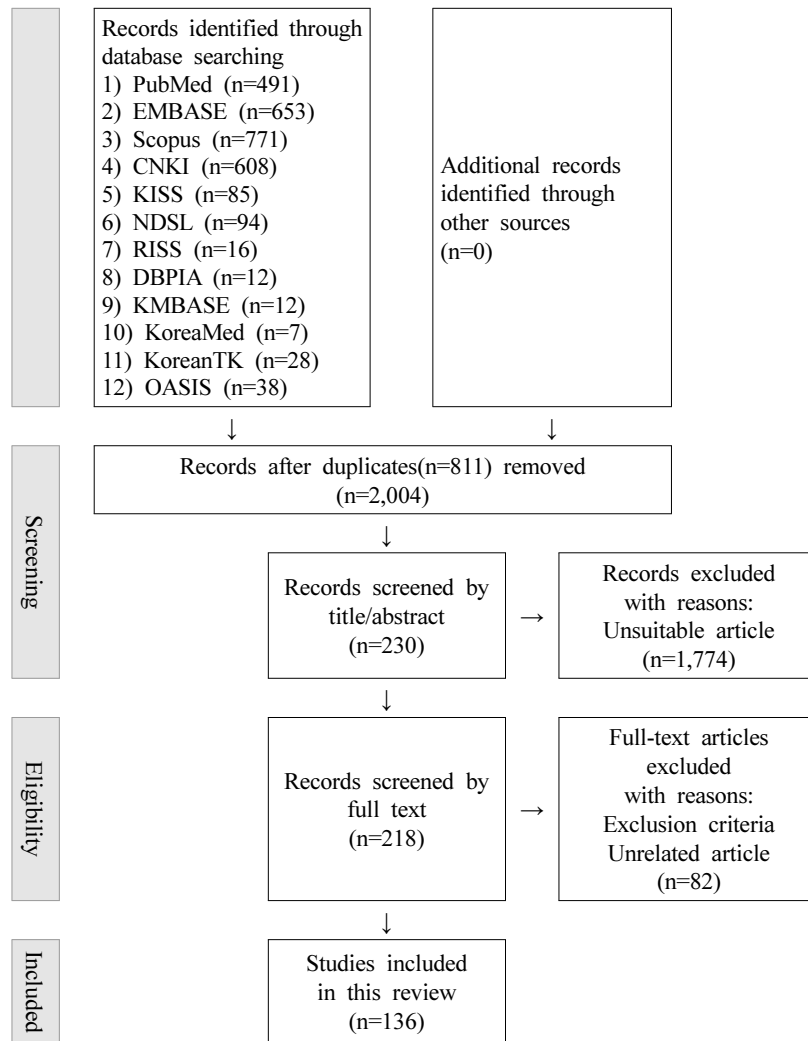


Fig. 1. Flow diagram of study screening. CNKI: China National Knowledge Infrastructure, KISS: Koreanstudies Information Service System, NDSL: National Digital Science Library, RISS: Research Information Sharing Service, OASIS: Oriental Medicine Advanced Searching Integrated System.

결과»»»»»

1. 연구에 포함된 처방과 본초

136편의 논문에서 총 33개의 처방과 129개의 본초가 포함되었다.

2. 연구에 포함된 처방과 본초의 빈도

1) 처방

가장 많이 사용된 처방은 태음조위탕이었으며, 방풍

통성산, 의이인탕, 양격산화탕은 그 다음으로 빈용된 처방이었다. 또한 통규활혈탕이나 서각지황탕 등 어혈을 해소하기 위한 처방들도 관찰되었으며, 변증의 중요성도 고려해볼 수 있었다(Table I).

2) 본초

가장 많이 사용된 본초는 마황이었으며, 그 뒤로 감초, 의이인, 인삼, 길경, 진피, 백출, 복령, 황금 등이 사용되었다(Table II).

Table I. Frequency of Herbal Formula

Frequency	Herbal formula
5	<i>Taeyeumjowui-tang</i>
3	<i>Bangpungtongsung-san, Yanggyeoksanhwa-tang</i>
2	<i>Euiiin-tang, Gangji-hwan, Tongyuhwalhyeol-tang</i>
1	<i>Gyejibokryeong-hwan, Gambi-tang, Yeonggyechulgam-tang, Haewoolhwajoong-tang, Samryongbakchul-san, Gambi-hwan, Samchulkunbi-tang, Daecheongryong-tang, Hwangryunhaedok-tang, Yeoldahanso-tang, Hwanggimacmundong-tang, Tongbi-san, Oyaksunki-san, Seungyangjeseup-tang, Gamche-tang, Sosiho-tang, Doirseungui-tang, Ojeok-san, Cheongpesagan-tang, Yukmijihwang-tang, Galgeun-tang, Seogagjihwang-tang, Dohongsamul-tang, Banhasasim-tang, Hyangsayangyi-tang, Banggihwanggi-tang, Samsoeum</i>

