**Supplementary Table S1** The composition of herbal preparations.

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| Preparation | Drug name | Chinese name | Plant origin | Part used | Dose used |
| Naoxintong capsule | *Astragali Radix* | Huangqi | *Astragalus membranaceus* (Fisch.) or  Bge.var.mongholicus (Bge.) Hsiao or  *Astragalus membranaceus* (Fisch.) Bge. | Root | 66 g |
| *Paeoniae Radix Rubra* | Chishao | *Paeonia lactiflora* Pall. or  *Paeonia veitchii* Lynch | Root | 27 g |
| *Salviae miltiorrhizae Radix et Rhizoma* | Danshen | *Salvia miltiorrhiza* Bge. | Root/ Rhizome | 27 g |
| *Angelicae sinensis Radix* | Danggui | *Angelica sinensis* (Oliv.) Diels | Root | 27 g |
| *Chuanxiong Rhizoma* | Chuanxiong | *Ligusticum chuanxiong* Hort. | Rhizome | 27 g |
| *Persicae Semen* | Taoren | *Prunus persica* (L.) Batsch or  *Prunus davidiana* (Carr.) Franch. | Seed | 27 g |
| *Achyranthis bidentatae Radix* | Niuxi | *Achyranthes bidentata* Bl. | Root | 27 g |
| *Spatholobi Caulis* | Jixueteng | *Spatholobus suberectus* Dunn | Stem | 20 g |
| *Cinnamomi Ranulus* | Guizhi | *Cinnamomum cassia* Presl | Twigs | 20 g |
| *Carthami Flos* | Honghua | *Carthamus tinctorius* L. | Flower | 13 g |
| *Mori Ramulus* | Sangzhi | *Morus alba* L. | Twigs | 27 g |
| *Olibanum* | Ruxiang | *Boswellia carterii* Birdw. or  *Boswellia bhaw-dajiana* Birdw. | Resin | 13 g |
| *Myrrha* | Moyao | *Commiphora myrrha* Engl. or  *Commiphora molmol* Engl. | Resin | 13 g |
| *Scorpio* | Quanxie | *Buthus martensii* Karsch | Dried body | 13 g |
| *Pheretima* | Dilong | *Pheretima aspergillum* (E.Perrier) or  *Pheretima vulgaris* Chen or  *Pheretima guillelmi* (Michaelsen) or  *Pheretima pectinifera* Michaelsen | Dried body | 27 g |
| *Hirudo* | Shuizhi | *Whitmania pigra* Whitman or  *Hirudo nipponica* Whitman or  *Whitmania acranulata* Whitman | Dried body | 27 g |
| Xiexin decoction | *Rhei Radix et Rhizome* | Dahuang | *Rheum palmatum* L. or  *Rheum tanguticum* Maxim. ex Bal£. or *Rheum officinale* Baill. | Root/ Rhizome | 10 g |
| *Scutellaria Radix* | Huangqin | *Scutellaria baicalensis* Georgi | Root | 5 g |
| *Coptidis Rhizoma* | Huanglian | *Coptis chinensis* Franch. or  *Coptis deltoidea* C.Y.Cheng et Hsiao or *Coptis teeta* Wall. | Rhizome | 5 g |
| Huanglian Jiedu decoction | *Coptidis Rhizoma* | Huanglian | *Coptis chinensis* Franch. or  *Coptis deltoidea* C.Y.Cheng et Hsiao or *Coptis teeta* Wall. | Rhizome | 9 g |
| *Scutellaria Radix* | Huangqin | *Scutellaria baicalensis* Georgi | Root | 6 g |
| *Phellodendri Chinensis Cortex* | Huangbo | *Phellodendron chinense* Schneid. | Cortex | 6 g |
| *Gardeniae Fructus* | Zhizi | *Gardenia jasminoides* Ellis | Fruit | 9 g |
| Jinqi Jiangtang tablet | *Coptidis Rhizoma* | Huanglian | *Coptis chinensis* Franch. or  *Coptis deltoidea* C.Y.Cheng et Hsiao or *Coptis teeta* Wall. | Rhizome | 343 g |
| *Scutellaria Radix* | Huangqin | *Scutellaria baicalensis* Georgi | Root | 513 g |
| *Lonicerae Japonicerae Flos* | Jinyinhua | *Lonicera japonica* Thunb. | Flower | 2058 g |
| Gegen Jiaotai pills | *Puerariae Lobatae Radix* | Gegen | *Pueraria lobata* (Willd.) Ohwi | Root | Unknown |
| *Coptidis Rhizoma* | Huanglian | *Coptis chinensis* Franch. or  *Coptis deltoidea* C.Y.Cheng et Hsiao or *Coptis teeta* Wall. | Rhizome |
| *Cinnamomi Cortex* | Rougui | *Cinnamomum cassia* Presl | Cortex |
| Shenqi compound | *Ginseng Radix et Rhizoma* | Renshen | *Panax ginseng* C.A.Mey. | Root/ Rhizome | 15 g |
| *Astragali Radix* | Huangqi | *Astragalus membranaceus* (Fisch.) Bge.var.mongholicus (Bge.) Hsiao or  *Astragalus membranaceus* (Fisch.) Bge | Root | 15 g |
| *Trichosanthis Radix* | Tianhuafen | *Trichosanthes kirilowii* Maxim. or  *Trichosanthes rosthornii* Harms | Root | 10 g |
| *Rehmanniae Radix* | Dihuang | *Rehmannia glutinosa* Libosch. | Earthnut | 10 g |
| *Salviae miltiorrhizae Radix et Rhizoma* | Danshen | *Salvia miltiorrhiza* Bge. | Radix/ Rhizome | 10 g |
| *Corni Fructus* | Shanzhuyu | *Cornus officinalis* Sieb et Zucc. | Fruit | 10 g |
| *Dioscoreae Rhizoma* | Shanyao | *Dioscorea oppositifolia* L. | Root/ Rhizome | 10 g |
| *Rhei Radix et Rhizome* | Dahuang | *Rheum palmatum* L. or  *Rheum tanguticum* Maxim. ex Bal£. or  *Rheum officinale* Baill. | Root/ Rhizome | 6 g |
| Gegen Qinlian decoction | *Coptidis Rhizoma* | Huanglian | *Coptis chinensis* Franch. or  *Coptis deltoidea* C.Y.Cheng et Hsiao or  *Coptis teeta* Wall. | Rhizome | Unknown |
| *Scutellaria Radix* | Huangqin | *Scutellaria baicalensis* Georgi | Root |
| *Puerariae Lobatae Radix* | Gegen | *Pueraria lobata* (Willd.) Ohwi | Root |
| *Anemarrhenae Rhizoma* | Zhimu | *Anemarrhena asphodeloides* Bge. | Rhizome |
| *Panacis Quinquefolii Radix* | Xiyangshen | *Panax quinquefolium* L. | Root |
| *Paeoniae Radix Rubra* | Chishao | *Paeonia lactiflora* Pall. or  *Paeonia veitchii* Lynch | Root |
| *Zingiberis Rhizoma* | Ganjiang | *Zingiber officinale* Rosc. | Rhizome |
| Jiangtangjing granules | *Astragali Radix* | Huangqi | *Astragalus membranaceus* (Fisch.) Bge.var.mongholicus (Bge.) Hsiao or  *Astragalus membranaceus* (Fisch.) Bge. | Root | 30 g |
| *Puerariae Lobatae Radix* | Gegen | *Pueraria lobata* (Willd.) Ohwi | Root | 30 g |
| *Dioscoreae Rhizoma* | Shanyao | *Dioscorea opposita* Thunb | Rhizome | 15 g |
| *Polygonati Rhizoma* | Huangjing | *Polygonatum kingianum* Coll.et Hemsl or *Polygonatum sibiricum* Red. or  *Polygonatum cyrtonema* Hua | Rhizome | 15 g |
| *Coicis Semen* | Yiyiren | *Coix lacryma-jobi* L.var.ma-yuen (Roman.) Stapf | Seed | 15 g |
| *Crataegi Fructus* | Shanzha | *Crataegus pinnatifida* Bge. var. major N. E. Br. or *Crataegus pinnatifida* Bge. | Fruit | 15 g |
| *Hirudo* | Shuizhi | *Whitmania pigra* Whitman *or*  *Hirudo nipponica* Whitman or  *Whitmania acranulata* Whitman | Dried body | 5 g |
| *Sinapis Semen* | Baijiezi | *Sinapis alba* L. or *Brassica juncea* (L.) Czern. et Coss. | Seed | 5 g |
| Linggui Zhugan formula | *Poria* | Fuling | *Poria cocos* (Schw.) Wolf | Sclerotium | 12 g |
| *Cinnamomi Ranulus* | Guizhi | *Cinnamomum cassia* Presl | Twigs | 9 g |
| *Atractylodis Macrocephalae Rhizoma* | Baizhu | *Atractylodes macrocephala* Koidz. | Rhizome | 6 g |
| *Glycyrrhizae Radix* | Gancao | *Glycyrrhiza uralensis* Fisch. or  *Glycyrrhiza inflata* Bat. or  *Glycyrrhiza glabra* L. | Root/ Rhizome | 6 g |
| Shenlian decoction | *Coptidis Rhizoma* | Huanglian | *Coptis chinensis* Franch. or  *Coptis deltoidea* C.Y.Cheng et Hsiao or  *Coptis teeta* Wall. | Rhizome | 30 g |
| *Ginseng Radix et Rhizoma* | Renshen | *Panax ginseng* C.A.Mey. | Root/ Rhizome | 15 g |
| Liuwei Dihuang pills | *Rehmanniae Radix Preparata* | Shudihuang | *Rehmannia glutinosa* Libosch. | Earthnut | 160 g |
| *Corni Fructus* | Shanzhuyu | *Cornus officinalis* Sieb et Zucc. | Fruit | 80 g |
| *Moutan Cortex* | Mudanpi | *Paeoniasuffruticosa* Andr. | Root skin | 60 g |
| *Dioscoreae Rhizoma* | Shanyao | *Dioscorea opposita* Thunb | Rhizome | 80 g |
| *Poria* | Fuling | *Poria cocos* (Schw.) Wolf | Sclerotium | 60 g |
| *Alismatis Rhizoma* | Zexie | *Alisma orientale* (Sam.) Juzep. or  *Alisma plantago-aquatica* Linn. | Rhizome | 60 g |
| Chowiseungcheng decoction | *Coicis Semen* | Yiyiren | *Coix lacryma-jobi* L.var*.ma-yuen* (Roman.) Stapf. | Seed | 3.75 g |
| *Castaneae Semen* | Maoliren | *Castanea seguinii* Dode. | Seed | 3.75 g |
| *Raphani Semen* | Laifuzi | *Raphanus sativus* L. | Seed | 1.875 g |
| *Ephedrae Herba* | Mahuang | *Ephedra sinica* Stapf. or  *Ephedra intermedia* Schrenk et C.A.Mey. *Ephedra equisetina* Bge. | Herbaceous stem | 1.25 g |
| *Platycodi Radix* | Jiegeng | *Platycodon grandiflorum* (Jacq.) A.DC. | Root | 1.25 g |
| *Liriopis Tuber* | Maidong | *Ophiopogon japonicus* (L.f) Ker-Gawl. | Earthnut | 1.25 g |
| *Schizandrae Fructus* | Wuweizi | *Schisandra chinensis* (Turcz.) Baill. | Fruit | 1.25 g |
| *Acori Graminei Rhizoma* | Shichangpu | *Acorus tatarinowii* Schott | Rhizoma | 1.25 g |
