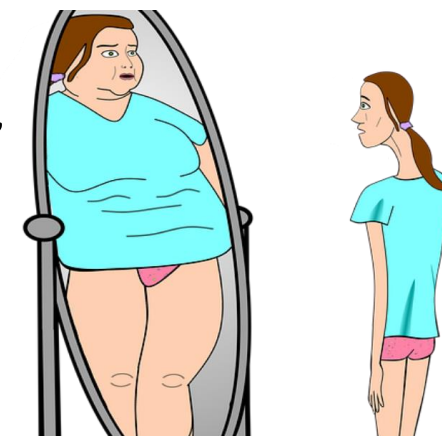




Food challenge to inhibitory control: the role of fronto-cerebellar networks in healthy participants and in patients with anorexia nervosa

Silvia Picazio

Romina Esposito, Francesca Foti, Viviana Ponzio, Valentina Bianco, Viviana Betti, Giacomo Koch



Inhibitory control is a crucial skill in the regulation of food intake

Reactivity to food cues is part of a trait that combines increased appetitive drive and reduced inhibitory control

The ability to control impulses is challenged by appetizing stimuli. This does not seem to be related to the need to procure the food necessary for the sustenance of the organism (homeostatic drive), but rather resembles a mechanism similar to addiction (hedonic drive)

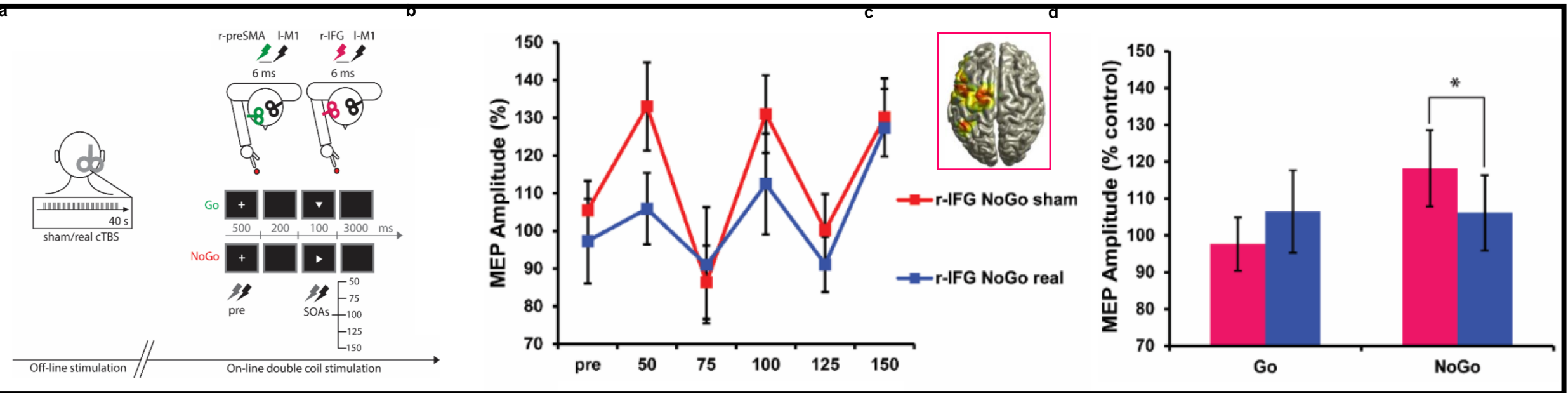


Dysfunctional inhibitory control has been implicated in eating disorders with anorexia nervosa at the over-controlling boundary, and bulimia nervosa/binge eating at the opposite extremity of impulsivity



Following real cerebellar cTBS (r-IFG NoGo real, in blue) the beta corticospinal excitability pattern related to inhibitory control was reduced. This suggests a specific interaction between Cb and PFC underlying inhibitory control.

Although inhibitory control has been traditionally considered to rely exclusively on the prefrontal cortex, recent findings using transcranial magnetic stimulation (TMS) have shown that other areas are involved



How is the motor circuit involved in the neurophysiopathology of food-related inhibitory control?

