

TABLE 1: Acupuncture and fertility management: effects on reproductive parameters in patients not receiving ART.

Female Studies

Author, date	Study Design	Outcome Measured	Control Group (n)	Acupuncture Method and Timing (n)	Additional Information	Conclusion
Yu <i>et al</i> , 2010	Prospective, randomised, controlled.	To <i>compare</i> the effect of acupuncture at SP6 on uterine arterial blood flow to use at GB39. Menstrual apin and pulsatility index measured.	Needling at GB39 for 5 minutes when participants suffered menstrual pain (n = 34).	Manual acupuncture at bilateral SP6 for 5 minutes after obtaining needling sensation (de qi) during the period of menstrual pain (n = 32).	All patients suffered primary dysmenorrhea. Immediate effect was noted.	The SP6 group showed immediate and significant reductions in uterine artery pulsatility index and menstrual pain. This was not evident in the control (GB39) group.
Jiang <i>et al</i> , 2009	Prospective, randomised, controlled.	Ovulation and pregnancy rates.	Anovulatory patients receiving Clomiphene and intramuscular injection of Chorionic Gonadotropin for 6 cycles (25).	Anovulatory patients receiving acupuncture and moxibustion together with Chinese herbal decoction (25).	ONLY ABSTRACT AVAILABLE. Age unknown.	No significant difference in ovulation rate but pregnancy rate was significantly higher after acupuncture. The treatment group was superior to the control group in the score of mucus and the endometrial thickness.
Song <i>et al</i> , 2008	Prospective, randomised. Non-blinded.	After 3 menstrual cycles: pregnancy rate, basal body temperature, B-ultrasonic examination and ovulation were assessed.	Patients receiving 50 mg Clomiphene.	Patients receiving acupuncture and suspended moxibustion. No clomiphene.	ONLY ABSTRACT AVAILABLE. Acupuncture protocol and ages unknown.	Acup-moxibustion and Clomiphene have the same ovulating effect. Pregnancy rate is higher and the abortion rate is lower for acup-moxibustion treatment than that for Clomiphene.

Yang <i>et al</i> , 2005	Prospective, randomised	Pregnancy rates.	Patients with endocrine dysfunctional infertility receiving clomiphene (80).	Patients with endocrine dysfunctional infertility receiving acupuncture (160).	ONLY ABSTRACT AVAILABLE. Blinding and ages unknown. Acupuncture protocol unknown.	Ovulation and pregnancy rates were significantly higher in the acupuncture group.
Stener-Victorin <i>et al</i> , 1996	Prospective.	A reduction in a high uterine artery blood flow impedance.	No controls.	Women with with a pulsatility index (PI) ≥ 3.0 in the uterine arteries received electroacupuncture 8 times, twice a week for 4 weeks (10). Mean PI was measured before treatment, after 8th treatment and 10-14 days into treatment protocol.	Women were also down- regulated with a gonadotrophin- releasing hormone analogue (GnRH α) to exclude any fluctuating endogenous hormone effects on the PI. Mean age of 32.3 years.	The PI at both time periods was significantly reduced compared to baseline PI before acupuncture. Suggested to be due to a central inhibition of the sympathetic activity.

Male Studies

Author, date	Study Design	Outcome Measured	Control Group (n)	Acupuncture Method and Timing (n)	Additional Information	Conclusion
Dieterle <i>et al</i> , 2009	Prospective, randomised. Single-blinded.	Sperm motility, sperm concentration, semen volume and percentage of motile sperm assessed ≤ 5 months and < 3 months <i>before</i> acupuncture and < 2 and ≤ 3 months <i>after</i> acupuncture.	Men receiving non-penetrating placebo acupuncture needles twice weekly for 6 weeks (29)	Men receiving TCM acupuncture twice weekly for 6 weeks (28)	Only men with initial sperm concentrations < 1 million/ml. All acupuncture sessions lasted 45 mins with no explanation. All performed by two specialists.	A significantly higher percentage of motile sperm was seen. There was a significant increase in sperm concentration after placebo acupuncture, but not after TCM acupuncture. No significant effect on any other variable.
Siterman <i>et al</i> , 2009	Prospective. Non-blinded.	Scrotal temperature and sperm count.	Normal fertile men, used to determine a threshold to define high scrotal temperature (18).	Men referred specifically for acupuncture due to low sperm count (39).	34 of the 39 patients in experimental group defined as having high scrotal temperature. Remaining were normal.	Following treatment, 17 of the 34 patients with hyperthermia, all of whom had genital tract inflammation, had normal scrotal skin temperature; in 15 of these 17 patients, sperm count was increased. The remaining patients saw no effect after acupuncture, but displayed high gonadotropins or mixed etiological factors. When low sperm count is caused by inflammation, acupuncture appears to be beneficial.
Wang <i>et al</i> , 2008	Prospective, randomised. Non-blinded.	Changes in semen parameters and acrosome enzyme activity before and after treatment.	No controls.	Group 1: electroacupuncture (71) Group 2: oral administration of Chinese drug Wuzi Yanzong Pill (82) Group 3: combined intervention (78)	ONLY ABSTRACT AVAILABLE. All participants were oligospermic or asthenospermic.	Both electroacupuncture and Wuzi Yanzong can improve variables measured, and improve pregnancy rates. Combined intervention was most effective.