| *Polygalae Radix* | Yuanzhi | *Polygala tenuifolia* Willd or  *Polygala sibirica* L. | Root | 1.25 g |
| *Asparagi Radix* | Tiandong | *Asparagus cochinchinensis* (Lour.) Merr. | Earthnut | 1.25 g |
| *Zizyphi Spinosae Semen* | Suanzaoren | *Ziziphus jujuba* Mill. var. spinosa (Bunge) Hu ex H. F. Chou | Seed | 1.25 g |
| *Longanae Arill* | Longyanrou | *Dimocarpus longan* Lour. | Aril | 1.25 g |
| Daesiho decoction | *Bupleuri radix* | Chaihu | *Bupleurum chinense* DC. or  *Bupleurum scorzonerifolium* Willd. | Root | 2.0 g |
| *Pinelliae rhizoma* | Banxia | *Pinellia ternata* (Thunb.) Breit. | Tuber | 1.33 g |
| *Zingiberis rhizoma* | Ganjiang | *Zingiber officinale* Rosc. | Rhizoma | 1.67 g |
| *Scutellariae radix* | Huangqin | *Scutellaria baicalensis* Georgi. | Root | 1.00 g |
| *Paeoniae radix alba* | Baishao | *Paeonia lactiflora* Pall. | Root | 1.00 g |
| *Jujubae fructus* | Dazao | *Ziziphus jujuba* Mill. | Fruit | 1.00 g |
| *Aurantii fructus immaturus* | Zhishi | *Citrus aurantium* L. or  *Citrus sinensis* Osbeck | Immature fruit | 0.67 g |
| *Rhei radix et rhizoma* | Dahuang | *Rheum palmatum* L. or  *Rheum tanguticum* Maxim. ex Bal£. or  *Rheum officinale* Baill. | Root/ Rhizome | 0.67 g |
| Kangshuailao tablet | *Rehmanniae radix* | Dihuang | *Rehmannia glutinosa* Libosch. | Root | Unknown |
| *Ginseng radix et rhizoma* | Renshen | *Panax ginseng* C. A. Mey. | Root/ Rhizome |
| *Asparagi Radix* | Tiandong | *Asparagus cochinchinensis* (Lour.) Merr. | Earthnut |
| *Liriopis Tuber* | Maidong | *Ophiopogon japonicus* (L.f) Ker-Gawl. | Earthnut |
| *Lycii fructus* | gouqizi | *Lycium chinense* Miller. | Fruit |
| *Poria* | Fuling | *Poria cocos* (Schw.) Wolf. | Sclerotium |
| Jianpi Tiaogan drink | *Scutellariae radix* | Huangqin | *Scutellaria baicalensis* Georgi. | Root | Unknown |
| *Bupleuri* *radix* | Chaihu | *Bupleurum chinense* DC. or  *Bupleurum scorzonerifolium* Willd. | Root |
| *Poria* | Fuling | *Poria cocos* (Schw.) Wolf. | Sclerotium |
| *Salviae miltiorrhizae radix et rhizoma* | Danshen | *Salvia miltiorrhiza* Bge. | Root/ Rhizome |
| *Coicis Semen* | Yiyiren | *Coix lacryma-jobi* L.var*.ma-yuen* (Roman.) Stapf. | Seed |
| *Paeoniae radix alba* | Baishao | *Paeonia lactiflora* Pall. | Root |
| *Cassiae semen* | Juemingzi | *Cassia obtusifolia* L. | Seed |
| *Pogostemonis herba* | Guanghuoxiang | *Pogostemon cablin* (Blanco) Benth. | Aerial Part |
| *Alismatis rhizoma* | Zexie | *Alisma orientale* (Sam.) Juzep. or  *Alisma plantago-aquatica* Linn. | Tuber |
| *Rhei radix et rhizoma* | Dahuang | *Rheum palmatum* L. or  *Rheum tanguticum* Maxim. ex Bal£. or  *Rheum officinale* Baill. | Root/ Rhizome |
| Ginseng extract Sanggua drink | *Mori folium* | Sangye | *Morus alba* L. | Leaf | 4 g |
| *Puerariae lobatae radix* | Gegen | *Pueraria lobata* (Willd.) Ohwi | Root | 6 g |
| *Dioscoreae rhizoma* | Shanyao | *Dioscorea opposita* Thunb. | Root | 3 g |
| *Momordicae Charantiae* | Kugua | *Momordica charantia* L. | Fruit | 3 g |
| Salvia-Nelumbinis naturalis formula | *Gynostemmae Pentaphylli herba* | Jiaogulan | *Gynostemma pentaphyllum* (Thunb.) Mak. | Aerial Part | 15 g |
| *Polygoni Cuspidati Rhizoma et Radix* | Huzhang | *Panax quinquefolium* L. | Root/ Rhizome | 15 g |
| *Salviae miltiorrhizae Radix et Rhizoma* | Danshen | *Salvia miltiorrhiza* Bge. | Radix/ Rhizome | 9 g |
| *Artemisiae Scopariae Herba* | Yinchen | *Artemisia scoparia* Waldst.etKit. or  *Artemisia capillaris* Thunb. | Aerial Part | 9 g |
| *Nelumbinis Folium* | Heye | *Nelumbo nucifera* Gaertn. | Leaf | 6 g |
| Shenling Baizhu powder | *Ginseng Radix et Rhizoma* | Renshen | *Panax ginseng* C.A.Mey. | Root/ Rhizome | 5 g |
| *Poria* | Fuling | *Poria cocos* (Schw.) Wolf | Sclerotium | 5 g |
| *Atractylodis Macrocephalae Rhizoma* | Baizhu | *Atractylodes macrocephala* Koidz. | Rhizome | 5 g |
| *Dioscoreae Rhizoma* | Shanyao | *Dioscorea opposita* Thunb. | Rhizome | 5 g |
| *Lablab Semen Album* | Baibiandou | *Dolichos lablab* L. | Seed | 4 g |
| *Nelumbinis Semen* | Lianzi | *Nelumbo nucifera* Gaertn. | Seed | 3 g |
| *Glycyrrhizae Radix et Rhizoma Praeparata Cum Melle* | Gancao | *Glycyrrhiza uralensis* Fisch. or  *Glycyrrhiza inflata* Bat. or  *Glycyrrhiza glabra* L | Root/ Rhizome | 3 g |
| *Coicis Semen* | Yiyiren | *Coix lacryma-jobi* L.var.ma-yuen (Roman.) Stapf | Seed | 3 g |
| *Platycodonis Radix* | Jiegeng | *Platycodon grandiflorum* (Jacq.) A.DC. | Root | 2 g |
| *Amomi Fructus* | Sharen | *Amomum villosum* Lour. or  *Amomum villosum* Lour.var.xanthioides T.L.Wu et Senjen or  *Amomum longiligulare* T.L.Wu | Fruit | 2 g |
| Qushi Huayu decoction | *Artemisiae Scopariae Herba* | Yinchen | *Artemisia scoparia* Waldst.etKit. or  *Artemisia capillaris* Thunb. | Aerial Part | 15 g |
| *Polygoni Cuspidati Rhizoma et Radix* | Huzhang | *Panax quinquefolium* L. | Root/ Rhizome | 12 g |
| *Curcumae Longae Rhizoma* | Jianghuang | *Curcuma Longa* L. | Rhizome | 9 g |
| *Gardeniae Fructus* | Zhizi | *Gardenia jasminoides* Ellis | Fruit | 12 g |
| *Hyperici japonici Herba* | Tianjihuang | *Hypericum japonicum* Thunb.ex Murray | Whole plant | 9 g |
| Dachaihu decoction | *Bupleuri Radix* | Chaihu | *Bupleurum chinense* DC. *or*  *Bupleurum scorzonerifolium* Willd. | Root | 12 g |
| *Scutellaria radix* | Huangqin | *Scutellaria baicalensis* Georgi | Root | 9 g |
| *Paeoniae Radix Alba* | Baishao | *Paeonia lactiflora* Pall. | Root | 9 g |
| *Pinelliae Rhizoma* | Banxia | *Pinellia ternata* (Thunb.) Makino | Rhizome | 9 g |
| *Citri Reticulatae Pericarpium* | Chenpi | *Citrus reticulata* Blanco | Pericarp | 9 g |
| *Zingiberis Rhizoma Recens* | Shengjiang | *Zingiber officinale* Rosc. | Rhizome | 15 g |
| *Jujubae Fructus* | Dazao | *Ziziphus jujuba* Mill. | Fruit | 12 g |
| *Rhei Radix et Rhizoma* | Dahuang | *Rheum palmatum* L. or  *Rheum tanguticum* Maxim. ex Bal£. or  *Rheum officinale* Baill. | Root/ Rhizome | 6 g |
| Qianggan formula | *Artemisiae Scopariae Herba* | Yinchen | *Artemisia scoparia* Waldst.etKit. or  *Artemisia capillaris* Thunb. | Aerial Part | 10 g |
| *Isatidis Radix* | Banlangen | *Isatis indigotica* Fort. | Root | 5 g |
| *Angelicae sinensis Radix* | Danggui | *Angelica sinensis* (Oliv.) Diels | Root | 5 g |
| *Paeoniae Radix Alba* | Baishao | *Paeonia lactiflora* Pall. | Root | 5 g |
| *Salviae miltiorrhizae Radix et Rhizoma* | Danshen | *Salvia miltiorrhiza* Bge. | Radix/ Rhizome | 10 g |
| *Curcumae Radix* | Yujin | *Curcuma wenyujin* Y. H. Chen et C. Ling or *Curcuma Longa* L. or *Curcuma kwangsiensis* S. G. Lee et C. F. Liang or *Curcuma phaeocaulis* Val. | Earthnut | 5 g |
| *Astragali Radix* | Huangqi | *Scutellaria baicalensis* Georgi | Root | 10 g |
| *Codonopsis Radix* | Dangshen | *Codonopsis pilosula* (Franch.) Nannf. or *Codonopsis pilosula* Nannf.var.modesta (Nannf.) L.T.Shen or *Codonopsis tangshen* Oliv | Root | 5 g |
| *Alismatis Rhizoma* | Zexie | *Alisma orientale* (Sam.) Juzep. or  *Alisma plantago-aquatica* Linn. | Rhizome | 5 g |
| *Polygonati Rhizoma* | Huangjing | *Polygonatum kingianum* Coll.et Hemsl. or *Polygonatum sibiricum* Red. or  *Polygonatum cyrtonema* Hua | Rhizome | 5 g |
| *Rehmanniae Radix* | Dihuang | *Rehmannia glutinosa* Libosch. | Earthnut | 5 g |
| *Dioscoreae Rhizoma* | Shanyao | *Dioscorea opposita* Thunb. | Rhizome | 5 g |
| *Crataegi Fructus* | Shanzha | *Crataegus pinnatifida* Bge. var. major  N. E. Br. or *Crataegus pinnatifida* Bge. | Fruit | 4 g |
| *Massa Medicata Fermentata* | Shenqu | *Medicated Leaven Massa Medicata Fermentata* | Zymotic product | 4 g |
| *Gentianae Macrophyllae Radix* | Qinjiao | *Gentiana macrophylla* Pall. or  *Gentiana straminea* Maxim. or  *Gentiana crassicaulis* Duthie ex Burk. or  *Gentiana dahurica* Fisc. | Root | 4 g |
| *Glycyrrhizae Radix* | Gancao | *Glycyrrhiza uralensis* Fisch. or  *Glycyrrhiza inflata* Bat. or  *Glycyrrhiza glabra* L. | Root/ Rhizome | 4 g |
| Jiangan Jiangzhi pills | *Polygoni Multiflori Radix* | Heshouwu | *Polygonum multiflorum* Thunb. | Earthnut | 20 g |
