Table S1 Experimental details of all 66 meta-analytic neuroimaging studies.

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| --- | --- | --- | --- | --- | --- | --- |
| Authors | Study design | Number of subjects and Age | Interventions and acupoints | Imaging modality | Normalizing Software | Reported standard space |
| **Heathy subjects** |
| An et al. (2009) | Pre - post acupuncture | SPECT: 20 (17 men, ages 24–31 years);18F-FDG PET: 13 (12 men, ages 23–30 years). | Electroacupuncture at two Hegu and Quchi (LI 4 and LI 11 in the right upper) for15 mins | SPECT and18F-FDG PET/CT | SPM2 | MNI |
| Lai et al. (2009) | Sham - true acupuncture | 18 (9 men, ages 22-27 years) | Manual acupuncture at Waiguan (TE5) for 15 mins | 18F-FDG PET/CT | SPM2 | Talairach |
| Biella et al. (2001) | Sham - true acupuncture | 13 young men, ages 21–32 years | Manual acupuncture at Zusanli (ST 36) and Qi-ze (LU 5); Sham acupuncture at points 1 cm lateral to the two acupoints for 25 mins | H215O bolus PET | SPM1996 | Talairach |
| Wang et al. (2007) | True - Non acupuncture | 14 (9 men, ages 22-27 years) | Electroacupuncture at right Hegu (LI 4, 9 subjects) and facial non-acupoint points (5 subjects) | BOLD fMRI | SPM2 | Talairach |
| Fang et al. (2009) | Sham - True acupuncture | 10 (5 men, ages 22-28 years) | Manual acupuncture at Taichong, Xingjian, and Neiting (LR3, LR2, and ST44) and a sham point for 6 mins | BOLD fMRI | SPM99 | MNI |
| Jiang et al. (2013) | Block-designed study | 18 (9 men, mean age 22 years) | Manual acupuncture, electroacupuncture and transcutaneous electrical acupoint stimulation and sham in Zusanli (ST 36) on the left leg | BOLD fMRI | SPM5 and GIFT | MNI |
| Long et al. (2016); Nierhaus et al. (2015) | Sham - True acupuncture | 22 (11 men, ages 21-32 years) | Manual acupuncture at Zusanli (ST 36) and two control acupoints for 6 mins | BOLD fMRI | SPM8 | Talairach |
| L. L. Li et al. (2018) | Sham - True acupuncture | 20 (10 men, ages 22-28 years) | Electroacupuncture at Tongli (HT 5) and a sham acupoint for 8 mins | BOLD fMRI | SPM8 | Talairach |
| Jin et al. (2018) | Block-designed study | 30 (ages 20-25 years) | Manual acupuncture at Sanyinjiao (SP 6) on the right side of the body | BOLD fMRI | SPM8 | Talairach |
| A. Li et al. (2018) | Pre - post acupuncture | 30 (15 men, mean age 24.3 years; 15 women, mean age 24.6 years ) | Manual acupuncture at Liangqiu (ST 34), Xuehai (SP 10), Neixiyan (EXLE4), and Dubi (ST 35) for 8 mins | BOLD fMRI | SPM12 | MNI |
| Liu et al. (2018); (Liu et al., 2016) | Pre - post acupuncture | 10 (4 men, ages 20-34 years) | Manual acupuncture at left Yanglingquan (GB 34) for 15 mins | BOLD fMRI | SPM8 and DPARSF | MNI |
| Wang et al. (2021) | Sham - True acupuncture | 15 (7 men, 28.0 ± 4.24; 8 women, 27.4 ± 3.65) | Manual acupuncture at Taibai (SP 3) for 15 mins | BOLD fMRI | DPARSF | MNI |
| Yang et al. (2017) | Block-designed study | 34 (21 men, 22.09 ± 1.26 years) | Manual acupuncture at Shenmen (HT 7; 9 males, 8 females) or Yangxi (LI 5; 12 males, 5 females) | BOLD fMRI | SPM8 | Talairach |
| He et al. (2020) | Pre - post acupuncture | 20 healthy young (9 men, ages 24.7 ± 2.9), 20 healthy elders (8 men, age 56.8 ± 7.2) | Manual acupuncture at Taixi (KI 3) for 3 mins | BOLD fMRI | DPARSF | MNI |