Cakmak <i>et al</i> , 2008	Prospective, randomised. Non-blinded.	Parameters of testicular blood flow (TBF).	No controls.	<i>Stage 1</i> : Group 1: simple needling (20) Group 2: 2Hz electro-acupuncture (20) Group 3: 10Hz electro-acupuncture (20). ST-29 (guilai) used for all stage one patients for 5 minutes. <i>Stage 2</i> : ST-25 (tianshu) stimulated for 5 minutes (20).	All patients were 30-35 years old. Men with varicocele and hydrocele were excluded. Same practitioner identified all acupuncture points.	10-Hz EA stimulation of ST-29 (guilai) increased TBF, other interventions had no effect.
Dong <i>et al</i> , 2006	Prospective, randomised.	Pregnancy rates, hormonal profile, superoxide dismutase (SOD) activity, Zn content in semen and cadmium levels.	Infertile males treated with oral administration of Wuzi Yanzong Pills (83).	Infertile males treated with needle-picking at bilateral Shengzhi points, Dicong Shenjing points and L2 Shenjing points (85).	ONLY ABSTRACT AVAILABLE.	Needle picking significantly improved hormonal values and semen quality, and increased pregnancy rates in wives.
Fu <i>et al</i> , 2005	Prospective, randomised, controlled.	Clinical effect on antisperm antibody level.	Infertile males treated with oral prednisone - an immunosuppressant drug (50).	Infertile males treated with acupuncture and herbal drug Liuwei Dihuang Wan (50).	ONLY ABSTRACT AVAILABLE. All participants had to be positive for antisperm antibodies.	Levels were significantly lowered in acupuncture group compared to control group.
Pei <i>et al</i> , 2005	Prospective, randomised, controlled.	Ultramorphologic sperm features assessed by transmission electron microscopy.	Male infertile patients receiving no acupuncture (12).	Male infertile patients receiving acupuncture twice a week for 5 weeks (28).	Median age: 33years. All participants were diagnosed with oligospermia, asthenospermia, and/or teratozoospermia but normal hormonal profiles. Infertile for 2 years.	Percentage and number of sperm without ultramorphological defects was seen in the acupuncture group: acrosome position and shape, nuclear shape, axonemal pattern and shape, and accessory fibers of sperm organelles were improved. However, apoptosis, immaturity, and necrosis showed no statistically significant improvements between the control and treatment groups before and after treatment.

