

First author et al.	Published in	Randomized	Sample size	Weight class (BMI, kg, lbs)	Gender (m/f)	Age (mean +/- standard deviation)	Method	single/repetitive session(s)	Target region(s)/side	Side of stimulation	stimulation regimen (duration, frequency, pulse width, intensity)	Control condition (sham)	Outcome (craving, liking, intake)	Effect duration	Effect size	
Grundeis et al.	2017	yes	25	obese 102.5 kg ± 11.8 kg 82-130kg0 BMI 36.5 ± 4.1 31.4-45	f	28.8 ± 6.0 range 18-43	IDCS	single	Left dorsolateral prefrontal cortex (DLPFC)	cathode left DLPFC F8; anode over right frontal operculum AF7; vice versa	20 min; 2 mA	sham-controlled	no confirmed effect on craving or calorie consumption			
Goldman et al.	2011	yes	19	82.02 kg ± 25.31 kg BMI: 27.25 ± 6.24 (26.3% overweight, 31.6% obese)	68.4% f	32.47 ± 10.85	IDCS	single	prefrontal cortex		20 min; 2 mA	sham-controlled	greater significant reduction of craving especially sweet food and carbohydrates; no difference food intake	temporary	d = .55	
Fregni et al.	2008	yes	23		21 f	23.7 ± 7.2	IDCS	single	3 sessions (anodal, cathodal, sham)	dorsolateral prefrontal cortex (DLPFC)	anode left/cathode right; anode right/cathode left	20 min; 2 mA (constant current)	sham-controlled	anode right/cathode left: food craving reduced; less frequent fixed at food-related pictures; consumed less food; anode left/cathode right: craving levels did not increase; active stimulation: caloric ingestion significantly lower		
Kekic et al.	2014	yes	17	BMI 23.81 ± 2.60 range 19.85-29.28 70.6% healthy (18.5-24.9) 29.4% overweight (25-25.9)	f	19-55 26.41 ± 8.30	bilateral IDCS	single	dorsolateral prefrontal cortex (DLPFC)	anode right(F4)/cathode left(F3) DLPFC	20 min; 2 mA	sham-controlled	reduced: craving for sweet food not savory; no difference: TD, food consumption	temporary		
Lapenta et al.	2014		9	BMI 21.9 ± 1.63 range 18.96-24.44 all normal weight	f	20-27 23.4 ± 2	bilateral IDCS	single	DLPFC	anode right/cathode left	20 min; 2 mA; one week interval between real and sham	sham-controlled	reduced frontal N2 component; enhanced P3a component of response to No-go stimuli (food or furniture) reduction caloric intake: food craving			
Montenegro et al.	2012	yes	9	overweight 84.7 kg (74.6-137.7kg) BMI 28.2 (25.2-43.5)	5 m; 4 f	20-32 24	IDCS	single	DLPFC	left (anode)	20 min; 2 mA	sham-controlled	left anodal: desire to eat decreased; greater effect IDCS + exercise: desire to eat & hunger		d = 3.0	
Gluck et al.	2015	yes	9	obese 94 ± 15 kg	3m, 6f	42 ± 8	IDCS	repetitive	3 sessions of IDCS or sham over 9 days (total of 6 sessions over 3 years)	LDLPFC	anode F3 cathode above right eye	40 min; 2 mA	sham-controlled	consumed fewer kilocalories per day; significant fewer kilocalories from side and fat; greater weight loss during anodal vs cathodal		
Jauch-Chara et al.	2014	yes	14	BMI 20-25 22.65 ± 0.34 (SEM)	m	21-28 24.81 ± 0.58 (SEM)	IDCS	repetitive	Right dorsolateral prefrontal cortex (DLPFC)	anode right DLPFC; cathode left supraorbital	2x 8 d daily stimulated IDCS/sham conditions 2-4 wk apart; 20 min; 1mA; fade in/out: 8s	sham-controlled	anodal: reduces caloric intake 14% (in comparison with sham) no effect: protein intake and fat		d > 1.09	