| *Poria* | Fuling | *Poria cocos* (Schw.) Wolf | Sclerotium | 30 g |
| *Curcumae Radix* | Yujin | *Curcuma wenyujin* Y. H. Chen et C. Ling or *Curcuma Longa* L. or  *Curcuma kwangsiensis* S. G. Lee et C. F. Liang or *Curcuma phaeocaulis* Val. | Earthnut | 20 g |
| *Cassiae Semen* | Juemingzi | *Cassia obtusifolia* L. or *Cassia tora* L. | Seed | 15 g |
| *Crataegi Fructus* | Shanzha | *Crataegus pinnatifida* Bge. var. major  N. E. Br. or *Crataegus pinnatifida* Bge. | Fruit | 30 g |
| *Salviae miltiorrhizae Radix et Rhizoma* | Danshen | *Salvia miltiorrhiza* Bge. | Radix/ Rhizome | 15 g |
| *Aurantii Fructus Immaturus* | Zhishi | *Citrus aurantium* L. or  *Citrus sinensis* Osbeck | Fruit | 15 g |
| *Curcumae Longae Rhizoma* | Jianghuang | *Curcuma Longa* L. | Rhizome | 10 g |
| *Alismatis Rhizoma* | Zexie | *Alisma orientale* (Sam.) Juzep. or  *Alisma plantago-aquatica* Linn. | Rhizome | 15 g |
| *Nelumbinis Folium* | Heye | *Nelumbo nucifera* Gaertn. | Leaf | 20 g |
| Erchen decoction | *Pinelliae Rhizoma* | Banxia | *Pinellia ternata* (Thunb.) Makino | Rhizome | 15 g |
| *Citri Reticulatae Pericarpium* | Chenpi | *Citrus reticulata* Blanco | Pericarp | 15 g |
| *Poria* | Fuling | *Poria cocos* (Schw.) Wolf | Sclerotium | 9 g |
| *Glycyrrhizae Radix* | Gancao | *Glycyrrhiza uralensis* Fisch. or  *Glycyrrhiza inflata* Bat. or  *Glycyrrhiza glabra* L. | Root/ Rhizome | 4.5 g |
| *Zingiberis Rhizoma Recens* | Shengjiang | *Zingiber officinale* Rosc. | Rhizome | 7 pieces |
| *Mume Fructus* | Wumei | Prunus mume (Sieb.) Sie.et Zucc. | Fruit | 1 piece |
| Jiangan Xiaozhi decoction | *Salviae miltiorrhizae Radix et Rhizoma* | Danshen | *Salvia miltiorrhiza* Bge. | Root/ Rhizome | 15 g |
| *Notoginseng Radix et Rhizoma* | Sanqi | *Panax notoginseng* ( Burk.) F. H. Chen | Root/ Rhizome | 6 g |
| *Curcumae Rhizoma* | Ezhu | *Curcuma phaeocaulis* VaL. or  *Curcuma kwangsiensis* S.G.Lee et C.F.Liang *Curcuma wenyujin* Y.H.ChenetC.Ling | Rhizome | 15 g |
| *Crataegi Fructus* | Shanzha | *Crataegus pinnatifida* Bge. var. major  N. E. Br. or  *Crataegus pinnatifida* Bge. | Fruit | 20 g |
| *Astragali Radix* | Huangqi | *Astragalus membranaceus* (Fisch.) Bge.var.mongholicus (Bge.) Hsiao or  *Astragalus membranaceus* (Fisch.) Bge. | Root | 20 g |
| *Vaticae Fructus* | Qingmei | *Vatica mangachapoi* Blanco | Fruits | 10 g |
| *Paeoniae Radix Rubra* | Chishao | *Paeonia lactiflora* Pall. or  *Paeonia veitchii* Lynch | Root | 20 g |
| *Curcumae Longae Rhizoma* | Jianghuang | *Curcuma Longa* L. | Rhizome | 12 g |
| *Alismatis Rhizoma* | Zexie | *Alisma orientale* (Sam.) Juzep. or  *Alisma plantago-aquatica* Linn. | Rhizome | 15 g |
| *Chrysanthemi Flos* | Juhua | *Chrysanthemum morifolium* Ramat. | Flower | 15 g |
| *Nelumbinis Folium* | Heye | *Nelumbo nucifera* Gaertn. | Leaf | 15 g |
| *Glycyrrhizae Radix* | Gancao | *Glycyrrhiza uralensis* Fisch. or  *Glycyrrhiza inflata* Bat. or  *Glycyrrhiza glabra* L. | Root/ Rhizome | 6 g |
| Jiangzhi granules | *Gynostemmae Pentaphylli herba* | Jiaogulan | *Gynostemma pentaphyllum* (Thunb.) Mak. | Whole plant | 15 g |
| *Polygoni Cuspidati Rhizoma et Radix* | Huzhang | *Panax quinquefolium* L. | Root/ Rhizome | 15 g |
| *Nelumbinis Folium* | Heye | *Nelumbo nucifera* Gaertn. | Leaf | 6 g |
| *Artemisiae Scopariae Herba* | Yinchen | *Artemisia scoparia* Waldst.etKit. or  *Artemisia capillaris* Thunb. | Aerial Part | 9 g |
| *Salviae miltiorrhizae Radix et Rhizoma* | Danshen | *Salvia miltiorrhiza* Bge. | Root/ Rhizome | 9 g |
| Chaihu Shugan powder | *Bupleuri Radix* | Chaihu | *Bupleurum chinense* DC. *or*  *Bupleurum scorzonerifolium* Willd. | Root | 6 g |
| *Chuanxiong Rhizoma* | Chuanxiong | *Ligusticum chuanxiong* Hort. | Rhizome | 5 g |
| *Aurantii Fructus* | Zhiqiao | *Citrus aurantium* L. | Fruit | 5 g |
| *Citri Reticulatae Pericarpium* | Chenpi | *Citrus reticulata* Blanco | Pericarp | 6 g |
| *Paeoniae Radix Alba* | Baishao | *Paeonia lactiflora* Pall. | Root | 5 g |
| Cyperi Rhizoma | Xiangfu | Cyperus rotundus L. | Rhizome | 5 g |
| *Glycyrrhizae Radix et Rhizoma Praeparata Cum Melle* | Gancao | *Glycyrrhiza uralensis* Fisch. or  *Glycyrrhiza inflata* Bat. or  *Glycyrrhiza glabra* L. | Root/ Rhizome | 3 g |
| Shugan Xiaozhi decoction | *Artemisiae Scopariae Herba* | Yinchen | *Artemisia scoparia* Waldst.etKit. or  *Artemisia capillaris* Thunb. | Aerial Part | 6 g |
| *Nelumbinis Folium* | Heye | *Nelumbo nucifera* Gaertn. | Leaf | 6 g |
| *Pumice Stone* | Fushi | *Pumex* | Cellular stone | 6 g |
| Cassiae Semen | Juemingzi | *Cassia obtusifolia* L. or *Cassia tora* L. | Seed | 6 g |
| *Crataegi Fructus* | Shanzha | *Crataegus pinnatifida* Bge. var. major  N. E. Br. or *Crataegus pinnatifida* Bge. | Fruit | 6 g |
| *Alismatis Rhizoma* | Zexie | *Alisma orientale* (Sam.) Juzep. or  *Alisma plantago-aquatica* Linn. | Rhizome | 6 g |
| *Poria* | Fuling | *Poria cocos* (Schw.) Wolf | Sclerotium | 4 g |
| *Aurantii Fructus* | Zhiqiao | *Citrus aurantium* L. | Fruit | 3 g |
| *Bupleuri Radix* | Chaihu | *Bupleurum chinense* DC. *or*  *Bupleurum scorzonerifolium* Willd. | Root | 2 g |
| *Gardeniae Fructus* | Zhizi | *Gardenia jasminoides* Ellis | Fruit | 2 g |
| *Paeoniae Radix Alba* | Baishao | *Paeonia lactiflora* Pall. | Root | 1 g |
| *Glycyrrhizae Radix* | Gancao | *Glycyrrhiza uralensis* Fisch. or  *Glycyrrhiza inflata* Bat. or  *Glycyrrhiza glabra* L. | Root/ Rhizome | 1 g |
| Hongqi Jiangzhi formula | *Astragali Radix* | Huangqi | *Astragalus membranaceus*(Fisch.) Bge.var.mongholicus (Bge.) Hsiao or  *Astragalus membranaceus* (Fisch.) Bge. | Root | 15 g |
| Rice fermented with the mould Monascus purpureus (Red Rice) | Hongqu | *Monascus purpureus* Went | Zymotic product | 12 g |
| *Artemisiae Scopariae Herba* | Yinchen | *Artemisia scoparia* Waldst.etKit. or  *Artemisia capillaris* Thunb. | Aerial Part | 10 g |
| *Lycii Fructus* | Gouqizi | *Lycium barbarum* L. | Fruit | 10 g |
| *Curcumae Longae Rhizoma* | Jianghuang | *Curcuma Longa* L. | Rhizome | 6 g |
| *Nelumbinis Folium* | Heye | *Nelumbo nucifera* Gaertn. | Leaf | 10 g |
| *Magnoliae Officinalis Cortex* | Houpo | *Magnolia officinalis* Rehd.et Wils. M*agnolia officinalis* Rehd.et Wils.var.biloba Rehd.et Wils. | Cortex | 6 g |
| Simiao decoction | *Atractylodis rhizoma* | Cangzhu | *Atractylodes lancea* (Thunb.) DC. | Rhizome | 12 g |
| *Phellodendri amurensis cortex* | Huangbo | *Phellodendron amurense* Rupr. | Cortex | 12 g |
| *Achyranthis bidentatae radix* | Niuxi | *Achyranthes bidentata* Bl. | Root | 12 g |
| *Coicis Semen* | Yiyiren | *Coix lacryma-jobi* L.var*.ma-yuen* (Roman.) Stapf. | Seed | 30 g |
| Quzhuo Tongbi decoction | *Smilacis glabrae rhizoma* | Tufuling | *Smilax glabra* Roxb. | Rhizome | 60 g |
| *Dioscoreae spongiosae rhizoma* | Bixie | *Dioscorea spongiosa* J. Q. Xi，M. Mizuno et W. L. Zhao | Rhizome | 30 g |
| *Corn Stigma* | Yumixu | *Zea mays* L. | Stigma | 15 g |
| *Coicis Semen* | Yiyiren | *Coix lacryma-jobi* L. var. ma-yuen (Rom.Caill.) Stapf | Seed | 30 g |
| *Siegesbeckiae Herba* | Xixiancao | *Siegesbeckia orientalis* L. | Whole plant | 18 g |
| *Curcumae Longae Rhizoma* | Jianghuang | *Curcuma longa* L. | Rhizome | 12 g |
| *Taxilli Herba* | Sangjishen | *Taxillus chinensis* (DC.) Danser. | Branch/Leaf | 15 g |
| *Corydalis Rhizoma* | Yanhusuo | *Corydalis yanhusuo* (Y. H. Chou and Chun C. Hsu) W. T. Wang ex Z. Y. Su and C. Y. Wu | Tuber | 18 g |
| *Citri Sarcodactylis Fructus* | Foshou | *Citrus medica* L. var. sarcodactylis Swingle. | Fruit | 12 g |
| Shanmei capsule | *Crataegi folium* | Shanzhaye | *Crataegus pinnatifida* Bge. var. major  N. E. Br. or *Crataegus pinnatifida* Bge. | Leaf | Unknown |
| *Davuricae fructus rosae* | Cimeiguo | *Rosa davurica* Pall. | Fruit |
| Shener Jiangzhi formula | *Acanthopanacis senticosi radix et rhizoma seu caulis* | Ciwujia | *Acanthopanax senticosus (Rupr.etMaxim.) Harms* | Root/ Rhizome | 265 g |
| *Lonice raejaponicae caulis* | Rendongteng | *Lonicera japonica* Thunb. | Stem | 177 g |