Table II. Frequency of Single Herb

Frequency	Herb (n)
Above 20	<i>Ephedrae Herba</i> (28), <i>Glycyrrhizae Radix</i> (25)
Above 15	<i>Coicis Semen</i> (18), <i>Ginseng Radix</i> (17), <i>Aurantii Nobilis Pericarpium</i> (17), <i>Platycodi Radix</i> (16), <i>Poria Cocos</i> (16), <i>Atractylodis Macrocephalae Rhizoma</i> (16)
Above 10	<i>Scutellariae Radix</i> (15), <i>Liriopsis Tuber</i> (11), <i>Gypsum Fibrosum</i> (11)
Above 5	<i>Rhei Radix et Rhizoma</i> (10), <i>Paeoniae Radix Rubra</i> (10), <i>Cnidii Rhizoma</i> (10), <i>Angelicae gigantis Radix</i> (9), <i>Gardeniae Fructus</i> (9), <i>Alismatis Rhizoma</i> (9), <i>Menthae Herba</i> (8), <i>Rehmanniae Radix Preparata</i> (8), <i>Curcumae Radix</i> (8), <i>Puerariae Radix</i> (7), <i>Cinnamomi Ramulus</i> (7), <i>Persicae Semen</i> (7), <i>Ledebouriellae Radix</i> (7), <i>Acori Graminei Rhizoma</i> (7), <i>Allii Fistulosi Bulbus</i> (7), <i>Astragali Radix</i> (7), <i>Rehmanniae Radix</i> (7), <i>Crataegi Fructus</i> (6), <i>Forsythiae Fructus</i> (6), <i>Schizandrae Fructus</i> (6), <i>Schizonepetae Herba</i> (6), <i>Coptidis Rhizoma</i> (6), <i>Magnoliae Cortex</i> (6)
5	<i>Zingiberis Rhizoma, Castaneae Semen, Raphani Semen, Hordei Fructus Germinatus, Moutan Cortex Radicis, Pinelliae Rhizoma, Aurantii Immaturus Fructus, Atractylodis Rhizoma, Bupleuri Radix</i>
4	<i>Artemisiae Capillaris Herba, Paeoniae Radix Alba, Dioscoreae Rhizoma, Massa Medicata Fermentata, Lonicerae Caulis, Cyperi Rhizoma, Carthami Flos, Eriobotryae Folium, Amomi Fructus</i>
3	<i>Aconiti Tuber, Cimicifugae Rhizoma, Polygoni Multiflori Radix, Angelicae Tenuissimae Radix, Natrii Sulfas, Angelicae Dahuricae Radix, Corni Fructus, Zizyphi Spinosa Semen, Nelumbinis Semen, Polygalae Radix, Anemarrhenae Rhizoma, Armeniacae Amarum Semen, Talcum</i>
2	<i>Lycii Fructus, Radix Salviae Miltiorrhizae, Polygoni Multiflori Radix, Dolichoris Semen, Mori Folium, Viola Herba, Laminariae Thallus, Stephaniae Tetrandrae Radix, Arecae Semen, Moschus, Saururi Herba seu Rhizoma, Perillae Herba, Houttuyniae Herba, Longanae Arillus, Cinnamomi Cortex, Lithospermi Radix, Peucedani Radix, Aurantii Immaturus Fructus, Asparagi Radix</i>
1	<i>Euphorbiae Kansui Radix, Osterici Radix, Rhizoma Curcumae Longae, Drynariae Rhizoma, Melonis Calyx, Agastachis Herba, Rosae Laevigatae Fructus, Lonicerae Flos, Thea sinensis, Glycine Semen Preparatum, Arecae Pericarpium, Aucklandiae Radix, Myrrha, Bombycis Batryticatus, Amomi Rotundus Fructus, Tokoro Rhizoma, Mori Cortex Radicis, Mori Ramulus, Rhinocerotis Cornu, Inulae Flos, Tritici Levis Semen, Veratri Nigri Rhizoma et Radix, Rosae Multiflorae Fructus, Evodiae Fructus, Linderae Radix, Gentianae Scabrae Radix, Agrimoniae Herba, Achyranthis Radix, Leonuri Herba, Perillae Semen, Polyporus, Phaseoli Angularis Semen, Caryophylli Flos, Gleditsiae Spina, Phyllostachyos Folium, Sanguisorbae Radix, Plantaginis Semen, Citri Reticulatae Viride Pericarpium, Artemisiae Annuae Herba, Amomi Tsaoko Fructus, Typhae Pollen, Trigonellae Semen, Polygoni cuspidati Radix, Phellodendri Cortex, Foeniculi Fructus</i>

3. 처방과 별개로 연구된 본초의 빈도

처방 내 구성 약물을 제외하고 단미로만 가장 많이 연구된 본초는 인삼이었으며, 울금, 마황, 의이인, 숙지황, 비파엽, 황금도 순이었다(Table III).

4. 연도별 분포

비만 치료에 사용한 한약에 대한 연구는 최근 5년간 지속적으로 보고되었으나 최근에는 조금씩 감소하는 경향이 있었다(Fig. 2).