20 HEALTHY PARTICIPANTS



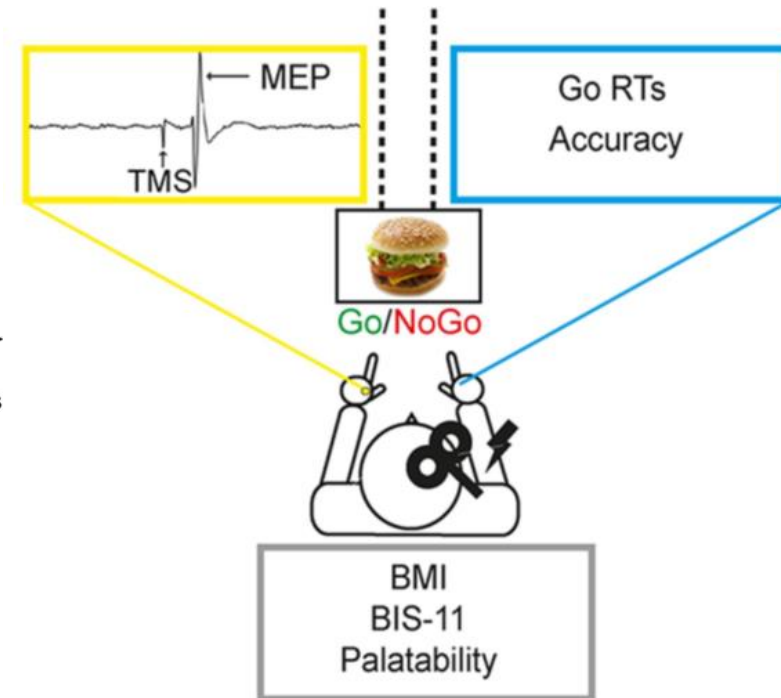
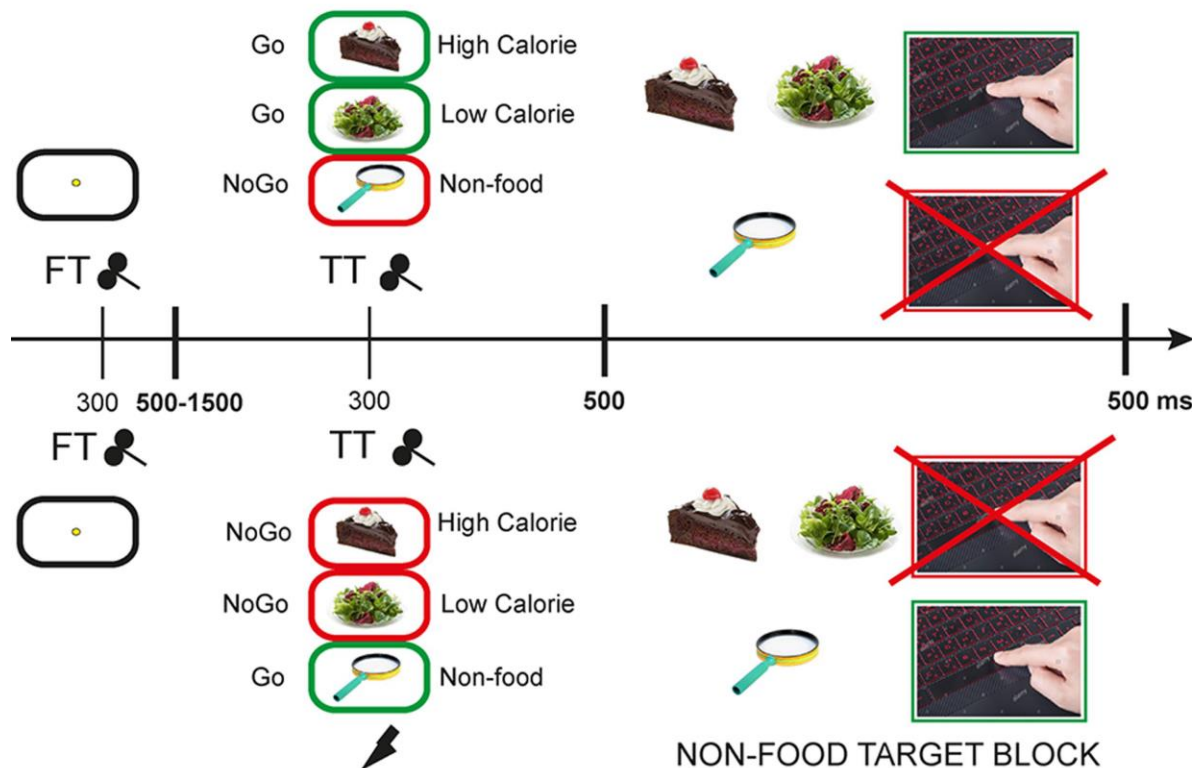
HIGH-CALORIE



LOW-CALORIE



NON-FOOD



Food Go/NoGo task involving food (high- low-calorie) and non-food images. Participants were instructed to respond when they saw a food (Go trials - 50%) and refrain from responding when they saw a non-food (NoGo trials -50%) picture (food target block) or vice versa (non-food target block).