| *Crataegi fructus* | Shanzha | *Crataegus pinnatifida* Bge. | Fruit | 177 g |
| *Auricularia auricula* | Heimuer | *Auricularia auricular* (L.) Underw. | Fruiting body | 133 g |
| Jieyu Qutan Huazhuo formula | *Cyperi rhizoma* | Xiangfu | *Cyperus rotundus* L. | Rhizome | 10 g |
| *Citri reticulatae pericarpium* | Chenpi | *Citrus reticulata* Blanco | Pericarp | 8 g |
| *Pinelliae rhizoma* | Fabanxia | *Pinellia ternata* (Thunb.) Breit. | Stem tuber | 9 g |
| *Poria* | Fuling | *Poria cocos* (Schw.) Wolf | Sclerotium | 10 g |
| *Atractylodis rhizoma* | Cangzhu | *Atractylodes lancea* (Thunb.) DC. | Rhizome | 10 g |
| *Amomi fructus* | Sharen | *Amomum villosum* Lour. or  *Amomum villosum* Lour.var.xanthioides T.L.Wu et Senjen or  *Amomum longiligulare* T.L.Wu | Fruit | 5 g |
| *Massa Medicata Fermentata* | Shenqu | Medicated Leaven Massa Medicata Fermentata | Zymotic product | 15 g |
| *Crataegi fructus* | Shanzha | *Crataegus pinnatifida* Bge. var. major  N. E. Br. *or Crataegus pinnatifida* Bge. | Fruit | 15 g |
| *Gardeniae fructus* | Zhizi | *Gardenia jasminoides* Ellis. | Fruit | 10 g |
| *Chuanxiong rhizoma* | Chuanxiong | *Ligusticum chuanxiong* Hort. | Rhizome | 9 g |
| Tianhuang formula | *Notoginseng radix et rhizoma* | Sanqi | *Panax notoginseng* (Burk.) F. H. Chen | Root/ Rhizome | 600 g |
| *Coptidis rhizoma* | Huanglian | *Coptis chinensis* Franch. or  *Coptis deltoidea* C.Y.Cheng et Hsiao or  *Coptis teeta* Wall. | Rhizome | 500 g |
| Wuwei Qingzhuo powder | *Granati pericarpium* | Shiliu | *Punica granarum* L. | Pericarp | 400 g |
| *Carthami flos* | Honghua | *Carthamus tinctorius* L. | Flower | 200 g |
| *Amomi fructus rotundus* | Doukou | *Amomum kravanh* Pierre ex Gagnep. *or*  *Amomum compactum* Soland ex Maton | Fruit | 50 g |
| Cinnamomi cortex | Rougui | *Cinnamomum cassia* Presl | Cortex | 50 g |
| *Piperis longi fructus* | Biba | *Piper longum* L. | Bunch | 50 g |
| Yinian Kangbao tea | *Nelumbinis folium* | Heye | *Nelumbo nucifera* Gaertn. | Leaf | Unknown |
| *Crataegi Fructus* | Shanzha | *Crataegus pinnatifida* Bge. | Fruit |
| *Lycii Fructus* | Gouqizi | *Lycium barbarum* L. | Fruit |
| *Mori Folium* | Sangye | *Morus alba* L. | Leaf |
| *Dioscoreae Rhizoma* | Shanyao | *Dioscorea opposita* Thunb. | Rhizome |
| *Lily Bulbus* | Baihe | *Lilium lancifolium* Thunb. | Meaty scale leaves |
| *Poria* | Fuling | *Poria cocos (Schw.)* Wolf | Sclerotium |
| *Glycyrrhizae Radix ET Rhizoma* | Gancao | *Glycyrrhiza uralensis* Fisch. | Root/ Rhizome |
| *Alpiniae Officinarum Rhizoma* | Gaoliangjiang | *Alpinia officinarum* Hance. | Rhizome |
| *Puerariae Lobatae Radix* | Gegen | *Pueraria lobata (Willd.)* Ohwi | Root |
| *Platycodon Radix* | Jiegeng | *Platycodon grandiflorum* (jacp.) A. DC. | Root |
| *Nelumbinis Semen* | Lianzi | *Nelumbo nucifera* Gaertn. | Seed |
| *Portulacae Herba* | Machixian | *Portulaca oleracea* L. | Whole plant |
| *Cinnamomi Cortex* | Rougui | *Cinnamomum cassia* Presl | Cortex |
| *Polygonati Odorati Rhizoma* | Yuzhu | *Polygonatum odoratum* (MilL.) Druce | Rhizome |
| Congxin Lunzhi formula | *Coptidis Rhizoma* | Huanglian | *Coptis chinensis* Franch. or  *Coptis deltoidea* C.Y.Cheng et Hsiao or  *Coptis teeta* Wall. | Rhizome | 6 g |
| *Ganoderam* | Lingzhi | *Ganoderma lucidum* (Leyss.ex Fr.) Karst. *Ganoderma sinense* Zhao，Xu et Zhang | Sporophore | 10 g |
| *Ziziphi Spinosae Semen* | Suanzaoren | *Ziziphus jujuba Mill. var. spinosa* (Bunge) Hu ex H. F. Chou | Seed | 20 g |
| *Salviae miltiorrhizae Radix et Rhizoma* | Danshen | *Salvia miltiorrhiza* Bge. | Root/ Rhizome | 15 g |
| Qijian mixture | *Astragali Radix* | Huangqi | *Astragalus membranaceus* (Fisch.) or  Bge.var.mongholicus (Bge.) Hsiao or  *Astragalus membranaceus* (Fisch.) Bge. | Root | Unknown |
| [*Winged Euonymus Twig*](javascript:;) | Guijianyu | *Euonymus alatus* (Thunb.) Sieb. | Twig |
| *Salviae miltiorrhizae Radix et Rhizoma* | Danshen | *Salvia miltiorrhiza* Bge. | Root/ Rhizome |
| *Dioscoreae Rhizoma* | Shanyao | *Dioscorea oppositifolia* L. | Root/ Rhizome |
| *Rehmanniae Radix* | Dihuang | *Rehmannia glutinosa* Libosch. | Earthnut |
| *Puerariae Lobatae Radix* | Gegen | *Pueraria lobata* (Willd.) Ohwi | Root |
| *Coptidis Rhizoma* | Huanglian | *Coptis chinensis* Franch. or  *Coptis deltoidea* C.Y.Cheng et Hsiao or *Coptis teeta* Wall. | Rhizome |
| *Trichosanthis Radix* | Tianhuafen | *Trichosanthes kirilowii* Maxim. or  *Trichosanthes rosthornii* Harms | Root |
| *Poria* | Fuling | *Poria cocos* (Schw.) Wolf | Sclerotium |
| *Liriopis Tuber* | Maidong | *Ophiopogon japonicus* (L.f) Ker-Gawl. | Earthnut |

**Supplementary Table S2** Effect of herbal medicine on gut microbiota and its potential mechanism in the treatment of T2DM.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Herbal medicine | Subject | Outcome | Potential mechanism | Changes in gut microbiota | Reference |
| Naoxintong capsule | SD rats | TG ↓, TC ↓, LDL-C ↓, FFA ↓ | 1. Inflammation: IL-1β ↓, IL-6 ↓, TNF-α ↓, CRP ↓  2. AAs: alanine ↑, tyrosine ↑, tryptophan ↑  3. BAs: GCA ↓, GCDCA ↓ | 1. Family level: Ruminococcaceae↑, Helicobacteraceae↓  2. Genus level: *Ruminococcus* 1 ↑ | (Yan et al., 2020) |
| Xiexin decoction | SD rats | TC ↓, TG ↓, LDL-C ↓, FFA ↓, HOMA-IR ↓, HDL-C ↑, HOMA-ISI ↑ | 1. Inflammation: CRP ↓, IL-6 ↓, IL-1β ↓, TNF-α ↓  2. SCFAs: acetic acid ↑, propionic acid ↑, isobutyric acid ↑, butyric acid ↑ | 1. Phylum level: Actinobacteria↑  2. SCFA-producing bacteria: *Alloprevotella* ↑, *Barnesiella* ↑, *Eubacterium Ventriosum* group ↑, *Lachnospiraceae* UCG 001 ↑, *Papillibacter* ↑, *Prevotellaceae* NK3B31 group ↑ | (Wei et al., 2018) |
| Huanglian Jiedu decoction | SD rats | FBG ↓, TC ↓, TG ↓, LDL-C↓, HOMA-IR ↓, FINS ↓ | 1. Inflammation: CRP ↓, IL-6 ↓, IL-1β ↓, TNF-α ↓  2. AAs: valine ↓, leucine ↓, isoleucine ↓ | 1. Phylum level: Bacteroidetes↑, F/B ↓  2. Genus level: *Akkermansia* ↑  3. SCFA-producing bacteria: *Adlercreutzia* ↑, *Porphyromonadaceae* ↑, *Lachnospiraceae* ↑ | (Chen et al., 2018) |
| *Scutellaria baicalensis* Georgi (Labiatae; *Scutellariae radix*) and *Coptis chinensis Franch.* (Ranunculaceae; *Coptidis rhizoma*) | SD rats | FBG ↓, TG ↓, TC ↓, LDL-C ↓, FFA ↓, FINS ↓, HDL-C ↑ | 1. Inflammation: CRP ↓, IL-6 ↓, IL-1β ↓, TNF-α ↓  2. BAs: DCA ↓, CA ↓, TUDCA ↑, GCA ↑, TCA ↑ | 1. Phylum level: F/B ↓  2. SCFA-producing bacteria: *Bacteroidales* S24-7 group norank ↑, *Parasutterella* ↑, *Prevotellaceae* UCG 001 ↑  3. Secondary BA-producing bacteria: *Escherichia*-*Shigella* ↓ | (Xiao et al., 2020) |
| Jinqi Jiangtang tablet | C57BL/6J mice | FBG ↓, HbA1c ↓ | 1. Inflammation: TNF-α ↓, IL-6 ↓, MCP-1 ↓  2. SCAFs: acetic acid ↑, propionic acid ↑, butyric acid ↑ | 1. Phylum level: Verrucomicrobia↑  2. Family level: Helicobacteraceae↓  3. Genus level: *Desulfovibrio* ↓  4. SCFA-producing bacteria: *Akkermansia* ↑ | (Cao et al., 2019) |
| Gegen Jiaotai pills | SD rats | FBG ↓, TG ↓, TC ↓, LDL-C ↓, HOMA-IR ↓, HDL-C ↑ | 1. BA receptors: FXR ↑, TGR5 ↑  2. Colon BAs: CA ↑, TCA ↑, GCA ↑, CDCA ↑, TCDCA ↑, GCDCA ↑ | 1. Phylum level: Proteobacteria↓  2. Genus level: *Lactobacillus* ↑ | (Chen et al., 2021a) |
| *Edgeworthia gardneri* (Wall.) Meisn.(Thymelaeaceae; *Edgeworthiae rhei radix et flos*) and *Carthamus tinctorius* L. (Compositae;*Carthami flos*) | ZLN and ZDF rats | FBG ↓, TC ↓, TG ↓, FFA ↓, HOMA-IR ↓, FINS ↓ | 1. Gut barrier: occludin ↑  2. Inflammation: TNF-α ↓, IL-6 ↓, LPS ↓, MyD88 ↓, CTSK ↓, TLR4 ↓ | Phylum level: Actinobacteria↑, F/B ↓ | (Li et al., 2021b) |
| Shenqi compound | GK rats | FBG ↓, INS ↑ | 1. Gut barrier: ZO-1 ↑  2. Inflammation: LPS ↓  3. AAs: isoleucine ↑, tyrosine ↑, alanine ↑  4. SCFA: butyric acid ↑ | 1. Phylum level: F/B *↓*  2. Family level: Prevotellaceae↑  3. SCFA-producing bacteria: *Butyricimonas* ↑, *Bacteroides* ↑, *Blautia* ↑, *Roseburia* ↑ | (Zhang et al., 2022d) |