논문이 가장 많았다는 결론이 있었다. 2016년에는 성인 비만의 한약치료 임상연구에 대한 논문⁸⁾이 있었는데, 13편의 무작위 대조군 임상연구를 고찰한 결과 한약을 사용한 비만치료가 위약에 비해서 체중감량 및 체질량지수, 복부둘레 등 비만관련 지표 개선에 효과가 있다는 결론을 얻었으며 특히 태음조위탕과 방풍통성산이 효과적인 것으로 나타나 본 연구의 결과와 유사한 경향이 확인되었다.

사상의학 관점에서 태음인은 상대적으로 다른 체질에 비하여 체격이 크고 기육이 풍부한 편으로 呼散之氣는 부족하고 吸聚之氣는 크다. 기존 연구에서 비만의 형태학적 특징이 이러한 사상의학에서 태음인의 체질적 특성과 유사한 점이 있어 태음인 처방이 많이 활용되고 있다. 실제로 태음인과 비만과의 연관성을 다룬 다양한 연구가 있으며 비만 인구 중 태음인이 많은 비율을 차지한다는 연구와¹⁰⁾, 임상적으로 비만인의 약 70%가 태음인이라는 연구 결과¹¹⁾도 존재했다. 이에 따라 2006년 선행된 기존 연구에서도 태음인 처방이 가장 많이 쓰이고 있었으며, 그 중에서도 태음조위탕을 가장 많이 사용하였다. 2019년 진행된 태음인 비만에 대한 임상 연구 동향을 분석한 선행 연구에서도 전체 분석 연구 14편 중 태음조위탕이 7편으로 가장 많이 사용한다는 결과¹²⁾가 있었다. 이러한 흐름을 참고하여 최근 항비만에 사용되는 한약 치료 경향에서 어떠한 변화가 있는지 분석해본 결과, 마찬가지로 태음조위탕이 가장 다빈용 처방이었다. 이는 태음조위탕의 약물 구성이 타 처방에 비해 薏苡仁, 蘿菴子, 馬黃을 위주로 祛痰, 祛濕 및 消食의 작용이 강해 체내의 불필요한 濕濁을 제거하는 효과가 뛰어나기 때문으로 생각된다¹³⁾. 최근 연구들에서도 단순한 체중 감량보다는 근본적인 치료를 추구하는 방향으로 연구 방향이 바뀌며 식욕억제와 관련된 신경조절전달물질의 신호전달체계 기전에 대한 연구가 많이 이루어지고 있어¹⁴⁾, 태음조위탕은 이전부터 최근까지 꾸준히 비만 연구에 있어 우선적으로 고려되는 처방이라고 볼 수 있다.

한약을 통한 비만 치료에서 마황이 전통적으로 가장 많이 사용되고 연구된 약제이다. 마황의 항비만 효과의 핵심 성분으로는 ephedrine-type alkaloids로 교감신경계 흥분 작용이 있어 식욕을 억제하고, 콜레스테롤 흡수를 저해하며, 지방조직에서 에너지 소비를 증가시켜 체지

방 분해를 가속화시킨다¹⁵⁾. 2006년 발표된 선행 연구에서도 처방과 별개로 단일 약제로 비만 치료에 가장 많이 쓰이는 약제였으나, 본 연구에서는 전체 형태에서 마황이 가장 다빈도로 사용되지만 처방에 속하지 않은 단미의 형태로는 인삼이나 울금이 더 많이 연구된 것을 알 수 있었다¹⁶⁾. 항비만 효과에 대한 연구는 이미 많이 입증되었으며, 마황 및 ephedrine의 안전성과 부작용에 관련한 연구 또한 많이 진행되고 있다. 가장 빈번하게 언급되는 ephedrine 부작용인 심혈관계 부작용의 경우에도 유의미한 결과가 도출된 바 없으며, 건강인이 적정량의 마황 및 ephedrine을 복용하는 것은 비교적 안전성이 확보되었으나 개개인의 특성을 면밀히 확인하여 처방하여야 한다는 것과 2, 3일 및 2주 정도 시점이 이상반응의 발현과 약화에 중요한 시기이므로 임상 치료 시에 고려되어야 한다는 고찰을 한 2017년 Jo 등의 연구가 있었으므로 비만 치료 시에도 반드시 참고하여 처방하여야 할 것이다¹⁷⁾.

인삼은 한의학에서 전통적으로 元氣가 손상된 것을 치료한다¹⁸⁾고 알려져 왔으며, 암¹⁹⁾, 뇌졸중²⁰⁾ 등의 질환에 대하여 치료 효과가 있을 뿐 아니라 항비만 효과도 꾸준히 연구²¹⁾되어 온 본초이다. 인삼의 항비만 기전은 인삼의 주요 생리활성 성분인 ginsenosides에 있으며, 체장의 리파아제 활성을 억제함으로써 지방의 장내 흡수를 감소하고²²⁾, 지방과 단백질의 소화를 자극하는 위장관계의 펩티드 호르몬인 콜레시스토키닌의 시상하부에서의 발현을 억제하는²³⁾ 등의 효과가 알려져 있다. 2016년에 발표된 Shon과 Kim의 연구²⁴⁾에서는 인삼의 다당체가 지방분해를 개시하고 유도하는 전사인자들의 발현을 억제시켜 adipogenesis를 억제한다는 것을 확인하여 인삼의 항비만 효과의 기전을 제시하였다. 또한 2018년의 Park 등의 연구에서는 인삼이 triglyceride, total cholesterol, low density cholesterol 농도는 감소시켰으나 high density cholesterol 농도는 증가시키는 효과도 보고되었다²⁵⁾. 이렇게 지속적으로 인삼의 항비만 효과는 연구되어 왔으며, 본 연구에서도 처방의 형태가 아닌 단미의 형태로 가장 많이 연구된 것을 보고하였으나 최근 발표된 연구들은 대부분 동물이나 세포 실험 연구로 사람 대상의 임상 실험이 많이 진행되어야 임상에서도 활용할 수 있으므로 비만 치료 시에 참고해야 할 것이다.