| Cao et al. (2020) | Sham - True acupuncture | 24 (8 men, ages 25.2 ± 0.8 years) | Manual acupuncture at right Sanyinjiao (SP 6) and Yinlingquan (SP 9) for 20 mins | BOLD fMRI | CONN and CAT12 | MNI |
| Quah-Smith et al. (2013) | Block-designed study | 16 (mean age 48.2 years ) | Laser acupuncture at Ququan (LR8) and needle acupuncture in Ququan (LR8) on the other leg | BOLD fMRI | SPM2 | MNI |
| Yoo et al. (2004) | Sham - True acupuncture | 12 (7 men, aged 27.2 F 6.3, all right-handed) | Manual Acupuncture at PC6 point of the right wrist | BOLD fMRI | SPM99 | Talairach |
| Yoo et al. (2007) | Sham - True acupuncture | 12 (three females, mean age = 25.2 ± 6.5) | Manual Acupuncture at LI4 | BOLD fMRI | SPM2 | Talairach |
| Hui et al. (2009) | Block-designed study | 48 (mean=28.6±7.56 SD, 19 M, 29F) | Manual Acupuncture at LI4, ST36 and LV3 | BOLD fMRI | AFNI | Talairach |
| Kong et al. (2007) | Block-designed study | 8 (4 males,mean age 29±7 years) | Manual Acupuncture at three points (UB 60, GB 37, and a non-acupoint) on the right leg | BOLD fMRI | SPM2 | MNI |
| Chae, Lee, Kim, Sohn, et al. (2009) | Block-designed study | 10 (6 men, 4 women; age range 20–34 years). | Manual acupuncture at acupoint LR2 | BOLD fMRI | SPM5 | Talairach |
| Li et al. (2008) | Single block design | 53 (31 men), aged 23.7 3.6 years | Manual acupuncture at LR3, Taichong; LR6, Zhongdu; ST36, Zusanli; ST43, Xiangu the right side | BOLD fMRI | SPM2 | Talairach |
| Dougherty et al. (2008) |  Sham - True acupuncture | 3 male and 3 females in each group with the age (mean ± S.D.) of 28 ± 7 years for the acupuncture group and 36 ± 10 years for the placebo acupuncture group | Manual acupuncture at Large Intestine 4 (LI 4) on the right han | [11C]diprenorphine | SPM2 | MNI |
| Wu et al. (1999) | Sham - True acupuncture | 9 (6 women, 20-35 years) | Manual acupuncture at ST36 amd LI4 | BOLD fMRI |  | Talairach |
| Wu et al. (2002) | Sham - True acupuncture | 15 healthy volunteers (age 20–30 years; 10males, 5 females), | Electroacupuncture at GB34, “Yanglinquan” | BOLD fMRI | SPM99 | Talairach |
| Kong et al. (2002) | Block-designed study | 11 righthanded normal, healthy volunteer adults, 6 male and 5 female, ages 21–64 (32 6 16.1) | Manual acupuncture and electroacupuncture at acupoint LI4 on the left hand only | BOLD fMRI | AFNI version 2.31b and SPM | Talairach |
| MacPherson et al. (2008) | Block-designed study | 8 males (mean age 33 years, range 18–46, S.D. = 11.9) and 9 females (mean age 39 years, range 20–54, S.D. = 10.2), with an average age of 36 years | Manual acupuncture at Hegu (LI-4) on the right hand | BOLD fMRI | FSL | MNI |
| Li et al. (2003) | Block-designed study | 10 healthy subjects | Manual acupuncture and electroacupuncture at (bladder (BL) 60, BL65, BL66, and BL67) [5,11] located in thelateral aspect of right foot | BOLD fMRI | SPM | Talairach |
| Li et al. (2006) | Pre - post acupuncture | 18 (mean age standard deviation [SD]: 26.6 3.2 years; range23–33 years; 11 male, 7 female) | Manual acupuncture at acupoint LI4 (Hegu right thenar muscle. | BOLD fMRI | SPM2 | Talairach |
| Li et al. (2016) | Sham - True acupuncture | 12 healthy right-handed male participants (range: 23–26 years; mean: 24.8 years) | Manual acupuncture at KI 2 | BOLD fMRI | SPM12 | MNI |