| Gegen Qinlian decoction | GK rats | FBG ↓, HOMA-IR ↓ | 1. SCFAs: acetic acid ↑, butyric acid ↑  2. Inflammation: IL-1β ↓, IL-6 ↓, IL-17 ↓, TNF-α ↓, IFN-γ ↓, MCP-1 ↓  3. Immune-related genes: NF-κB *↓* | 1. Genus level: *Alistipes* ↑, *Butyricimonas* ↑  2. SCFA-producing bacteria: *Faecalibacterium* ↑, *Roseburia* ↑, *Dorea* ↑, *Clostridium* XIVa↑, *Ruminococcus* 2↑, *Butyricicoccus* ↑ | (Xu et al., 2020) |
| *Lycium barbarum* L. (Solanaceae;*Lycii* leaves) | Rats | FBG ↓, TG ↓, LDL-C ↓, FFA ↓, ALT ↓, AST ↓, INS ↑ | Histidinal ↑, L-allothreonine ↑ | Genus level: *Ruminococcus* 1 ↓ | (Zhao et al., 2020) |
| Jiangtangjing granules | SD rats | FBG ↓, HbA1c ↓, INS ↑ | 1. GLP-1 ↑  2. Signaling pathway: cAMP/PKA ↑ | Phylum level: Bacteroidetes↑ | (Sun et al., 2022b) |
| *Scutellaria baicalensis* Georgi(Labiatae; *Scutellariae radix*) | SD rats | BW ↓, FBG ↓, TC ↓, TG ↓, LDL-C ↓, HDL-C ↓, INS ↓, HOMA-IR ↓ | 1. BA receptors: CYP7A1 ↑, FXR ↓  2. BAs: DCA ↓, LCA ↓, GDCA ↓, GLCA ↓, GUDCA ↓, TLCA ↓ | Genus level: *Lactobacillus* ↑, *Faecalibaculum* ↑ | (Zhao et al., 2021a) |
| *Ganoderma lucidum* (Leyss.ex Fr.) Karst.(Polyporaceae; *Ganoderma*) | SD rats | TC ↓, TG ↓, HDL-C ↑, INS1 ↑, INS2 ↑ | 1. Glycogen synthesis: GYG1 ↑, G6PC ↓  2. Lipid metabolism: ACC ↓, Fads1 ↓ | 1. Phylum level: Proteobacteria↓  2. Genus level: *Lactobacillus* ↑ | (Jiang et al., 2021b) |
| Linggui Zhugan formula | C57BL/6J mice | FBG ↓, HbA1c ↓, HOMA-IR ↓, TC ↓, TG ↓, LDL-C ↓, FFA ↓ | GLP-1 ↑, PYY ↑ | 1. Phylum level: Firmicutes↓, Bacteroidetes↑  2. Genus level: *Lactobacillus* ↑, *Bacteroides* ↑ | (Wu et al., 2019) |
| Shenlian decoction | C57BL/KsJ-db/db mice | BW ↓, FBG ↓ | 1. Lipopolysaccharide biosynthesis ↓  2. Insulin generation ↑ | 1. Phylum level: Epsilonbacteraeota↓, Verrucomicrobia↑  2. Family level: Rikenellaceae↓, Helicobacteraceae↓  3. Species level: *Bacteroides caecimuris* ↑, *Bacteroides acidifaciens* ↑ | (Sun et al., 2022a) |
| Liuwi Dihuang pills | GK rats | FBG ↓, INS ↓ | 1. SCFAs: acetic acid↑, propionic acid↑, butyric acid ↑  2. Signaling pathway: GPR43/41 ↑, GLP-1 ↑ | 1. Phylum level: Proteobacteria↓  2. Genus level: *Faexalibacterium* ↓  3. SCFA-producing bacteria: *Lactobacillus* ↑ | (Yi et al., 2022) |
| *Berberis kansuensis* C.K.Schneid.(Berberidaceae; *Berberis cortex*) | Wistar rats | BW ↓, FBG ↓, GSP ↓, HOMA-IR ↓, ISI ↑ | Inflammation: TNF-α ↓, IL-1β ↓, IL-6 ↓, LPS ↓ | 1. Phylum level: Bacteroidetes↑, Proteobacteria ↓, F/B ↓  2. Genus level: *Akkermansia* ↑, *Ruminococcus* g*auvreauii* Group ↓, *Escherichia*-*Shigella* ↓, *Enterococcus* ↓ | (Xu et al., 2021) |
| *Plantago asiatica* L.(Plantaginaceae; *Plantaginis semen*) | Wistar rats | FBG ↓, GSP ↓, NEFA ↓, TC ↓, TG ↓, HDL-C ↓, MDA ↓, SOD ↑, T-AOC ↑ | SCAFs: acetic acid ↑, propionic acid ↑, butyric acid ↑ | Species level: *Bacteroides* *ovatus* ↑, *Lactobacillus* *fermentum* ↑, *Prevotella* *loescheii* ↑ | (Nie et al., 2019) |
| *Rheum palmatum* L. (Polygonaceae; *Rhei radix et rhizoma*) | SD rats | FBG ↓, GSP ↓, HOMA-IR ↓ | 1. Gut barrier: ZO-1 ↑, occludin ↑  2. Inflammation: LPS ↓  3. Signaling pathway: GLP-1 ↑ | 1. Phylum level: Firmicutes↓, Bacteroidetes↑  2. Genus level: *Lactobacillus* ↑, *Roseburia* ↑, *Akkermansia* ↑, *Desulfovibrio* ↓ | (Cui et al., 2019) |
| *Sophora flavescens* Ait. (Leguminosae; *Sophorae flavescentis radix*) | SD rats | FBG ↓, GSP ↓, TC ↓, TG ↓, LDL-C ↓, HDL-C ↑ | 1. AAs: indole ↑, tyramine ↑  2. BAs: CA ↓, DCA ↓, GCA ↓ | 1. Genus level: *Blautia* ↑, *Phascolarctobacterium* ↓, *Prevotella* ↓, *Faecalibacterium* ↓  2. BA-producing bacteria: *Ruminococcus* ↑ | (Shao et al., 2020) |
| *Ophiopogon japonicus* (L.f) Ker-Gawl. (Liliaceae; *Ophiopogonis radix*) | C57BL/6J mice | FBG ↓, HOMA-IR ↓ | SCFAs: isobutyrate ↑, acetate ↑, caprate ↑, butyrate ↑, propionate ↑, lactate ↑, valerate ↑ | 1. Phylum level: Proteobacteria↓, Actinobacteria↑  2. Family level: Desulfovibrionaceae↓  3. Genus level: *Bifidobacterium* ↑ | (Wang et al., 2019a) |
| *Cyclocarya paliurus* (Batalin) Iljinsk. (Juglandaceae; *Cylocaryae paliuri folium*) | Wistar rats | FBG ↓, HOMA-IR ↓ | 1. Inflammation: IL-1β ↓, IL-6 ↓, TNF-α ↓  2. Leptin ↓, diponectin ↑, GLP-1 ↑  3. SCFAs: acetic ↑, propionic ↑, butyric acids ↑ | 1. Phylum level: F/B ↓  2. Genus level: *Lachnospiraceae* NK4A136 group↑, *Roseburia* ↑, *Prevotellaceae* UCG 001 ↓ | (Li et al., 2021d) |
| *Sargassum fusiforme* (Harv.) Setch. (Sargassaceae; *Sargassum*) | ICR mice | FBG ↓, MDA ↓, IPGTT ↓, TC ↓, TG ↓, LDL-C ↓, HDL-C ↑, CAT ↑, SOD ↑ | AAs: L-valine ↓, L-isoleucine ↓, aromatic amino acids ↓, L-tyrosine ↑, L-phenylalanine ↑ | Genus level: *Romboutsia* ↓, *Roseburia* ↑, *Anaerotruncus* ↑, *Lachnoclostridium* ↑, *Bifidobacterium* ↑, *Ruminococcus* ↑ | (Wu et al., 2021b) |
| Qijian mixture | Male KKay  mice | FBG ↓, TC ↓, INS ↑ | - | 1. Phylum level: Bacteroidetes↑  2. Family level: Lachnospiraceae↑  3. Genus level: *Lachnospiraceae* NK4A136, *Alistipes*, *Parabacteroides* ↑ | (Gao et al., 2018) |

**Abbreviations:** TG, triglyceride; TC, total cholesterol; LDL-C, low-density lipoprotein cholesterol; FFA, free fatty acid; HOMA-IR, homeostasis assessment of insulin resistance; HDL-C, high-density lipoprotein cholesterol; HOMA-ISI, homeostasis assessment of insulin sensitivity index; FBG, fasting blood glucose; FINS, fasting insulin; HbAlc, glycosylated hemoglobin; INS, insulin; ALT, alanine aminotransferase; AST, aspartate aminotransferase; BW, body weight; GSP, glycated serum protein; ISI, insulin sensitivity index; NEFA, non esterified fatty acid; MDA, malondialdehyde; SOD, superoxide dismutase; T-AOC, total antioxidant capacity; IPGTT, intraperitoneal glucose tolerance test; CAT, catalase; IL, interleukin; TNF-α, tumor necrosis factor α; CRP, C reactive protein; AA, amino acid; BA, bile acid; SCFA, short-chain fatty acid; DCA, deoxycholic acid; CA, cholic acid; TUDCA, tauroursodeoxycholic acid; GCA, glycocholic acid; TCA, taurocholic acid; FXR, farnesoid X receptor; TGR5, takeda G protein-coupled receptor 5; CDCA, chenodeoxycholic acid; TCDCA, taurochenodeoxycholic acid; GCDCA, glycoursodeoxycholic acid; LPS, lipopolysaccharide; MyD88, myeloid differentiation primary response gene 88; CTSK, cathepsin K; TLR, toll-like receptor; ZO-1, zonulaoccludens 1; IFN, interferon; MCP-1, monocyte chemoattractant protein 1; NF-κB, nuclear factor kappa B; GLP-1, glucagon-like peptide-1; cAMP, cyclic adenosine monophosphate; PKA, protein kinase A; CYP7A1, cholesterol 7α-hydroxylase; LCA, lithocholic acid; GDCA, glycodeoxycholic acid; GLCA, glycolithocholate acid; GUDCA, glycoursodeoxycholic acid; TLCA, Taurolithocholic acid; GYG1, glycogenin‐1; G6PC, glucose‐6‐phosphatase‐α; ACC, acetyl-CoA carboxylse; Fads, fatty acyl desaturases; PYY, peptide YY; GPR, G protein-coupled receptor.

**Supplementary Table S3 Effect of herbal medicine on gut microbiota and its potential mechanism in the treatment of obesity.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Herbal medicine | Subject | Outcome | Potential mechanism | Changes in gut microbiota | Reference |
| Chowiseungcheng decoction | C57BL/6J mice | BW ↓, LW ↓, ATW ↓, FBG ↓, TG ↓, AST ↓, ALT ↑, HDL-C ↑ | 1. Neuropeptides: AgRP ↓, NPY ↓  2. Adipokines: RBP4 ↓ | Phylum level: Firmicutes *↓*, F/B *↓* | (Ansari et al., 2016) |
| *Bupleurum chinense* DC. (Apiaceae; *Bupleuri* *radix*) | C57BL/6J mice | TG ↓, NEFA ↓, LDL-C ↓ | 1. Gene expression: ATG ↑, FASN ↓, SREBP1c ↓  2. Signaling pathway: FGF21 ↑, KLB ↑, PGC1α↑, GLUT1 ↑ | 1. Phylum level: F/B↓, Proteobacteria↓  2. Family level: Desulfovibrionacea↓, Porphyromonadaceae↑  3. Genus level: *Parabacteroides* ↑, *Lactobacillus* ↑ | (Wu et al., 2021a) |
| Daesiho decoction | C57BL/6J mice | BW ↓, LW ↓, TC ↓, TG ↓, FBG ↓, HDL-C ↑ | Lipid metabolism: ACAA2 ↑, CXCL16 ↑, SNX17 ↑, SREBF2 ↑, Vldlr ↑ | Genus level: *Roseburia* ↑, *Bacteroides* ↑, *Ruminococcus* ↑, *Bifidobacterium* ↑ | (Hussain et al., 2016) |
| Erchen decoction | C57BL/6J mice | BW ↓, BWG ↓, FBG ↓, HOMA-IR ↓, LDL-C ↓, TG ↓, ALT ↑ | SCFA: isobutyric ↑ | 1. Phylum level: Fimicutes↓  2. Genus level: *Prevotella* ↓, *Holdemania* ↓, *Akkermansia* ↑ | (Zhao et al., 2021b) |