본 연구에서의 빈용 본초 중 마황, 인삼 등 기타 본초

적으로 필요하다.

4. 비만 치료에 사용되는 한약에 대한 연구는 최근 5년간 지속적으로 보고되고 있고 조금씩 감소하는 경향이 있으나 유의미한 수치는 아닌 것으로 보인다.
5. 비만 치료에 한약을 사용한 논문은 국내에서는 한방 비만학회지, 해외에서는 Evidence-based Complementary and Alternative Medicine에 가장 많이 발표되었다.

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Appendix I. List of Studies - 2015

Title of study	Journal
Anti-adipogenic effect of <i>Artemisia annua</i> in diet-induced-obesity mice model	Journal of Veterinary Science
Insulin sensitivity improvement of fermented Korean red ginseng (<i>Panax ginseng</i>) mediated by insulin resistance hallmarks in old-aged ob/ob mice	Journal of Ginseng Research
Coix seed extract attenuates the high-fat induced mouse obesity via PPAR γ and C/EBP α a downregulation	Molecular and Cellular Toxicology
Effects of <i>Rosa multiflora</i> and <i>Rosa multiflora</i> complex on lipid content in rats fed a high-fat · high-cholesterol diet	Journal of the Korean Society of Food Science and Nutrition
<i>Dioscorea batatas</i> extract attenuates high-fat diet-induced obesity in mice by decreasing expression of inflammatory cytokines	Medical Science Monitor
Synergistic effects of <i>Artemisia iwayomogi</i> and <i>Curcuma longa</i> radix on high-fat diet-induced hyperlipidemia in a mouse model	Journal of Ethnopharmacology
<i>Rehmannia glutinosa</i> reduced waist circumferences of Korean obese women possibly through modulation of gut microbiota	Food and Function
Anti-obesity effect of <i>Triticum aestivum</i> sprout extract in high-fat-diet-induced obese mice	Bioscience, Biotechnology and Biochemistry
Traditional Korean herbal formula samsoeum attenuates adipogenesis by regulating the phosphorylation of ERK1/2 in 3T3-L1 cells	Evidence-based Complementary and Alternative Medicine
Traditional medicine yanggyuksanhwa-tang inhibits adipogenesis and suppresses proliferator-activated receptor gamma expression in 3T3-L1 cells	Pharmacognosy Magazine
Fennel (<i>Foeniculum vulgare</i>) and Fenugreek (<i>Trigonella foenum-graecum</i>) tea drinking suppresses subjective short-term appetite in overweight women	Clinical Nutrition Research
High hydrostatic pressure extract of red ginseng attenuates inflammation in rats with high-fat diet induced obesity	Preventive Nutrition and Food Science
<i>Mori folium</i> and <i>Mori Fructus</i> mixture attenuates high-fat diet-induced cognitive deficits in mice	Evidence-based Complementary and Alternative Medicine
<i>Platycodon grandiflorum</i> A. de candolle ethanolic extract inhibits adipogenic regulators in 3T3-L1 cells and induces mitochondrial biogenesis in primary brown preadipocytes	Journal of Agricultural and Food Chemistry
Administration of Hwang-Ryun-Haedok-tang, a herbal complex, for patients with abdominal obesity: A case series	Explore: The Journal of Science and Healing
The herbal medicine KBH-1 inhibits fat accumulation in 3T3-L1 adipocytes and reduces high fat diet-induced obesity through regulation of the AMPK pathway	PLoS ONE
ACE reduces metabolic abnormalities in a high-fat diet mouse model	Evidence-based Complementary and Alternative Medicine
A herbal formula HT048, <i>Citrus unshiu</i> and <i>Crataegus pinnatifida</i> , prevents obesity by inhibiting adipogenesis and lipogenesis in 3T3-L1 preadipocytes and HFD-induced obese rats	Molecules
Effect of wild Korean ginseng (<i>Panax ginseng</i>) extract on blood glucose and serum lipid contents in rats with multiple low-dose streptozotocin-induced diabetes	Food Science and Biotechnology
The herbal composition GGEx18 from <i>Laminaria japonica</i> , <i>Rheum palmatum</i> , and <i>Ephedra sinica</i> inhibits visceral obesity and insulin resistance by upregulating visceral adipose genes involved in fatty acid oxidation	Pharmaceutical Biology
Herbal composition Gambigyeongsinwan (4) from <i>Curcuma longa</i> , <i>Alnus japonica</i> , and <i>Massa Medicata Fermentata</i> inhibits lipid accumulation in 3T3-L1 cells and regulates obesity in Otsuka long-evans tokushima fatty rats	Journal of Ethnopharmacology
Anti-obesity effects of the mixture of <i>Eriobotrya japonica</i> and <i>Nelumbo nucifera</i> in adipocytes and high-fat diet-induced obese mice	American Journal of Chinese Medicine
The nutritional composition and anti-obesity effects of an herbal mixed extract containing <i>Allium fistulosum</i> and <i>Viola mandshurica</i> in high-fat-diet-induced obese mice	BMC Complementary and Alternative Medicine