| Wik et al. (2016) | Sham - True acupuncture | 12 male and 12 femaleright-handed volunteers with a mean age of 23.1 2.2years (range, 21e28 years) | Manual acupuncture at SJ 5 acupoint | BOLD fMRI | SPM2 | Talairach |
| Yeo et al. (2016) | Sham - True acupuncture | 19 healthyparticipants (9 male, 10 female) 48.1±3.38 | Manual acupuncture at GB34 on the right side | BOLD fMRI | SPM5 | Talairach |
| Lv et al. (2016) | Pre - post acupuncture | 21 (18 to27 (mean age: 21.9 years) | Laser acupuncture at HI11 and CV1 GV26 (renzhong), CV24 (chengjiang), ST6 (jiache), BL62 (shenmai), SP1 (yinbai), and LU11 (shaoshang), PC7 (daling), PC8 (laogong) | BOLD fMRI | SPM8  | MNI |
| Chung et al. (2019) | Pre - post acupuncture | 10 healthy participants | Manual acupuncture at MS5, left MS6, and left MS7 | BOLD fMRI | SPM12 and REST  | MNI |
| Wei et al. (2020) | Block-designed study | 16 right-handed acupuncture-naive healthyvolunteers (8 females and 8 males) aged 21–30 years (mean24.1 years) | Manual and Ultrasound stimulation ST 36. | BOLD fMRI | SPM12  | MNI |
| Xu et al. (2022) | Pre - post acupuncture | 20 healthy female subjects | Bilateral uterine points(EX-CA1) by electroacupuncture | BOLD fMRI | DPABI | MNI |
| Shan et al. (2018) | Sham - True acupuncture | 14 healthy subjects (66.1 years) | Manual acupuncture at Siguan | BOLD fMRI | SPM12 | MNI |
| Yoon et al. (2023) | Pre - post acupuncture | 25 healthy participants (12 females, 24.2 ± 0.81 years) | Manual acupuncture at left ST36 | BOLD fMRI | SPM12 and AFNI  | MNI |
| **Patients with various of diseases** |
| Chen et al. (2020) | Pre - post acupuncture | 10 patients with ischemic stroke (7 men, 57.70 ± 7.69 years) | Manual acupuncture at Quchi and Zusanli (LI 11 and ST 36) on the right side for 15 mins | BOLD fMRI | DPARSF and REST | MNI |
| Fang et al. (2012) | Pre - post acupuncture | 6 patients with ischemic stroke (3 men, ages 50–75 years) | Electroacupuncture at Baihui (GV 20) and right Qubin (GB 7) for 20 mins | 18F-FDG PET/CT | SPM99 | MNI |
| Zhao et al. (2014) | Sham - True acupuncture | 40 migraineurs without aura (14 men, ages 35.08 ± 10.34 years ) | Manual acupuncture at acupuncture at bilateral Waiguan (TE5), Fengchi (GB 20), Yanglingquan (GB 34), and Qiuxu (GB 40); and sham acupuncture on bilateral Erheliao (TE 22), Daling (PC 7), Guangming (GB 37), and Taibai (SP 3) | BOLD fMRI | SPM5 | Talairach |
| Yang et al. (2012); Yang et al. (2014) | Sham - True acupuncture | 30 patients with acutemigraine without aura (12 men, ages 33.28 ± 8.03 years) | Electroacupuncture at Shaoyang meridians, Luxi (TE 19), Sanyangluo (TE 8), and Xiyangguan (GB 33) for 30 mins. | 18F-FDG PET/CT | SPM2 | MNI |
| Li et al. (2017) | Sham - True acupuncture | 62 patients with migraine without aura (14 men, mean age 21.29 years) | Manual acupuncture for Group 1: Yanglingquan (GB 34), Qiuxu (GB 40) and Waiguan (TE 5). Group 2: Xiyangguan (GB 33), Diwuhui (GB 42) and Sanyangluo (TE 8). Group 3: Zusanli (ST 36), Chongyang (ST 42) and Pianli (LI 6). Sham acupoints at three adjacent non‐acupoints. | BOLD fMRI | SPM12 and DPARSF | MNI |
| Liu et al. (2014) | Pre - post acupuncture | 15 female depressive patients (ages 41.03 ± 11.36 years ) | Manual acupuncture at Zhongwan (CV 12), Xiawan (CV 10), Qihai (CV 6), Guanyuan (CV 4), Shangqu (KI 17), Huaroumen (ST 24), and Qipang (extra-point). | BOLD fMRI | SPM8 and DPARSF | MNI |