| Kangshuailao tablet | C57BL/6J mice | BW ↓, FBG ↓ | —— | 1. Phylum level: Firmicutes ↓, Proteobacteria ↓, F/B ↓, Bacteroidetes↑  2. Genus level: *Bacteroides* ↑, *Alistipes* ↑, *Christensenellaceae* R-7 group↓ | (Gong et al., 2020) |
| *Juglans mandshurica* Maxim. (Juglandaceae; *Juglandis mandshurica pericarpium*) | SD rats | TC ↓, TG ↓, LDL-C ↓, ALT ↓, AST ↓, MDA ↓, FPG ↓, INS ↓, HOMA-IR ↓, HDL-C ↑ | —— | 1. Phylum level: Firmicutes↓, Bacteroidetes↑  2. Genus level: *Romboutsia* ↓, *Bacteroides* ↑ | (Wang et al., 2019b) |
| *Spatholobus suberectus* Dunn (Leguminosae; *Spatholobi caulis*) | C57BL/6J mice | BW ↓, TG ↓, LDL-C ↓, HDL-C ↑ | 1. BAT: UCP1 ↑, PRDM16 ↑, PGC1α ↑, MCAD ↑, TFAM ↑  2. Inflammation: TNF-α ↓, IL-6 ↓, IL-1β ↓  3. Lipid metabolism: SREBP1 ↓, ACC ↓, FASN ↓, PPARγ ↓, PPARα ↑, HSL ↑, ATGL ↑, FAO ↑, SIRT1 ↑, CPT-1α ↑, CPT-1β ↑ | 1. Phylum level: Bacteroidetes↑, Anaerotruncus↑,  2. Family level: Ruminococcaceae↑  3. Genus level: *Enterococcus* ↓, *Bacteroides* ↓, *Lactobacillus* ↑, *Candidatus*-*Arthromitus* ↑, *Ruminococcus* ↑, *Prevotella* ↑, *Adlercreutzia* ↑, *Anaerotruncus* ↑, *Parabacteroides* ↑, *Bifidobacterium* ↑ | (Zhang et al., 2019) |
| *Corydalis bungeana* Turcz. (Papaveraceae; *Corydalis bungeanae herba*) | Wistar rats | BW ↓, CCK ↓, TG ↓, TC ↓ | 1. AAs: citrulline ↑, L-lysine ↑, dimethylglycine ↓  2. BA: CA ↓ | 1. Phylum level: Proteobacteria↓  2. Family level: Lachnospiraceae↑, Sutterellaceae↑, Porphyromonadaceae↑ | (Fu et al., 2022) |
| Jianpi Tiaogan drink | C57BL/6J mice | TC ↓, TG ↓, LDL-C ↓, HDL-C ↑ | —— | 1. Phylum level: Proteobacteria ↓, Firmicutes ↓, F/B ↓  2. Family level: Erysipelotrichaceae ↓, Parvibacter↓  3. Genus level: *Clostridium sensu stricto* 1 ↓, *Erysipelotrichia* ↓, *Erysipelotrichales* ↓ | (Dong et al., 2022) |
| *Momordica charantia* L. (Cucurbitaceae; *Momordicae charantiae fructus*) | SD rats | BW ↓, FBG ↓, HOMA-IR ↓, FBG ↓, FINS ↓, TC ↓, HDL-C ↑ | 1. Inflammation: TNF-α ↓, IL-6 ↓, MCP-1 ↓  2. Signaling pathway: NF-кB ↓ | 1. Family level: Enterobacteriaceae↓, Desulfovibrionaceae↓  2. Genus level: *Allobaculum* ↑, *Butyricimonas* ↑, *Faecalibacterium* ↑, *Escherichia* ↓ | (Bai et al., 2016) |
| *Ganoderma lucidum* (Leyss.ex Fr.) Karst. (Polyporaceae; *Ganoderma*) | C57BL/6J mice | BW ↓, BWG ↓, FBG ↓, FFA ↓, FINS ↓, IR ↓ | 1. Inflammation: TNF-α↓, IL-1β ↓, IL-6 ↓, PAI-1 ↓, IL-10 ↑, TLR4 ↓  2. Gut barrier: ZO-1 ↑, occludin ↑ | 1. Phylum level: F/B↓, Proteobacteria↓  2. Species level: *Bacteroides* spp. ↑, *Anaerotruncus colihominis* ↑, *Roseburia hominis* ↑, *Clostridium* cluster↑, *Escherichia fergusonii* ↓, *Oscillibacter valericigenes* ↓, *Lactococcus lactis* ↓ | (Chang et al., 2017) |
| *Paeonia suffruticosa* Andr. (Ranunculaceae; *Moutan cortex*)  and *Paeonia veitchii* Lynch (Ranunculaceae; *Paeoniae radix* rubra) | C57BL/6J mice | BWG ↓, FPINS ↓, FBG ↓, FBG ↓, TC ↓, TG ↓, LDL-C ↓, HDL-C ↑ | 1. Glucose metabolism ↑  2. Gut-liver axis: SREBP1c ↓, SREBP2 ↓ | Genus level: *Bacteroides* ↓, *Anaerotruncus* ↑, *Flavonifractor* ↑ | (Zhong et al., 2017) |
| *Panax ginseng* C. A. Mey. (Araliaceae; *Ginseng radix et rhizoma*) | C57BL/6J mice | BWG ↓, BW ↓, HOMA-ISI ↑ | —— | Species level: *Enterococcus faecalis* ↑ | (Quan et al., 2020) |
| Sanggua drink | C57BL/6J mice | HOMA-IR ↓, TC ↓, TG ↓, LDL-C ↓, HDL-C ↑ | 1. Pathway: PPARα ↑ | 1. Phylum level: F/B ↓, Verrucomicrobia↑  2. Family level: Erysipelotrichaceae↓, Christensenellaceae↓, Verrucomicrobiaceae↓,Rikenellaceae↓ | (Zheng et al., 2020) |
| *Citrus aurantium* L. (Rutaceae; *Aurantii fructus*) | C57BL/6J mice | BW ↓, LW ↓, FBG ↓, FINS ↓, HOMA-IR ↓, TC ↓, TG ↓, NEFA ↓, LDL-C ↓, ALT ↓, AST ↓ | 1.Inflammation: LPS ↓, NF-κB/IκKα/β ↓, TNF-α ↓  2. Gut barrier: claudin-3 ↑, occludin ↑ | 1. Phylum level: Verrucomicrobia ↑, Bacteroidetes ↑, F/B ↓  2. Genus level: *Akkermansia* ↑, *Alistipes* ↑ | (Bai et al., 2019) |

**Abbreviations:** BW, body weight; LW, liver weight; ATW, adipose tissue weight; FBG, fasting blood glucose; TG, triglyceride; ALT, alanine aminotransferase; AST, aspartate aminotransferase; HDL-C, high-density lipoprotein cholesterol; NEFA, non esterified fatty acid; LDL-C, low-density lipoprotein cholesterol; BWG, body weight gain; HOMA-IR, homeostasis assessment of insulin resistance; MDA, malondialdehyde; FPG, fasting plasma glucose; INS, insulin; CCK, cholecystokinin; FINS, fasting insulin; FFA, free fatty acid; IR, insulin resistance; FPINS, fasting plasma insulin; HOMA-ISI, homeostasis assessment of insulin sensitivity index; LPS, lipopolysaccharide; NF-κB, nuclear factor kappa B; IκK, inhibitor of NF-κB kinase α; PPAR, peroxisome proliferator-activated receptor; SREBP, sterol-regulatory element binding protein, ZO-1, zonulaoccludens 1; TLR, toll-like receptor; IL, interleukin; TNF-α, tumor necrosis factor α; PAI-1, plasminogen activator inhibitor 1; MCP-1, monocyte chemoattractant protein 1; AA, amino acid; BA, bile acid; CA, cholic acid; SCFA, short-chain fatty acid; ACC, acetyl-CoA carboxylse; CPT, carnitine palmitoyl transferase; ATG, anti-thymocyte globulin; HSL, hormone sensitive lipase; ATGL, adipose triglyceride lipase; GLUT, glucose transporter; CXCL16, CXC chemokine ligand 16; SNX17, sorting nexin 17; Vldlr, very low density lipoprotein receptor; ACAA2, acetyl-coenzyme A acyltransferase 2; PGC1α, peroxisome proliferator-activated receptor gamma coactivator 1α; RBP4, retinol‐binding protein 4; AgRP, agouti-related peptide; NPY, neuropeptide Y; SIRT1, sirtuin 1; TFAM, mitochondrial transcription factor A; MCAD, medium-chain acyl-CoA dehydrogenase; KLB, β-klotho; FASN, fatty acid synthase; UCP, uncoupling protein 1; PRDM, positive regulatory domain containing; FGF, fibroblast growth factor; BAT, brown adipose tissue; FAO, fatty acid oxidation.

**Supplementary Table S4 Effect of herbal medicine on gut microbiota and its potential mechanism in the treatment of NAFLD.**

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| Herbal medicine | Subject | Outcome | Potential mechanism | Changes in gut microbiota | Reference |
| *Ophiopogon japonicus* (L.f) Ker-Gawl. (Liliaceae; *Ophiopogonis radix*) | C57BL/6J mice | BW ↓, TG ↓, TC ↓, HDL-C ↓, LDL-C ↓, AST ↓, ALT ↓ | 1. Inflammation: IL-1β ↓, IL-6 ↓, TNF-α ↓  2. Gut barrier: occludin ↑, ZO-1 ↑, Muc-2 ↑  3. Lipid metabolism: SREBP1c ↓, FASN ↓, ACC-1 ↓, C/EBP ↓, PPARγ ↓ | 1. Phylum level: F/B ↓  2. Genus level: *Akkermansia* ↑, *Lachnospiraceae* NK4A136 group↑, *Allobaculum* ↑ | (Zhang et al., 2022a) |
| Salvia-Nelumbinis naturalis formula | C57BL/6J mice | TG ↓, TC ↓, ALT ↓, AST ↓ | 1. BAs: GHCA ↓, T-ω-MCA ↓, GCA ↓, GDCA ↓, ω-MCA ↓  2. Receptors: FXR ↑, FGF15 ↑  3. Inflammation: CD68 ↓, IL-1β ↓, TNF-α ↓ | 1. Phylum level: F/B ↓  2. Family level: Prevotellaceae↑, Lachnospiraceae↑, Akkermansiaceae↑  3. Genus level: *Clostridium sensu stricto* 1 ↓, *Alloprevotella* ↑, *Roseburia* ↑, *Lachnospiraceae* NK4A136 group↑, *Akkermansia* ↑ | (Li et al., 2021a) |
| Shenling Baizhu powder | SD rats | BW ↓, LW ↓, ALT ↓, AST ↓, TG ↓, TC ↓ | 1. Inflammation: LPS ↓, IL-1β ↓, IL-1 ↓, TNF-α ↓  2. Signaling pathway: TLR4 ↓, MyD88 ↓, NLRP3 ↓ | 1. Phylum level: Actinobacteria↑, Bacteroidetes↑, F/B ↓  2. Genus level: *Bifidobacterium* ↑, *Phascolarctobacterium* ↓, *Desulfovibrio* ↓ | (Zhang et al., 2018) |
| *Poria cocos* (Schw.) Wolf (Polyporaceae; *Poria*) | C57BL/6J mice | MDA ↓, T- AOC ↑, AST ↓, ALT ↓, HDL-C ↑ | 1. Inflammation: LPS ↓  2. Signaling pathway: NF-κB ↓, CCL3 ↓, CCR1 ↓ | Genus level: *Faecalibaculu* ↑, *Tuzzerella* ↓, *Enterococcus* ↓ | (Tan et al., 2022) |
| Simiao decoction | C57BL/6J mice | BWG ↓, BW ↓, LW ↓, FBG ↓, IPGTT ↓, TG ↓, TC ↓, LDL-C ↓, AST ↓, ALT ↓ | 1. Lipid metabolism: Acly ↓, ACC ↓, FASN ↓, SCD-1 ↓, PPARα ↓, CD36 ↓  2. Inflammation: NLRP3 ↓, Il-1α ↓, IL-1β ↓  3. Gut barrier: ZO-1 ↑, occludin ↑ | 1. Phylum level: Verrucomicrobia↑, Firmicutes↓  2. Genus level: *Akkermansia* ↑  3. SCFA-producing bacteria: *Bifidobacterium* ↑, *Faecalibaculum* ↑  4. Species level: *Akkermansia muciniphila* ↑ | (Han et al., 2021) |