Appendix I. Continued

Title of study	Journal
Anti-adipogenic and antioxidant effects of the traditional Korean herbal formula samchulgeonbi-tang: An in vitro study	International Journal of Clinical and Experimental Medicine
Traditional herbal formula oyaksungi-san inhibits adipogenesis in 3T3-L1 adipocytes	Evidence-based Complementary and Alternative Medicine
Beneficial effect of Polygoni Multiflori Radix in high fructose diet-induced metabolic syndrome rat model	The Korea Journal of Herbology
Effects of Agastache rugosa on obesity via inhibition of peroxisome proliferator-activated receptor-gamma and reduction of food intake	Journal of Korean Medicine for Obesity Research
Comparison of Pakistani Ephedra herba and Chinese Ephedra Herba containing Gangjihwan in the improvement effects of weight loss in a high fat diet-fed obese mice	Journal of Korean Medicine for Obesity Research
Retrospective study about the effectiveness of Korean medicine treatment on 254 patients visited obesity clinic	Journal of Korean Medicine for Obesity Research
Effect of atractylodes Rhizoma Alba, Houttuyniae Herba, Lonicerae Flos, Agrobacterium Rhizogenes and Coptidis Rhizoma extracts combined with metformin on the antioxidant and adipocyte differentiate inhibition	Journal of Korean Medicine for Obesity Research
Ethanol extracts of citrus peel inhibits adipogenesis through AMPK signaling pathway in 3T3-L1 preadipocytes	Korean Journal of Life Science
Inhibitory effect of by Ojeok-san lipid accumulation in high fat diet-induced obesity mice and 3T3-L1 adipocytes	The Korea Journal of Herbology
Effects of Gami-Cheongpyesagan-Tang on body fat in high fat diet-fed obese mice	Journal of Korean Medicine for Obesity Research
Korean medical obesity treatments on localized fat in three Japanese	Journal of Korean Medicine for Obesity Research
Effect of the Samwondan ethanol extract on obesity inducer	The Korea Journal of Herbology
Differential protein expression in white adipose tissue from obesity-prone and obesity-resistant mice in response to high fat diet and anti-obesity herbal medicines	Cellular Physiology and Biochemistry