| Wang et al. (2017) | Sham - True acupuncture | 46 female major depressive patients (44.14 ± 8.78) | Manual acupuncture at Zhongwan (CV 12), Xiawan (CV 10), Qihai (CV 6), Guanyuan (CV 4), Shangqu (KI 17), Huaroumen (ST 24), and Qipang (extra-point). | BOLD fMRI | SPM8 | MNI |
| Pang et al. (2018) | Pre - post acupuncture | 20 patients with premenstrual syndrome (ages 21.85 ± 1.72) years) | Electroacupuncture at Sanyinjiao (SP 6); | BOLD fMRI | SPM8 | MNI |
| Shan et al. (2018) | Sham - True acupuncture | 21 Alzheimer’s disease patients (9 men, mean age 66.9 years), 14 mild cognitive impairment (6 men, mean age 66.4 years), and 14 healthy people (6 men, mean age 66.1 years) | Manual acupuncture at bilateral Taichong (LR 3), bilateral Hegu (LI 4), bilateral Taichong (LR 3) or Hegu (LI 4). | BOLD fMRI | SPM12 | MNI |
| Z. Li et al. (2018) | Sham - True acupuncture | 41 patients with Parkinson’s disease (24 men, ages 63.60 ± 6.24 years) | Manual acupuncture at Baihui (GV20), Fengchi (GB20), and Chorea-Tremor Controlled Zone for 12 weeks | BOLD fMRI | DPABI | MNI |
| Yeo et al. (2018) | Pre - post acupuncture | 10 idiopathic patients with Parkinson’s disease (5 men, ages 56.9 ± 9.49 years) | Electroacupuncture at right Yanglingquan (GB 34), right Taechung (LR 3), Quchi (LI 11), Zusanli (ST 36), Fengchi (GB 20), Sanyinjiao (SP 6), Hegu (LI 4), and Yanglingquan (GB 34). For 8 weeks, two times a week. | BOLD fMRI | SPM5 | MNI |
| (Yan et al., 2020; Zhang et al., 2018) | Pre - post acupuncture | Chronic shoulder pain: 12 contralateral (6 men, ages 53.33 ± 5.26 years) 8 ipsilateral (4men, ages 54.13 ± 7.45 years) | Manual acupuncture at contralateral or ipsilateral Tiaokou (ST 38). | BOLD fMRI | SPM12 and DPARSF | MNI |
| J. Zhang et al. (2021)  | Sham - True acupuncture | 15 patients with hypertension in Group 1 (5 men), 14 patients in Group 2 (5men) | Manual acupuncture for Group 1: Taichong (LR 3) +Taixi (KI 3); Group2: Taichong (LR 3) + sham | BOLD fMRI | REST 1.8 | MNI |
| Liu et al. (2020) | Pre - post acupuncture | 12 sciatica patients (6 men, ages 61.42 ± 14.84 years) | Manual acupuncture at Shenshu (BL 23), Huantiao (GB 30), Weizhong (BL 40), Yanglingquan (GB 34), Kunlun (BL 60), and Xuanzhong (GB 39). The eighteen acupoints were Shenshu (BL 23), Dachangshu (BL 25), Xiaochangshu (BL 27), Huantiao (GB 30), Yinmen (BL 37), Zhibian (BL 54), Chengfu (BL 36), Fengshi (GB 31), Weizhong (BL 40), Zusanli (ST 36), Yanglingquan (GB 34), Yinlingquan (SP 9), Feiyang (BL 58), Sanyinjiao (SP 6), Xuanzhong (GB 39), Kunlun (BL 60), Taixi (KI 3), and Shenmai (BL 62) | BOLD fMRI | DPARSF | MNI |
| Bao et al. (2016) | Pre - post acupuncture | 18 patients with emissive Crohn’s Disease (13 men, ages 31.61 ± 5.00 years) | Electroacupuncture at the Tianshu (ST 25) and Qihai (CV 6) at the left-hand side, as well as the Tianshu (ST 25) and Zhongwan (CV 12) at the right-hand side. | BOLD fMRI | SPM8 | MNI |
| Shi et al. (2021) | Pre - post acupuncture | 30 primary insomnia (12 women, ages 48.94 ± 8.63 years) | Electroacupuncturetreatment on HT-7 for 5-week | BOLD fMRI | DPARSF | MNI |