Ljubicavljivic et al.	2016	yes	27	BMI 25.6 ± 4.4 77.3 ± 18.3 kg	19 m; 8 f	21.3 ± 2	IDCS	repetitive	right DLPFC	anode right/cathode left	5 days 1 session per day; 20 min; anode right/cathode left; 2 mA current density kept at 0.06 mA/cm2; 1min ramp-up/ramp-down	sham-controlled	single session: reduced intensity of current food craving; repetitiv session: reduced habitual experiences of food craving; decreased craving for fast food & sweets, lesser for fat; no significant effect on craving for carbohydrates; no association with initial weight or weight	after 5-days; after 30-days: repetitive: current and habitual food craving significant reduced; single: no significant effect		
Barth et al.	2011	yes	10	mean: BMI 27.8 165.8lb SD: 8.0 50.3lb (healthy)	f	Mean: 28.3 SD: 6.5	single session rTMS	single	left prefrontal cortex (PFC)	left	10 Hz, 100% resting motor threshold, 10 s-on, 20 s-off for 15 min; 3000 pulses in a single 15 min session	sham-controlled	Cravings significantly lower regardless real or sham; not significant: -condition main effect and time by condition interaction - difference in hours since last ate		d = 0.09	
Camus et al.	2009	no	Exp1: 56 Exp2: 15	Normal-weight BMI 18-25	1: m 30 2: m 8	1: mean 22 range 19-26 2: mean 21 range 19-25	rTMS; inhibitory	single	Right dorsolateral prefrontal cortex (DLPFC) (sham: vertex)	right	Single 15 min, 50% of stimulator maximum 1 Hz rTMS train, 900 pulses	sham-controlled	1: -downmodulation of computation of goals values 2: effect might be specific to computation of goals values			
Uher et al.	2005	yes	28	BMI: real 27.7 ± 5.5 sham: 23.3 ± 5.3	f	real: 25.2 ± 5.4 sham: 26.4 ± 4.9	rTMS	single	Left dorsolateral prefrontal cortex	left	Single session, 10 Hz, intensity 110%; 1000 pulses over 20 min	sham-controlled	Inhibits the development of craving		d = .85	
Lowe et al.	2008	?	28	BMI: mean 23.64 SD 3.352 normal weight	f	mean 20.43 SD 1.345	rTMS, cTBS	pre-/post-stimulation + active cTBS, sham cTBS	Left dorsolateral prefrontal cortex (DLPFC)	left	1 week intersession intensity 80% RMT; 40s continuous train; 600 pulses in theta burst pattern 3 stimuli at 50Hz repeated at 5Hz frequency	sham-controlled	caloric intake higher; high calorie food preferred over low calorie;			
Kim et al.	2008	yes	57 obese adults TMS:29 Sham: 28	BMI: -TMS: 86.90 ± 23.61 -Sham: 78.90± 17.04	TMS: m 13(44.8%) f 16(55.2%) Sham: m 13 (46.4%) f 15 (53.6%)	TMS: 38.66 ± 10.41 Sham: 43.32 ± 11.92	Repetitive transcranial mangnetic stimulation (rTMS)	repetitive 4 sessions	Left dorsolateral prefrontal cortex (DLPFC)	left	2 weeks intervention 2 weeks F/U; 4 sessions; 20 trains of 5 s with 55-s inter-train intervals; frequency 10 Hz; intensity 110% of individual's motor threshold; 1000 pulses over 20 min	sham-controlled	reduction: weight, BMI, fat mass VAT kilocalories, protein, fat intake; increased: feeling of fullness; no change: hunger and desire	2 weeks		