Appendix II List of Studies - 2016

Title of study	Journal
Anti-adipogenic effect of <i>Artemisia annua</i> in diet-induced-obesity mice model	Food Science and Biotechnology
Alleviative effects of Yukmijihwang-tang on cholesterol related disease in a postmenopausal rat model and lipid accumulation in HepG2 cells	International Journal of Clinical and Experimental Medicine
Inhibitory effects and molecular mechanism of adipocyte differentiation by <i>rosae laevigata fructus ethanol extracts</i>	Korean Journal of Microbiology and Biotechnology
<i>Sanguisorba officinalis</i> L. Extracts exert antiobesity effects in 3T3-L1 ADIPOCYTES AND C57BL/6J mice fed high-fat diets	Journal of Medicinal Food
Combination with Red ginseng and <i>Polygoni Multiflori</i> ameliorates highfructose diet induced metabolic syndrome	BMC Complementary and Alternative Medicine
Inhibitory effects of <i>Leonurus sibiricus</i> on weight gain after menopause in ovariectomized and high-fat diet-fed mice	Journal of Natural Medicines
Tongqiaohuoxue decoction ameliorates obesity-induced inflammation and the prothrombotic state by regulating adiponectin and plasminogen activator inhibitor-1	Journal of Ethnopharmacology
Physiological activities and inhibitory effect of extracts of <i>Cynanchi wilfordii radix</i> and <i>Perilla sikokiana</i> against cell differentiation in 3T3-L1 adipocytes	Journal of the Korean Society of Food Science and Nutrition
Effects of Korean red ginseng (<i>Panax ginseng</i>) on obesity and adipose inflammation in ovariectomized mice	Journal of Ethnopharmacology
Anti-diabetic and anti-obesitic effects of aqueous extracts of <i>Yangkyuksanhwa-tang</i> and its two major compositions on db/db mice	Biomedicine and Pharmacotherapy
<i>Veratri Nigri Rhizoma et Radix</i> (<i>Veratrum nigrum</i> L.) and its constituent jervine prevent adipogenesis via activation of the LKB1-AMPKalpha-ACC axis in vivo and in vitro	Evidence-based Complementary and Alternative Medicine
Korean <i>Curcuma longa</i> L. induces lipolysis and regulates leptin in adipocyte cells and rats	Nutrition Research and Practice
Modulatory effect of <i>Eui-E-In-Tang</i> on serum leptin concentration in obese Korean female adults: a randomized controlled trial	Evidence-based Complementary and Alternative Medicine
<i>Soshiho-Tang</i> aqueous extract exerts antiobesity effects in high fat diet-fed mice and inhibits adipogenesis in 3T3-L1 adipocytes	Evidence-based Complementary and Alternative Medicine
Effect of <i>Acorus gramineus</i> root water extract on the body adipose tissues	Journal of Biomedical and Translational Research
Anti-obesity effects of <i>Galgeun-tang</i> in high fat diet induced obese mice model	Journal of Korean Medicine Rehabilitation
The study on anti-obesity of <i>Myrrh ethanol extract</i>	The Korea Journal of Herbology
Anti-obese function of polysaccharides derived from Korean Ginseng (<i>Panax ginseng</i> C.A. Meyer) and development of functional food material in preventing obesity	The Korea Journal of Herbology
Anti-adipogenesis effects of 3 herbal formula on blood stasis	The Korea Journal of Herbology
The retrospective analysis of obesity and overweight female patients with clinical treatment including herbal medicine	The Journal of Oriental Obstetrics & Gynecology
The anti-obesity effects of <i>Platycodi Radix</i> , combination of <i>Platycodi Radix</i> and <i>Cyperi Rhizoma</i> on obesity induced by high fat diet	The Korea Journal of Herbology
Effects of <i>Gami-Handayeolso-Tang</i> on body fat reduction in high fat diet-fed obese mice	Journal of Korean Medicine Rehabilitation
Effects of <i>Loquat</i> (<i>Eriobotrya japonica</i> Lindl.) extracts in different aerial components on differentiation of 3T3-L1 cells and pig preadipocytes	The Korean Journal of Community Living Science
Anti-adipogenic effect of <i>Mori Follium</i> extract in 3T3-L1 cells	The Korea Journal of Herbology
Antiobesity effect of water extract of <i>Coix lacrymajobi</i> var. <i>mayuen</i> in high fat fed C57BL/6 mice	J Korean Med Obes Res

Appendix III List of Studies - 2017

Title of study	Journal
PE-228: Effect of Bangpungdongseong-san on obesity and its comorbidities with transcriptome profiles in diet-induced obese mice	International Congress of Diabetes and Metabolism
Effect of a herbal extract powder (YY-312) from <i>Imperata cylindrica</i> Beauvois, <i>Citrus unshiu</i> Markovich, and <i>Evodia officinalis</i> Dode on body fat mass in overweight adults: A 12-week, randomized, double-blind, placebo-controlled, parallel-group clinical trial	BMC Complementary and Alternative Medicine
Metabolic effect of an oriental herbal medicine on obesity and its comorbidities with transcriptional responses in diet-induced obese mice	International Journal of Molecular Sciences
<i>Agrimonia pilosa</i> Ledeb. aqueous extract improves impaired glucose tolerance in high-fat diet-fed rats by decreasing the inflammatory response	BMC Complementary and Alternative Medicine
<i>Lycium chinense</i> improves post-menopausal obesity via regulation of PPAR- γ and estrogen receptor- α/β expressions	American Journal of Chinese Medicine
Anti-obesity effects of fermented soybean oils in 3T3-L1 pre-adipocytes and high fat diet-fed C57BL/6J mice	Journal of the Korean Society of Food Science and Nutrition
Anti-obesity effect of <i>Amomum taso-ko</i> ethanol extract in 3T3-L1 adipocytes	Journal of Applied Biological Chemistry
Effects of <i>cimicifugae rhizoma</i> on the osteogenic and adipogenic differentiation of stem cells	Experimental and Therapeutic Medicine
<i>Euphorbia kansui</i> attenuates insulin resistance in obese human subjects and high-fat diet-induced obese mice	Evidence-based Complementary and Alternative Medicine
Effect of methanol extract of <i>Salviae miltiorrhizae Radix</i> in high-fat diet-induced hyperlipidemic mice	Chinese Medicine (United Kingdom)
Effect of <i>seyoem</i> on obesity, insulin resistance, and nonalcoholic fatty liver disease of high-fat diet-fed C57BL/6 mice	Evidence-based Complementary and Alternative Medicine
The effect of Korean Red Ginseng extract on rosiglitazone-induced improvement of glucose regulation in diet-induced obese mice	Journal of Ginseng Research
Oral administration of <i>Rehmannia glutinosa</i> extract for obesity treatment via adiposity and fatty acid binding protein expression in obese rats	Toxicology and Environmental Health Sciences
Anti-adipogenic effects of the traditional herbal formula <i>Dohongsamul-tang</i> in 3T3-L1 adipocytes	BMC Complementary and Alternative Medicine
Do in <i>Seung Gi-Tang</i> extract suppresses adipocyte differentiation in 3T3-L1 cells	Molecular Medicine Reports
In vivo metabolomic interpretation of the anti-obesity effects of hyacinth bean (<i>Dolichos lablab</i> L.) administration in high-fat diet mice	Molecular Nutrition and Food Research
Anti-obesity activity, acute toxicity, and chemical constituents of aqueous and ethanol <i>Viola mandshurica</i> extracts	BMC Complementary and Alternative Medicine
<i>Ephedra</i> -treated donor-derived gut microbiota transplantation ameliorates high fat diet-induced obesity in rats	International Journal of Environmental Research and Public Health
Antioxidant and anti-obesity effect of SM17 in high-fat diet induced C57BL/6 mice	The Korea Journal of Herbology
The mixed herbal extract, CAPA, prevents obesity and glucose intolerance in obese mice	Journal of Korean Medicine for Obesity Research
The retrospective analysis on obese and overweight female patients with Korean medical treatment and its effectiveness for clinical setting of seasonal treatment	Journal of Korean Medicine for Obesity Research
Anti-obesity effects of <i>Curcuma longa</i> L. extracts through inhibiting adipogenic transcription factors	Asian Journal of Beauty and Cosmetology
The effect of <i>Scutellariae Radix</i> combined with metformin on obesity-relating biomarker in high fat fed C57BL/6 mice	Journal of Korean Medicine for Obesity Research
Effects of the obesity therapy with Korean herbal medicine on liver function: case series	Journal of Korean Medicine for Obesity Research
A study on factors associated with weight loss by 'Gamitaeumjowee-Tang'	Journal of Korean Medicine for Obesity Research
Effects of <i>Pueraria lobata</i> on obesity related hormones in rats with estrogen deficiency	Journal of Korean Medicine for Obesity Research
Evaluation of efficacy of <i>Aconitum carmichaeli</i> Debx extract on obesity and glucose tolerance in diet induced obese mice	Journal of Korean Medicine for Obesity Research
Effect of <i>Eriobotrya folium</i> on local fat via regulation of lipase secretion	Journal of Korean Medicine for Obesity Research
Effects of acupotomy and selective cryolysis including herbal medicine treatment on thigh circumference: case series	Journal of Korean Medicine for Obesity Research