Gurfinkel <i>et al</i> , 2003	Prospective, randomised, controlled. (Practitioner obtaining semen analysis was blinded.)	Changes in semen parameters (concentration, morphology and motility) before and after treatment.	Male infertile patients receiving no acupuncture or moxa treatment (10)	Male infertile patients receiving acupuncture (25 minutes) and moxa treatment (20 minutes) twice weekly for 10 weeks (9).	All participants were childless. Control group mean age: 31.6years, treatment group: 33.4 years. All patients had abnormal semen parameters at start of the study.	A significant increase in normal semen parameters was noted after acupuncture treatment compared to control group.
Siterman <i>et al</i> , 2000	Prospective, controlled.	Sperm count and concentration determined by y light microscope (LM) and scanning electron microscope (SEM).	Infertile males receiving no acupuncture (20).	Infertile males (azoospermia) receiving TCM acupuncture twice weekly for 5 weeks. Each session lasted 25minutes (20).	Each semen analysis obtained after 17days sexual abstinence. Mean age unknown.	Sperm count and concentration increased after acupuncture, especially in participants with genital tract inflammation. No effect on biochemical parameters of semen.
Sherman <i>et al</i> , 1997	Prospective, randomised, controlled.	Changes in routine semen analysis and ultramorphological observations	Subfertile males receiving no acupuncture (16).	Subfertile males receiving TCM acupuncture twice weekly for 5 weeks (16).	All participants had evidence of bacterial contamination. Semen analysis performed before and 1 months post treatment, or at an interval of on average 2 months for control group. Mean age of experimental group: 35.8 years. Control group: 36.1 years.	The total functional sperm fraction, percentage of viability, total motile sperm per ejaculate and integrity of the axonema significantly improved after acupuncture, resulting in an improved fertility index.
Zhiyuan <i>et al</i> , 1997	Prospective.	Pregnancy rates in wives, changes in semen parameters.	No controls.	All patients received acupuncture at Zhongji REN-3, Guanyuan REN-4, Zusanli ST-36, Sanyinjiao SP-6 for up to 3 courses (1 course = ten 30minutes sessions (54).	All patients had azoospermia confirmed by aspiration biopsy. All other medication was stopped one week before acupuncture.	30 wives became pregnant within the 3 course timeframe. Of the remaining, 13 showed improvements in semen parameters despite wives not becoming pregnant, 11 showed no improvements.

Riegler <i>et al</i> , 1984	Prospective.	Changes in male fertility parameters (concentration, volume and motility) and <u>psychology</u> .	No controls.	Subfertile males receiving TCM acupuncture (28).	ONLY ABSTRACT AVAILABLE. Mean age and acupuncture protocol unknown.	Significant increase in concentration and motility after acupuncture compared to baseline values. No effect on volume or psychology as assessed by a written test.
Fishchl <i>et al</i> , 1984	Prospective.	Changes in male fertility parameters (total count, concentration and motility) and hormonal profiles.	No controls.	Subfertile males receiving TCM acupuncture: 10 treatments over three weeks (28).	ONLY ABSTRACT AVAILABLE. Mean age unknown.	Significant improvement in all variables compared to baseline values.

Model Animal Studies

Author, date	Study Design	Outcome measured	Control Group (n)	Acupuncture Method and timing (n)	Additional Information	Conclusion
Huang <i>et al</i> , 2010	MURINE MODEL: A model of rat blastocyst implantation disorders was made using mifepristone	Implantation rate (determined on day 8 of pregnancy) and connexin 43 mRNA expression	Group 1: Pregnant rats, sham injected with carrier oil (n = 8); group 2: Model rats, no intervention	Groups 1: model rat, acupuncture only; Group 2: model rat, also injected with sham RNA plasmid; Group 3: model rat, also injected with true RNA plasmid to silence Cx43 expression. (n = 8 in each group)	Acupuncture given once a day for 3 mins. Case groups 2 and 3 also received acupuncture.	Acupuncture could significantly improve blastocyst implantation in rats with implantation disorders, and can antagonise the action of mifepristone. When the expression of Cx43 in the acupoints was lowered by the true RNA plasmid, the acupuncture effect was significantly weakened, demonstrating that Cx43 is involved in the acupuncture effect of improving blastocyst implantation.
Liu <i>et al</i> , 2007(a)	MURINE MODEL: A rat model with dysfunctional embryo implantation made using mifepristone	Pregnancy rate, average embryo implantation number, uterine and ovarian weight, size and weight of single embryos. Endometrium and ovarian morphology.	Normal rats, not receiving mifepristone and model rat (mifepristone) with no acupuncture	Model rat receiving acupuncture for one week after first day of pregnancy.	ONLY ABSTRACT AVAILABLE IN ENGLISH. Sample numbers unknown.	Acupuncture can reverse Mifepristone's anti-implantation effect to a certain extent by allowing normal endometrium development, and promote implantation and development of embryo in the rat.