Ruiz-Tovar et al.	2014	yes	105; group 1: 45; group 2: 45; group 3: 15	(group 1/2/3) BMI: 46.1±7.5/45.3±6/32.5±2.4 weight: 123.3±25.1/121.3±20.6/82.8±10.2 kg	80% f; 20% m	45.6 ± 14.3 (21-74)	percutaneous electrical neurostimulation(PENS)	12 sessions	dermatome T6		30 min session/week for 12 weeks; 20Hz (0-20 mA)	control group	group 1: significant reduction weight(7.1±1.5kg, BMI(2.7±0.5), appetite along with diet; 10.7±2.6 % EWL			
Ruiz-Tovar et al.	2016		150	obese pat, BMI 30-40			PENS		dermatome T6				weight loss after 12 weeks: 11.8±2.6kg; 3 months after completing 14.6±2.7kg; 9 months 14.5±2.8kg; appetite (VAS) pre 6; after treatment 1, 3 months 1, 9 months 4; appetite is restored after 3 months, no weight regain	3 months		
Ikramuddin et al.	2014	yes	239 VNB: 162 sham: 77	BMI 41 ± 3 VNB: 113 ± 13kg sham: 116 ± 14kg comorbidity: (VNB/sham) DM2 96%(46/8%); Hypertension 63(39%)/32(42%); Dyslipidemia 91(56%)/46(60%); OSA 33(20%)/23(30%)	VNB: 141 (87%) f sham: 62 (81%) f	VNB: 47 ± 10 Sham: 47 ± 9	invasive VNS	invasive 12 month period	anterior and posterior vagal nerve (gastroesophageal junction)		6-8 mA; 12h/d	sham-controlled	VNB: 24.4% excess weight loss (9.2% of initial body weight loss) sham: 15.9%(6.0%) mean difference 8.5% VNB: 25% of pat. achieved 20% or more EWL, 38% achieved 25% or more loss	12 months		
Shikora et al.	2015	yes	239	BMI 41 ± 3 VNB: 113 ± 13kg sham: 116 ± 14kg comorbidity: (VNB/sham) DM2 96%(46/8%); Hypertension 63(39%)/32(42%); Dyslipidemia 91(56%)/46(60%); OSA 33(20%)/23(30%)	VNB: 141 (87%) f sham: 62 (81%) f	VNB: 47 ± 10 Sham: 47 ± 9	invasive VNS	18 month result	anterior and posterior vagal nerve (gastroesophageal junction)		unblinding	sham-controlled	18-month weight loss vBLoc: 23% EWL(8.8%TWL) sham: 10%EWL(3.8%TWL) vBLoc: maintained 12-month weight loss 23%EWL (9.7%) sham: regained over 40% of the 17%EWL(6.4%TWL) by 18 month, most weight regain preceded unblinding	18 months		
Shikora et al.	2016		28	T2DM; obese pat.; 107 ± 16kg BMI 37 ± 3	17 f (61%)	51 ± 9	invasive VNS	2 year results	vagal nerve		5000 Hz; 3-8 mA for at least 12h each day (goal: 6mA for 14h/d)	no control	57% achieved 20% EWL/5% TWL 43% achieved 25%EWL/7.5%TWL; 30% achieved 10%TWL	2 years		
Whiting et al.	2013		3	(lbs/BMI) 278.7/49.4(HTN); 326/48.1(sleep apnoe, DM2;HTN; migraine); 314/45(lower-extremity edema)	2 f, 1 m	60, 50, 45	DBS	35 months	lateral hypothalamic area (LHA)	bilateral	monopolar or bipolar stimulation; 90 usec pulse width; 185 Hz		significant weight loss 2 patients; 1 stable; increase RMR certain contacts/voltages			
Ho et al.	2015						DBS		lateral hypothalamic area (LHA)							
Harati et al.	2016		1	151.4kg	f	19	DBS		nucleus accumbens	bilateral	both electrodes bipolar stimulation; 208 us pulse width, 130 Hz, 2 mA-3.75 mA		14 months after surgery 138kg, BMI 48.3; no feeling of increased appetite nor need for food; accidental switch off of pacemaker: increased craving for food			