| Qushi Huayu decoction | C57BL/6J mice | BW ↓, ALT ↓, TG ↓ | 1. Inflammation: LPS ↓, LBP ↓, CD14 ↓, NF-κB ↓, CPT ↓  2. Gut barrier: ZO-1 ↑, occludin ↑, claudin-1 ↑ | 1. Phylum level: Firmicutes↓  2. Genus level: *Romboutsia* ↓, *Rikenella* ↓, *Tyzzerella* ↓, *Parabacteroides* ↑ | (Leng et al., 2020) |
| *Cassia obtusifolia* L. (Leguminosae; *Cassiae semen*) | C57BL/6J mice | LW ↓, TC ↓, TG ↓, FFA ↓, LDL-C ↓, ALT ↓, AST ↓ | 1. Inflammation: TNF-α ↓, LPS ↓, IL-6 ↓, IL-10 ↑  2. Gut barriers: occludin ↑, ZO-1 ↑ | 1. Phylum level: Firmicutes↓  2. Genus level: *Klebsiella* ↓, *Ruminococcus* ↑ | (Luo et al., 2021) |
| *Paeonia lactiflora* Pall. (Ranunculaceae; *Paeoniae radix* alba) and *Glycyrrhiza uralensis* Fisch. (Leguminosae; *Glycyrrhizae radix et rhizoma*) | C57BL/6J mice | BW ↓, BWG ↓, LW ↓, HOMA-IR ↓, FINS ↓  TG ↓, FFA ↓, ALT ↓ | 1. Inflammation: LPS ↓, MCP-1 ↓, IL-6 ↓  2. Gut barrier: ZO-1 ↑, occludin ↑  3. Gut-liver axis: TLR2 ↓, TLR9 ↓ | 1. Phylum level:Firmicutes↓, F/B↓, Proteobacteria↓, Bacteroidetes↑  2. Genus level: *Desulfovibrio* ↓ | (Chen et al., 2021b) |
| Dachaihu decoction | SD rats | BW ↓, MDA ↓, SOD ↑, GSH-Px ↑, TG ↓, TC ↓, AST ↓, ALT ↓, INS ↓, HOMA-IR ↓ | AAs: glycine ↓, serine ↓, threonine ↓, leucine ↓, 5-HPETE ↓, isoleucine ↓ | 1. Phylum level: F/B ↓  2. Genus: *Bacteroides* ↑, *Lactobacillus* ↑, *Akkermansia* ↑, *Turicibacter* ↑ | (Cui et al., 2020) |
| *Dendrobium officinale* Kimura & Migo (Orchidceae; *Dendrobii officinalis caulis*) | ICR mice | TC ↓, LDL-C ↓ | 1. Signaling pathway: TLR4 ↓, NF-κB ↓, MyD88 ↓  2. Inflammation: LPS ↓, TNF-α ↓, IL-6 ↓, IFN-γ ↓  3. Gut barrier: ZO-1 ↑, occlaudin ↑ | Genus level: *Desulfovibrio* ↓, *Rikenella* ↓ | (Lei et al., 2019) |
| Defatted walnut powder | C57BL/6 mice | BW ↓, LW ↓, FBG ↓  TG ↓, TC ↓, LDL-C ↓, MDA ↓, HDL-C ↑ | Signaling pathway: NF-κB ↓, MAPK ↓ | 1. Phylum level: Firmicutes↓  2. Class level: Erysipelotrichia↓  3. Family level: Prevotellaceae↑  4. Genus level: *Bacteroides* ↑ | (Ren et al., 2021) |
| *Penthorum chinense* Pursh. (Saxifragaceae; *Penthori chinensis herba*) | C57BL/6J mice | LW ↓, FBG ↓, FINS ↓, HOMA-IR ↓, TC ↓, TG ↓, LDL-C ↓, ALT ↓, AST ↓ | 1. BA receptors: CYP7A1 ↑, CYP7B1 ↑, FXR ↑, BSEP ↑  2. BAs: T-β-MCA ↓, TDCA ↓, TCDCA ↓, TUDCA ↓, UDCA ↓, CDCA ↓, T-β-MCA ↑, DCA ↑ | 1. Phylum level: F/B ↓  2. Genus level: *Akkermansia* ↑, *Parabacteroides* ↑, *Clostridium* Ⅳ ↓ | (Li et al., 2022) |
| Qianggan formula | C57BL/6J mice | ALT ↓, AST ↓ | 1. Inflammation: TNF-α ↓, IL-1β ↓, TLR4 ↓, MyD88 ↓, NF-ĸB ↓, IκBα ↓  2. BA receptors: TGR5 ↓, FXR ↓, BSEP ↑  3. BAs: TDCA ↓, TLCA ↓ | Class level: Clostridia↑ | (Li et al., 2020) |
| *Gynostemma pentaphyllum* (Thunb.) Makino(Cucurbitaceae; *Gynostemmae pentaphylli* herba) | C57BL/6 J mice | FBG ↓, HOMA-IR ↓, AST ↓, ALT ↓  Liver: TG ↓ | Liver lipid metabolism: HNF-4α ↑, SIRT1 ↑, PPARα ↑ | 1. Phylum level:Firmicutes↓,Proteobacteria↓  2. Genus level: *Eubacterium* ↓, *Clostridium* ↓, *Parasutterella* ↑ | (Jia et al., 2018) |
| Qushi  Huayu formula | SD rats | BW ↓, TG ↓, FFA ↓ | —— | 1. Phylum level: Actinobacteria↑  2. Family level:Peptococcaceae↓  3. Genus level: *Sporacetigenium* ↑, *Collinsella* ↑  4. Species level: *Collinsella aerofaciens* ↑ | (Yin et al., 2013) |
| Jiangan Jiangzhi pills | SD rats | BW ↓, TC ↓, TG ↓, ALT ↓, AST ↓ | Inflammation: IL-6 ↓, IL-1β ↓, TNF-α ↓ | 1. Phylum level: F/B ↓  2. Genus level: *Lactobacillus* ↑, *Bacteroides* ↑, *Turicibacter* ↑, *Akkermansia* ↑, *Staphylococcaceae* ↑, *Enterococcus* ↓ | (Zhao et al., 2022) |
| Erchen decoction | SD rats | BW ↓, MDA ↓, SOD ↓, GSH-Px ↑, TC ↓, TG ↓, ALT ↓, AST ↓ | 1. Inflammation: IL-6 ↓, IL-1β ↓, TNF-α ↓  2. BA: TCA ↑ | 1. Phylum level: F/B ↓  2. Family level: Lachnospiraceae↑  3. Genus level: *Desulfovibrio* ↓, *Lactobacillus* ↑, *Dubosiella* ↑, *Akkermansia* ↑, *Intestinimonas* ↑ | (Miao et al., 2022) |
| Jiangan Xiaozhi decoction | SD rats | BWG ↓, ALT ↓, AST ↓, TC ↓, TG ↓ | 1. Gut barrier: occludin ↑, ZO-1 ↑  2. Inflammation: IL-6 ↓, IL-1β ↓, TNF-α ↓ | 1. Phylum level: F/B ↓  2. Genus level: *Lactobacillus* ↓, *Blautia* ↓, *Collinsella* ↓ | (Liao et al., 2020) |
| Jiangzhi granules | C57BL/6J mice | BW ↓, BWG ↓, MDA ↓, HOMA-IR ↓, SOD ↑, FFA ↓, ALT ↓, TC ↓, TG ↓ | 1. Gut barrier: occludin ↑, ZO-1 ↑, Muc-5 ↑  2. Liver lipid metabolism: PPARα ↑, CD14 ↑, TLR2 ↓, FABP5 ↓ | 1. Phylum level: Proteobacteria ↓, F/B ↓  2. Family level: Lachnospiraceae↑, Desulfovibrionaceae↓, Rikenellaceae↓, Christensenellaceae↓, Peptococcaceae↓ | (Wang et al., 2021) |
| Chaihu Shugan powder | SD rats | BW ↓, TC ↓, TG ↓ | 1. Inflammation: TNF-α ↓, IL-1β ↓, IL-18 ↓, NF-кB ↓, NLRP3 ↓  2. SCFA: butyric acid ↑ | 1. Family level:Enterobacteriaceae↓,Staphylococcaceae↓  2. Genus level: *Veillonella* ↑, *Anaeroplasma* ↑ | (Liang et al., 2018b) |
| *Mallotus oblongifolius* (Miq.) Muell. Arg. (Euphorbiaceae *Mallotus folium*) | Wistar rats | TC ↓, LDL-C ↓, ALT ↓, GGT ↓ | Inflammation: IL-1β ↓, TNF-α↓, IL-6 ↓ | Phylum level: Actinobacteria↑, Tenericutes↑ | (Lin et al., 2022) |
| Shugan Xiaozhi decoction | SD rats | ALT ↓, AST ↓, TC ↓, TG ↓ | 1. Lipid metabolism: PPARα ↑  2. Gut barrier: ZO-1 ↑, occludin ↑, SIgA ↓  3. Inflammation: LPS ↓, IL-1β ↓, TNF-α ↓,  MCP-1 ↓ | Family level: Erysipelotrichaceae↓, Desulfovibrionaceae↓, Prevotellaceae↑ | (Yang et al., 2022a) |
| Hongqi Jiangzhi formula | SD rats | BW ↓, TC ↓, TG ↓, LDL-C ↓ | 1. Gut barrier: occludin ↑ZO-1 ↑  2. Inflammation: LPS ↓, IL-1β↓, IL-18 ↓,  NLRP3 ↓ | 1. Class level: Epsilonproteobacteria↓  2. Order level:Campylobacterales↓  3. Family level: Helicobacteraceae ↓, Verrucomicrobiaceae ↓, Enterobacteriaceae↓ | (Liang et al., 2018a) |

**Abbreviations:** BW, body weight; LW, liver weight; ALT, alanine aminotransferase; AST, aspartate aminotransferase; MDA, malondialdehyde; FFA, free fatty acid; TG, triglyceride; TC, total cholesterol; LDL-C, low-density lipoprotein cholesterol; HOMA-IR, homeostasis assessment of insulin resistance; HDL-C, high-density lipoprotein cholesterol; HOMA-ISI, homeostasis assessment of insulin sensitivity index; FBG, fasting blood glucose; FINS, fasting insulin; SOD, superoxide dismutase; T-AOC, total antioxidant capacity; IPGTT, intraperitoneal glucose tolerance test; INS, insulin; BWG, body weight gain; GGT, gamma-glutamyltransferase; LPS, lipopolysaccharide; IL, interleukin; TNF-α, tumor necrosis factor α; ZO-1, zonulaoccludens 1; MCP-1, monocyte chemoattractant protein 1; NLRP3, NOD-like receptor thermal protein domain associated protein 3; GSH-Px, glutathtone peroxtdase; SIgA, secretory immunoglobulin A; PPAR, peroxisome proliferator-activated receptor; NF-κB, nuclear factor kappa B; IκK, inhibitor of NF-κB kinase α; TLR, toll-like receptor; Muc, mucin; FABP, fatty acid binding protein; CD, leukocyte differentiation antigen; BA, bile acid; TCA, taurocholic acid; SCFA, short-chain fatty acid; CYP7A1, cholesterol 7α-hydroxylase; CYP7B1, oxysterol 7α-hydroxylase; FXR, farnesoid X receptor; MAPK, mitogen-activated protein kinase; TDCA, taurodeoxycholic acid; DCA, deoxycholic acid; UDCA, ursodeoxycholic acid; CDCA, chenodeoxycholic acid; TUDCA, tauroursodeoxycholic acid; TCDCA, taurochenodeoxycholic acid; T-β-MCA, tauro-β-muricholic acid; TDCA, taurodeoxycholic acid; TLCA, Taurolithocholic acid; SIRT1, sirtuin 1; MyD88, myeloid differentiation primary response gene 88; AA, amino acid; IFN, interferon; C/EBP, CCAAT/enhancer-binding protein; CCR1, chemokine receptor; BSEP, bile salt export pump; HNF-4α, hepatocyte nuclear factor 4α; SREBP, sterol regulatory element-binding protein; FASN, fatty acid synthase; SCD, stearoyl-CoA desaturase; ACC, acetyl-CoA carboxylse; GHCA, glycohyocholic acid; T-ω-MCA, tauro-ω-muricholic acid; GDCA, glycodeoxycholic acid; ω-MCA, ω-muricholic acid; GCA, glycocholic acid; FGF, fibroblast growth factor; Acly, ATP citrate lyase; CPT, carnitine palmitoyl transferase; CCL3, C-C motif chemokine ligand 3; LBP, lipopolysaccharide binding protein.