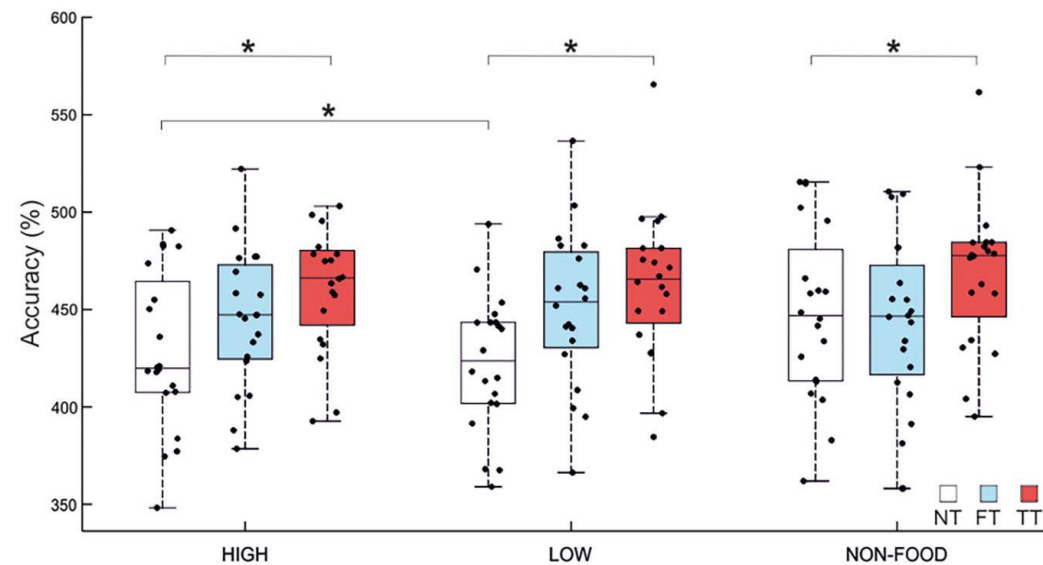
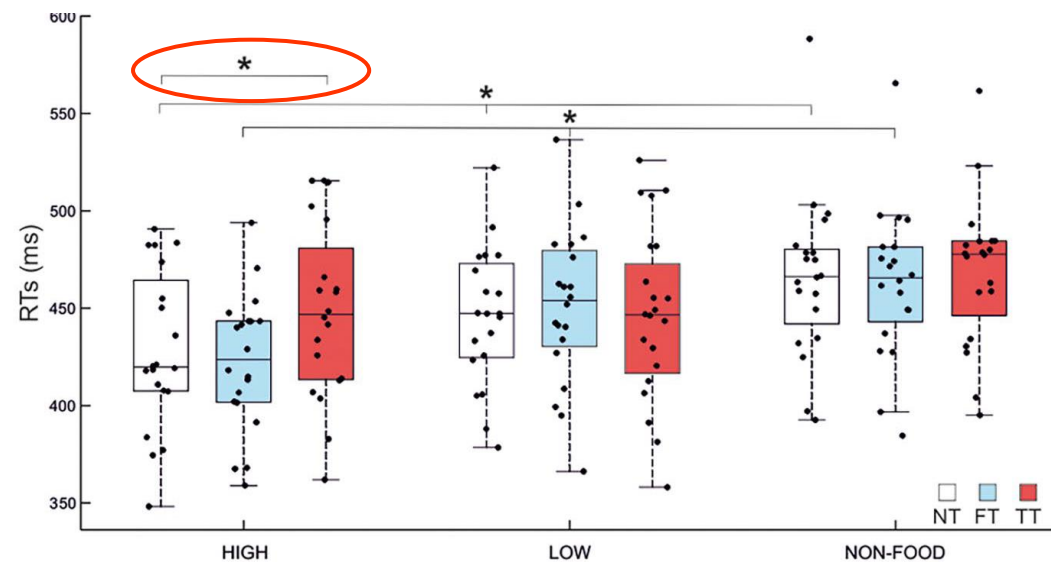