Appendix IV. List of Studies - 2018

Title of study	Journal
Inhibitory effect of ethanolic extract of <i>Ramulus mori</i> on adipogenic differentiation of 3T3-L1 cells and their antioxidant activity	Journal of Food Biochemistry
Gangjihwan, a polyherbal composition, inhibits fat accumulation through the modulation of lipogenic transcription factors SREBP1C, PPAR γ and C/EBP α	Journal of Ethnopharmacology
The combination of <i>Ephedrae herba</i> and <i>Coicis semen</i> in Gambihwan attenuates obesity and metabolic syndrome in high-fat diet-induced obese mice	Evidence-based Complementary and Alternative Medicine
Anti-obesity potential of <i>Glycyrrhiza uralensis</i> and licochalcone A through induction of adipocyte browning	Biochemical and Biophysical Research Communications
The fruits of <i>Gleditsia sinensis</i> Lam. inhibits adipogenesis through modulation of mitotic clonal expansion and STAT3 activation in 3T3-L1 cells	Journal of Ethnopharmacology
<i>Cucumis melo</i> L. Alleviates obesity and insulin resistance in obese human subjects and high fat diet-induced obese mice	International Journal of Clinical and Experimental Medicine
Korean red ginseng (<i>Panax ginseng</i>) inhibits obesity and improves lipid metabolism in high fat diet-fed castrated mice	Journal of Ethnopharmacology
The root of <i>atractylodes macrocephala koidzumi</i> prevents obesity and glucose intolerance and increases energy metabolism in mice	International Journal of Molecular Sciences
Aqueous and ethanolic extracts of welsh onion, <i>Allium fistulosum</i> , attenuate high-fat diet-induced obesity	BMC Complementary and Alternative Medicine
Single oral acute toxicity of Banhasasim-Tang and its antiobesity effect on diet-induced obese mice and 3T3-L1 adipocytes	Evidence-based Complementary and Alternative Medicine
Effects of the modified fasting therapy using Gamrosu and herbal medicine on changes of body compositions in women: case series	Journal of Korean Medicine for Obesity Research
Effects of the obesity therapy with Korean herbal medicine on menstrual cycle disorder: case series	Journal of Korean Medicine for Obesity Research
The effects of Daecheongryoung-tang on anti-weight gain and anti-hyperlipidemic in obese sprague dawley rat induced by high fat diet	Journal of Korean Medicine for Obesity Research
A case report of a patient with weight loss diagnosed with pattern of liver-spleen disharmony	Journal of Oriental Neuropsychiatry
The effect of <i>Alisma canaliculatum</i> and <i>Polyporus umbellatus</i> extracts on adipogenic differentiation of human bone marrow derived mesenchymal stromal stem cells	The Journal of Internal Korean Medicine
Analysis of adverse events in weight loss program in combination with 'Gamitaeumjowee-Tang' and low-calorie diet	Journal of Korean Medicine for Obesity Research
Effect of Gejibokryung-hwan and combination of Gejibokryung-hwan and Gangji-hwan on obesity and lipid metabolism in Ob/Ob mice	The Journal of Oriental Obstetrics & Gynecology
Effect of <i>Platycodon grandiflorum</i> fermentation with salt on fermentation characteristics, microbial change and anti-obesity activity	Journal of Korean Medicine for Obesity Research
The anti-obesity effect of Seungyangjeseup-tang for high fat diet induced obese mice	Journal of Korean Medicine
The anti-obesity effects of Younggyechulgam-tang-ga Hwanggi on obesity in mice induced by high fat diet	Journal of Korean Medicine Rehabilitation
Effect of <i>Artemisia capillaris</i> Thunberg on anti-oxidative and inhibition of adipogenesis in 3T3-L1 Cells	Journal of Applied Oriental Medicine
Effect of <i>Plantaginis asiaticae</i> Folium water extract on body fat loss in high fat-induced obese C57BL/6 mice	The Korea Journal of Herbology
Effects of Hwanggimacmundong-tang on body weight and gene expression in obese rats with estrogen deficiency	The Journal of Oriental Obstetrics & Gynecology
Effects of essential oils extracted from <i>Cnidii Rhizoma</i> on differentiation and adipogenesis in 3T3-L1 adipocytes	Journal of Korean Medicine Rehabilitation
Synergistic effect of <i>Bupleuri Radix</i> and <i>Scutellariae Radix</i> on adipogenesis and AMP-activated protein kinase: a network pharmacological approach	Evidence-based Complementary and Alternative Medicine