**Supplementary Table S5 Effect of herbal medicine on gut microbiota and its potential mechanism in the treatment of gout.**

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| --- | --- | --- | --- | --- | --- |
| Herbal medicine | Subject | Outcome | Potential mechanism | Changes in gut microbiota | Reference |
| Simiao decoction | C57BL/6J mice | XOD ↓, MPO ↓, SUA ↓, BW ↓ | 1. Inflammation: IL-1β ↓, IL-9 ↓, IFN-γ ↓, MIP-1α ↓, MIP-1β ↓, IL-1α ↓, IL-6 ↓, IL-12 ↓, MCP-1 ↓, NLRP3 ↓, TNF-α↓, Caspase-8 ↓  2. Lipid metabolism: p-STAT3 ↓, APOB ↓, PPARα ↓, FN1 ↓, LPL ↓ | Genus level: *Prevotella* ↓, *Escherichia-Shigella* ↓, *Klebsiella* ↓, *Megamonas* ↓, *Enterococcus* ↓, *Phascolarctobacterium* ↓, *Prevotellaceae* Nk3b31 ↓ | (Lin et al., 2020) |
| Quzhuo Tongbi decoction | C57BL/6J mice | SUA ↓ | 1. Gut barrier: ZO-1 ↑, occludin ↑  2. Inflammation: NLRP3 ↑, IL-1β ↓, TNF-α ↓  3. Signaling pathway: GPR43 ↓, GLP-1 ↓ | 1. Phylum level: Bacteroidetes↑, Epsilonbacteraeota↓, Proteobacteria↓  2. Butyrate producers: *Lachnospiraceae* A2 ↓, *Muribaculum* ↑, *Butyricicoccus* ↑ | (Wen et al., 2020) |
| *Astragalus membranaceus* (Fisch.) Bge. (Leguminosae; *Astragali radix*) | ICR mice | SUA ↓, BUN ↓, XOD ↓ | 1. Urate transporters: GLUT9 ↑, URAT1 ↑  2. Kidney inflammation: IL-1β ↓, IL-6 ↓, LPS ↓  3. Signaling pathway: TLR4 ↓, NF-кB ↓ | 1. Phylum level: Firmicutes↓, Bacteroidetes↑  2. Species level: *Lactobacillus intestinalis* ↑, *Bacillus mycoides* ↑  3. SCFA-producing bacteria: *Butyricimonas* ↑, *Collinsella* ↑ | (Wang et al., 2023) |
| *Carthamus tinctorius* L. (Compositae;*Carthami flos*) | SD rats | SUA ↓, BUN ↓, XOD ↓, MDA ↓, TG ↓, LDL-C ↓, SOD ↑, GSH-PX ↑ | 1. SCFAs ↑  2. AAs: decanoylcarnitine ↑, L-aspartic acid ↑, betaine ↑, L-glutamine ↓, L-leucine ↓, L-asparagine ↓, L-isoleucine ↓, L-tyrosine ↓ | Genus level: *Holdemania* ↓, *Parabacteroides-goldsteinii* ↓ | (Chen et al., 2022) |
| *Astragalus membranaceus* (Fisch.) Bge. (Leguminosae; *Astragali radix*) | SD rats | SUA ↓, ALT ↓, AST ↓, IBIL ↓, TG ↓, BW ↓ | Cholic acid ↓ | 1. Phylum level: Firmicutes ↓, F/B ↓  2. Genus level: *Blautia* ↑  3. Species level: *Lactobacillus johnsonii* ↓  4. SCFA-producing bacteria: *Lachnospiraceae* ↑ | (Zhang et al., 2022c) |
| *Thlaspi arvense* L. (Cruciferae; *Thlaspi herba*) | Kunming mice | —— | —— | 1. Family level: Lactobacillaceae↑, Muribaculaceae↓  2. Genus level: *Helicobacter* ↑, *Prevotellaceae* UCG 001↓, *Parabacteroides* ↓ | (Kang et al., 2021) |
| *Phellinus igniarius* (L. ex Fr.) Quel. (Polyporaceae; *Phellinus*) | SD rats | SUA ↓, XOD ↓ | Renal function: creatinine level | Genus level: *Lactobacillus* ↑, *Turicibacter* ↑, *Lachnospiraceae* NK4A136 group ↑, *Prevotella* 9↓, *Romboutsia* ↓ | (Li et al., 2021e) |
| *Cichorium intybus* L. (Compositae; *Cichorii herba cichorii radix*) | SD rats | SUA ↓ | 1. Inflammation: LPS ↓  2. Gut barrier: SIgA ↑ | 1. Genus level: *Bifidobacterium* ↑  2. Species level: *Escherichia coli* ↓, *Enterococcus faecalis* ↓ | (Wang et al., 2018) |

**Abbreviations:** XOD, xanthine oxidase; MPO, myeloperoxidase; SUA, serum uric acid; BW, body weight; BUN, blood urea nitrogen; MDA, malondialdehyde; TG, triglyceride; TC, total cholesterol; LDL-C, low-density lipoprotein cholesterol; GSH-Px, glutathtone peroxtdase; ALT, glutathione aminotransferase; AST, glutathione transaminase; IBIL, indirect bilirubin; IL, interleukin; TNF-α, tumor necrosis factor α; IFN, interferon; MIP, macrophage inflammatory protein; MCP-1, monocyte chemoattractant protein 1; NLRP3, NOD-like receptor thermal protein domain associated protein 3; STAT, signal transducerand activator of transcription; APOB, apolipoprotein B; PPAR, peroxisome proliferator-activated receptor; IFN, interferon; LPL, lipoprotein lipase; ZO-1, zonula occludens 1; GPR, G protein-coupled receptor; GLP-1, glucagon-like peptide-1; GLUT, glucose transporter; URAT1, urate transporter 1; LPS, lipopolysaccharide; TLR, toll-like receptor; NF-κB, nuclear factor kappa B; SCFA, short-chain fatty acid; SIgA, secretory immunoglobulin A.

**Supplementary Table S6 Effect of herbal medicine on gut microbiota and its potential mechanism in the treatment of hyperlipidemia.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Herbal medicine | Subject | Outcome | Potential mechanism | Changes in gut microbiota | Reference |
| Shanmei capsule | C57BL/6J mice | TG ↓, TC ↓, LDL-C ↓, FINS ↑ | Glycerophospholipid metabolism  Linolenic acid metabolism  Arachidonic acid metabolism | 1. Phylum level: F/B ↓  2. Genus level: *Lachnospiraceae* NK4B4 group↓, *Olsenella* ↓, *Robinsoniella* ↓, *Ruminococcus* 1↓, *Tyzzerella* ↓ | (Du et al., 2022) |
| *Lindera aggregate* (Sims) Kos-term. (Lauraceae; *Linderae radix*) | SD rats | TC ↓, TG ↓, LDL-C ↓, ALT ↓, AST ↓ | 1. BAs: TUDCA ↑, TCA ↑, TUDCA ↑, THDCA ↓  2. BA receptors: CYP7A1 ↑ | Phylum level: F/B ↓ | (Jiang et al., 2021a) |
| Shener Jiangzhi formula | SD rats | TC ↓, TG ↓, LDL-C ↓, HDL-C ↑ | 1. AAs: tryptophan, arginine  2. NLRP3 | 1. Phylum level: F/B ↓, Proteobacteria↓  2. Genus level: *Akkermansia* ↑, *Roseburia* ↑, *Helicobacter* ↑ | (Zhang et al., 2022b) |
| *Alisma orientale* (Sam.) Juz. (Alismataceae; *Alismatis rhizoma*) | SD rats | TC ↓, LDL-C ↓ | Liver tissue damage ↓ | 1. Phylum level:Verrucomicrobia↑, Bacteroidetes↑, Tenericutes↑,Firmicutes↓  2. Genus level: *Bacteroides* ↑, *Akkermansia* ↑ | (Li et al., 2019c) |
| Jieyu Qutan Huazhuo formula | Wistar mice | TC ↓, TG ↓, LDL-C ↓, HDL-C ↑ | Improve liver cell and ileal mucosal tissue damage | 1. Class level: Bacteroidia↑  2. Order level: Erysipelotrichales↓  3. Family level: Ruminococcaceae↑  4. Genus level: *Bacteroides* S24-7 ↑,  *Rumencoccus* UCG 005 ↑ | (Li et al., 2021c) |
| Tianhuang formula | C57BL/6J mice | TC ↓, TG ↓ | 1. BA receptors: FXR ↓, FGF15 ↓, CYP7A1 ↑  2. BAs: T-β-MCA ↑  3. BSH activity ↓ | 1. Phylum level: Proteobacteria↓  2. Family level: Enterobacteriaceae↓  3. Genus level: *Escherichia* ↓, *Bacteroides* ↑, *Akkermansia* ↑ | (Yang et al., 2022b) |
| Wuwei Qingzhuo powder | ApoE-/- mice | TC ↓, TG ↓, LDL-C ↓ | 1. BAs: biosynthesis ↑  2. BA receptor: CYP7A1 | 1. Phylum level: Firmicutes↓, Bacteroides↑  2. Genus level: *Bilophila* ↑, *Roseburia* ↑, *Dubosiella* ↑ | (Ge et al., 2022) |
| Yinian Kangbao tea | ApoE-/- mice | LW ↓, TG ↓, ALT ↓, TG ↓, TC ↓, AST ↑, HDL-C ↑ | —— | 1. Phylum level: Firmicutes↓, Actinobacteria↑, Verrucomicrobia↑, Bacteroidetes↑  2. Genus level: *Turicibacter* ↑, *Lactobacillus* ↑, *Bifidobacterium* ↑, *Akkermansia* ↑, *Romboutsia* ↓ | (Li et al., 2019b) |
| *Polyporus frondosus* (Dicks.) Fr. (Polyporaceae; *Fructificatio polypori frondosi*) | Wistar rats | TG ↓, TC ↓, LDL-C ↓, FFA ↓, MDA ↓, ALT ↓, AST ↓, GSH-PX ↑, SOD ↑, HDL-C ↑ | Lipid metabolism: ACAT2 ↓, PPARγ ↑, CYP7A1 ↑, CAT ↑ | Genus level: *Helicobater* ↑, *Intestinimonas* ↑, *Barnesiella* ↑, *Parasutterella* ↑, *Ruminococcus* ↑, *Butyricicoccus* ↓ | (Li et al., 2019a) |
| *Coptis chinensis* Franch. (Ranunculaceae; *Coptidis rhizoma*) | C57BL/6J mice | BW ↓, TG ↓, TC ↓, LDL-C ↓, LW ↓ | 1. Inflammation: TNF-α ↓, IL-1β ↓, IL-6 ↓  2. Gut barrier: occludin ↑, ZO-1 ↑, claudin-2 ↑, claudin-3 ↑, claudin-4 ↑ | 1. Phylum level: Firmicutes↓, Actinobacteri↓, Candidatus-Melainabacteria↓, *Verrucomicrobia* ↑  2. Species levels: *Akkermansia muciniphila* ↑, *Lactobacillus johnsonii* ↑, *Klebsiella variicola* ↑, *Muribaculum intestinale* ↑ | (Yang et al., 2022c) |
| Congxin Lunzhi formula | ApoE-/- mice | BW ↓, TC ↓, TG ↓, LDL-C ↓, HDL-C ↑ | Liver steatosis ↓ | 1. Phylum level: Bacteroidetes↑, Firmicutes↓  2. Class level: Bacteroidia↓, Erysipelotrichia↓  3. Family level: Erysipelotrichaceae↓,Lachnospiraceae↑, Ruminococcaceae↑ | (Zhang et al., 2020) |
| *Bletilla striata* (Thunb.) Reichb.f. (Orchidaceae; *Bletillae rhizoma*) | C57BL/6J mice | HOMA-IR ↓, FINS ↓, TC ↓, TG ↓, HDL-C ↑ | 1. Lipid metabolic: MCP-1 ↓  2. Gut barrier: Muc-3 ↑  3. BAs: DCA ↓, TUDCA ↑, TDCA ↑, TCDCA ↑, TCA ↑, T-α-MCA ↑, T-β-MCA ↑, CA ↑  4. SCFA: acetic acid ↑  5. AA: tryptamine ↓ | Genus level: *Lachnospiraceae* NC2004 group ↓, *Enterococcus* ↓, *Ruminococcus* 1 ↓, *Eubacterium nodatum* group↑, *Butyricicoccus* ↑, *Coriobacteriaceae* UCG 002 ↑, *Blautia* ↑, *Erysipelatoclostridium* ↑, *Faecalibaculum* ↑ | (Hu et al., 2020) |

**Abbreviations:** TC, total cholesterol; TG, triglyceride; LDL-C, low-density lipoprotein cholesterol; FINS, fasting insulin; ALT, glutathione aminotransferase; AST, glutathione transaminase; HDL-C, high-density lipoprotein cholesterol; FFA, free fatty acid; MDA, malondialdehyde; GSH-Px, glutathtone peroxtdase; SOD, superoxide dismutase; LW, liver weight; CYP7A1, cholesterol 7α-hydroxylase; NLRP3, NOD-like receptor thermal protein domain associated protein 3; FXR, farnesoid X receptor; FGF, fibroblast growth factor; ACAT2, acetyl-coenzyme A acetyltransferase 2; PPAR, peroxisome proliferator-activated receptor; IL, interleukin; ZO-1, zonulaoccludens 1; MCP-1, monocyte chemoattractant protein 1; TDCA, taurodeoxycholic acid; DCA, deoxycholic acid; GCA, glycocholic acid; CDCA, chenodeoxycholic acid; THDCA, taurohyodeoxycholic acid; TUDCA, tauroursodeoxycholic acid; TCDCA, taurochenodeoxycholic acid; TCA, taurocholic acid; T-ω-MCA, tauro-ω-muricholic acid; T-β-MCA, tauro-β-muricholic acid; CAT, catalase.

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