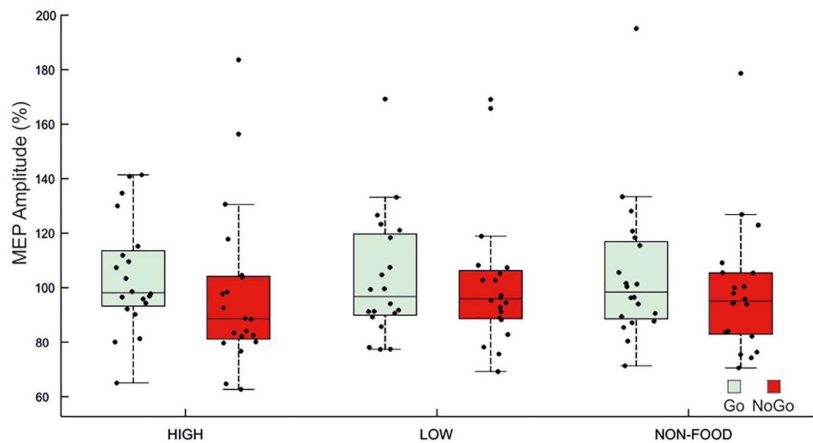
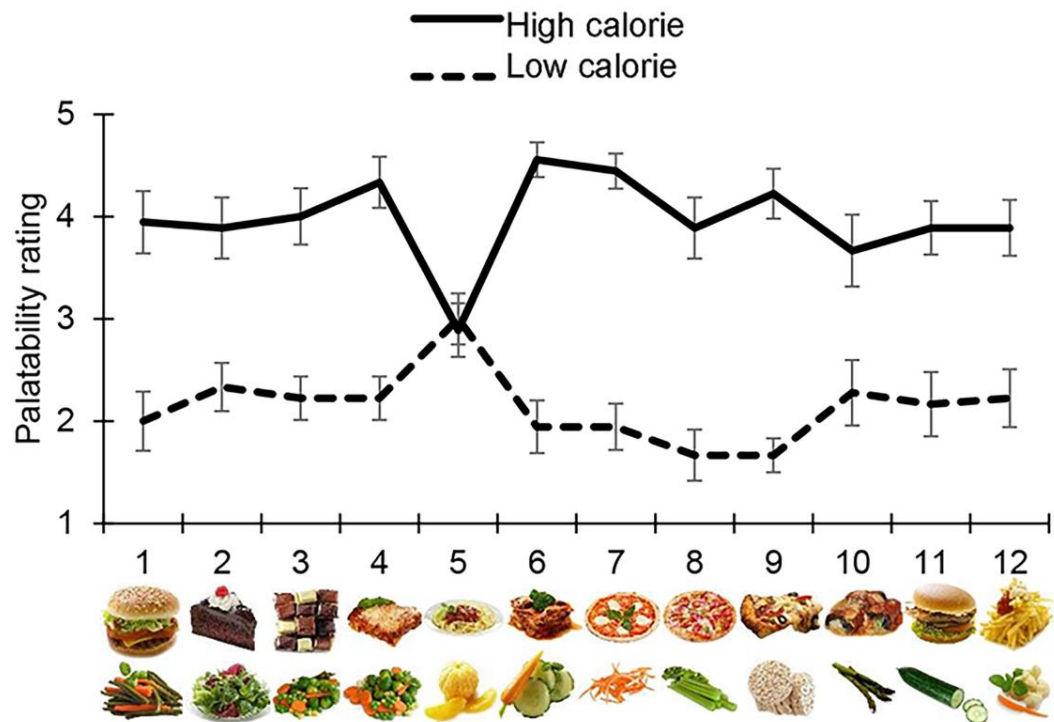
Introduction