Liu <i>et al</i> , 2007(b)	MURINE MODEL: Pregnant rats	Pregnancy rate, serum levels of estradiol (E2), progesterone (P4) and prolactin (PRL), and the protein and mRNA expression of progesterone receptor (PR) and prolactin receptor (PRLR) in endometrial tissue of implantation site.	Unknown	Pregnant rats receiving acupuncture.	ONLY ABSTRACT AVAILABLE. Abstract mentions control, model and acupuncture group, but precise characteristics of each unknown. Sample numbers unknown.	Pregnancy rates and average number of blastocyst were significantly higher in the acupuncture group. Authors concluded acupuncture mechanism might be related to modulating hormone levels and receptor expression.
Yang <i>et al</i> , 1994	RABBIT MODEL: Concious New Zealand female rabbits	Release of GnRH from the mediobasal hypothalamus (MBH) using push-pull perfusion technique. GnRH is released in a pulsatile manner during normal ovulation.	Control 1: Rabbits receiving no acupuncture and Cupric acetate at the 1st hour of 6 hours perfusion since it is known as a stimulant for the release of GnRH (5). Control 2: No acupuncture, no Cupric acetate but same perfusion technique.	Rabbits receiving electro-acupuncture at 1st, 3rd and 5th hour during 6 hours' perfusion (6).	ONLY ABSTRACT AVAILABLE.	GnRH level was elevated one hour after cupric acetate injection as expected. Acupuncture also immediately and significantly elevated GnRH. Corpus lutein were observed both in the electroacupuncture (2/6) and the cupric acetate group (5/5). No similar changes were found in the control group. The data suggest that EA is capable of facilitating GnRH release from the MBH.
Hu <i>et al</i> , 1993	MURINE MODEL: Ovariectomized rat	The distribution of Fos labelled neurons in CNS after acupuncturing by C-fos immunocytochemistry.	Rats receiving electro-acupuncture but ovaries intact.	Two weeks after ovariectomy, rats received electro-acupuncture.	ONLY ABSTRACT AVAILABLE. C-fos immunoreactive labelled neurons from multiple neuronal had disappeared two weeks after ovaries were removed.	Many specific Fos labelled cells were observed in several neuronal areas after acupuncture in the ovariectomised rats, and this was not seen in control group. Concluded that electro-acupuncture could modulate the hypo-pituitary-ovarian axis by acting on brain nuclei.

Stener-Victorin <i>et al</i> , 2006	MURINE MODEL: Virgin adult cycling Sprague-Dawley rats.	Changes in ovarian blood flow (OBF), and the involvement of spinal and supraspinal reflexes in OBF.	No controls.	Anesthetized rats receiving electro-acupuncture to the abdominal or the hindlimb muscles at three different frequencies (2, 10, and 80 Hz).	Fourteen rats were investigated in the estrus phase and 13 in the diestrus phase.	OBF response to both abdominal and hindlimb EA stimulation was mediated as a reflex response via the ovarian sympathetic nerves, and the response was controlled via supraspinal pathways. Furthermore, the OBF response to segmental abdominal EA stimulation was frequency dependent and amplified in the estrous phase.
Stener-Victorin <i>et al</i> , 2003(a)	MURINE MODEL: Virgin adult cycling Sprague-Dawley rats.	Changes in ovarian blood flow (OBF) and mean arterial blood pressure (MAP).	No controls.	Rats receiving acupuncture at two frequencies-2 Hz (low) and 80 Hz (high)-with three different intensities-1.5, 3, and 6 mA- for 35 s.	Whether the sympathetic nervous system was involved was determined by severing ovarian sympathetic nerve.	Low-frequency EA at 3 and 6 mA elicited significant increases in OBF. In contrast, high-frequency EA with an intensity of 6 mA evoked significant decreases in OBF followed by decreases in MAP. Nerve severance abolished low frequency effects but did not affect high frequency effects.
Zhao <i>et al</i> , 2003	MURINE MODEL: Ovariectomized rats.	Changes in levels of corticotropin-releasing hormone (CRH) and gonadotropin-releasing hormone (GnRH) immunoreactivity (ir) in the hypothalamus. Blood level of oestrogen (E2)	Control 1: intact normal rats. Control 2: ovariectomised rats receiving no acupuncture.	Ovariectomized rats receiving electroacupuncture.	ONLY ABSTRACT AVAILABLE. Sample sizes and exact acupuncture protocols unknown.	Blood level of E ₂ and GnRH cell number increased in ovariectomized rats. CRH neuron number was higher in the group ovariectomized with EA compared to control groups. CRH-ir and GnRH-ir substances were co-localised in one cell of hypothalamic nucleus paraventricularis in the acupuncture group only. The results suggest that CRH might be an important factor in EA normalizing the subnormal function of hypothalamus-pituitary-ovary axis.