Appendix V. List of Studies - 2019

Title of study	Journal
Anti-obesity effects of Korean red ginseng extract in healthy beagles	Polish Journal of Veterinary Sciences
Ginseng berry extract enhances metformin efficacy against obesity and hepatic steatosis in mice fed high-fat diet through increase of metformin uptake in liver	Journal of Functional Foods
Elucidation of the metabolic and transcriptional responses of an oriental herbal medicine, Bangpungtongseong-san, to nonalcoholic fatty liver disease in diet-induced obese mice	Journal of medicinal food
Gentiopicroside isolated from <i>Gentiana scabra</i> Bge. inhibits adipogenesis in 3T3-L1 cells and reduces body weight in diet-induced obese mice	Bioorganic and Medicinal Chemistry Letters
The polyherbal composition Gyeongshingangjeehwan 18 attenuates glucose intolerance and pancreatic steatosis in C57BL/6J mice on a high-fat diet	Journal of Ethnopharmacology
Anti-osteoporotic and anti-adipogenic effects of the water extract of <i>drynaria roosii</i> nakaike in ovariectomized mice fed a high-fat diet	Molecules
Effects of Gambisan in overweight adults and adults with obesity: A retrospective chart review	Medicine (United States)
Anti-obesity effect of Yangkyuksanwha-tang in high-fat diet-induced obese mice	BMC complementary and alternative medicine
Effect of enzymatic treatment of <i>Chrysanthemum Indicum</i> Linné extracts on lipid accumulation and adipogenesis in high-fat-diet-induced obese male mice	Nutrients
Effect of <i>Ephedrae Herba</i> methanol extract on high-fat diet-induced hyperlipidaemic mice	Pharmaceutical Biology
<i>Inula Japonica</i> thunb. Flower ethanol extract improves obesity and exercise endurance in mice fed a high-fat diet	Nutrients
The anti-obesity effects of Tongbi-san in a high-fat diet-induced obese mouse model	BMC Complementary and Alternative Medicine
Anti-obesity effects of the flower of <i>Prunus persica</i> in high-fat diet-induced obese mice	Nutrients
Effects of combination therapy with anti-obesity herbal medicine including <i>ephedra herba</i> and <i>lorcaserin</i> in obese patients: two case reports	Journal of Korean Medicine for Obesity Research
Anti-obesity effects of Banggihwnggi-tang-hap-yeonggyechulgam-tang in high fat diet induced obese mice model	Journal of Korean Medicine Rehabilitation
Anti-obesity effect of <i>Cynanchi Wilfordii Radix</i> on High fat diet-induced obese mice	The Korea Journal of Herbology
Anti-obesity effect of <i>Crataegus pinnatifida</i> through gut microbiota modulation in high-fat-diet induced obese mice	Journal of Korean Medicine
Anti-obesity and anti-oxidative efficacy evaluation of <i>alisma orientalis</i>	Journal of Applied Oriental Medicine
Simple obesity treatment by single intervention of herbal medicines without <i>ephedra herba</i> : a case report	The Journal of Internal Korean Medicine
Anti-obesity effects of mixture of <i>Atractylodes macrocephala</i> and <i>Amomum villosum</i> extracts	Journal of Physiology & Pathology in Korean Medicine
The role of the herbal medicines, <i>Rehmanniae Radix</i> , <i>Citrus unshiu Peel</i> , and <i>Poria cocos</i> wolf, in high-fat diet-induced obesity	Pharmacognosy Magazine