| Chae, Lee, Kim, Kim, et al. (2009) | Block design study | 10 (six men, four women; age range: 45–66 years; disease duration 3.0 6 2.0 years; | Manual acupuncture GB34 | BOLD fMRI | SPM5 | Talairach |
| Zhang et al. (2019) | Pre - post acupuncture | 20 | Manual acupuncture at LR3 and KI3 | BOLD fMRI | SPM8 and REST | MNI |
| Wang et al. (2020) | Pre - post acupuncture | S-Acu group(43, 55.42 ± 9.23) M-Acu group (43, 51.45 ± 12.10) | Manual acupuncture at Shenmen (HT-7), Sanyinjiao (SP-6), Baihui (GV-20) | BOLD fMRI | DPARSF | MNI |
| H. Liu et al. (2021) | Sham - True acupuncture | 13 patients with stroke | Manual acupuncture at the midline of vertex (MS5), the left anterior oblique line of vertextemporal (MS6) and the left posterior oblique line of vertex-temporal (MS7). | BOLD fMRI | SPM12 | MNI |
| S. Liu et al. (2021) | Pre - post acupuncture | 37 patients with migraine without Aura | Manual acupuncture at Baihui (DU20), Taiyang (EX-HN5), bilateral Fengchi (GB20), Shuaigu (GB8), Xuanlu (GB5), Toulinqi (GB15), Hegu (LI4), and Taichong (LR3) | BOLD fMRI | SPM12 | MNI |
| Wei et al. (2021) | Pre - post acupuncture | 20 (10males)26.45 ± 1.82 (22–30) | Electroacupuncture was performed at GV20 acupoint | BOLD fMRI | DPABI | MNI |
| Y. Zhang et al. (2021) | Sham - True acupuncture | 24 patients with migraine | Manual acupuncture at GB20 (Fengchi), GB8 (Shuaigu), PC6 (Neiguan), SP6 (Sanyinjiao), and LR3 (Taichong) | BOLD fMRI | DPABI | Talairach |
| Duan et al. (2021) | Pre - post acupuncture | 20 patients with premenstrual syndrome (21.85 ± 1.72 years) | Electroacupuncture the left leg at acupoint SP6  | BOLD fMRI | DPARSF | MNI |
| Lan et al. (2022) | Pre - post acupuncture | 29 patients with chronic stable angina pectoris | Manual acupuncture at Group A (acupoints on the meridian directly related to the Heart): bilateral Neiguan (PC6) and bilateral Tongli (HT5); Group B (acupoints on the meridian indirectly related to the Heart): bilateral Yangxi (LI5) and bilateral Pianli (LI6). | BOLD fMRI | DPABI | MNI |
| Li et al. (2022) | Pre - post acupuncture | 24 volunteers (14 males) with anxiety disorders | Manual acupuncture at left Neiguan for 15 minutes | BOLD fMRI | DPARSF 2.3 | MNI |
| Liu et al. (2022) | Pre - post acupuncture | 20 participants (24.70 ± 2.11) with PDM | Manual acupuncture at bilateral SP6 | BOLD fMRI | SPM12 and BRANT toolkit | MNI |
| Teng et al. (2022) | Pre - post acupuncture | 115 FD patients | Study1: Manual acupuncture at ST36 combined with CV12 ; Study 2: ST36 with Deqi and without Deqi | BOLD fMRI | SPM12 and DPARSF 4.5 | MNI |
| Zhou et al. (2024) | Pre - post acupuncture | 30 patients (19 males,63.17 ± 10.31 years) | Manual acupuncture at Dazhui (GV14), Zhiyang (GV9) and Mingmen (GV4) | BOLD fMRI | DPABI | MNI |
| Wang et al. (2023) | Sham - True acupuncture | 36 patients with anxiety disorders (aged 20 to 35 years) | Manual acupuncture at LU10 for 20 minutes | BOLD fMRI | NeuroScholar cloud platform | MNI |
| Yang et al. (2023) | Pre - post acupuncture | 25 CSVDCI patients (13 males, 61.9 ± 4.56 years) | Manual acupuncture at Shenting and Baihui. | BOLD fMRI | DPARSF | MNI |
| Yang et al. (2024) | Pre - post acupuncture | 50 patients (28.36 ± 3.61) | Electroacupuncture at Baihui (DU20), Shuaigu (GB8), Xuanlu (GB5), and Touwei (ST8) | BOLD fMRI | SPM 12 | MNI |

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