EXP 1

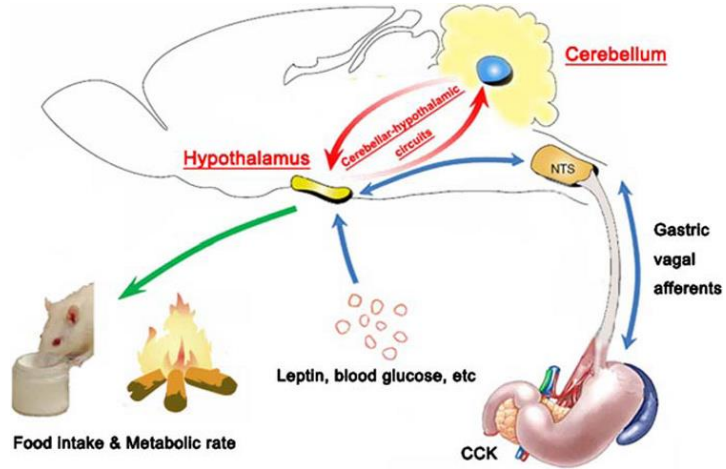
EXP 2

EXP 3

Conclusions

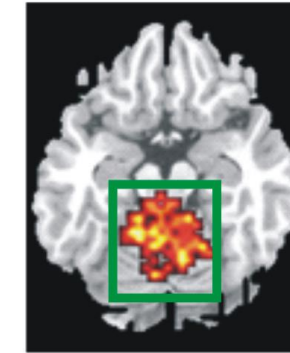


Converging evidence indicates a role of cerebellum in feeding behavior and inhibitory control

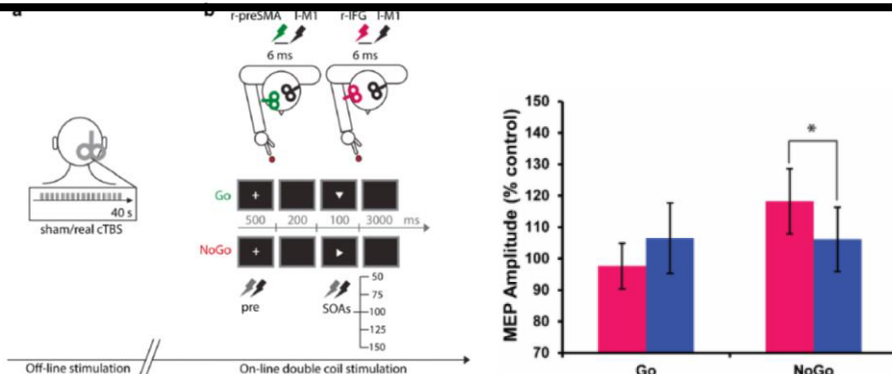


Cerebellum has direct bidirectional connections with hypothalamic areas involved in food intake regulation and receive visceral and somatic information from the gastric vagal afferents (Zhu & Wang, Cell Mol Neurobiol, 2008)

AN < HC



Cerebellum is consistently shown to be altered in eating disorders. In particular, reduced cerebellar structures and activations were repeatedly reported in patients with AN (Brooks et al., pone, 2012)



Manipulating cerebellar plasticity is possible to modulate prefrontal to motor effective connectivity during NoGo trials (Picazio et al., Cerebellum, 2016)

Introduction

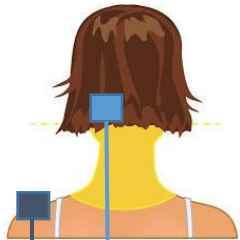
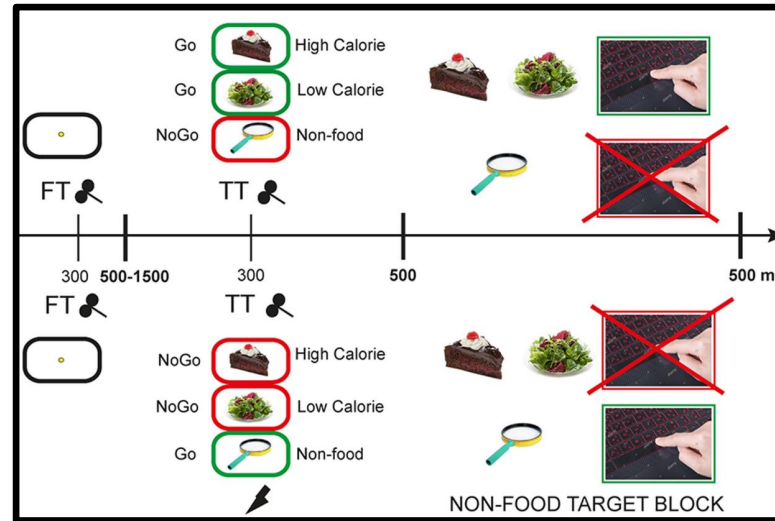
EXP 1

EXP 2

EXP 3

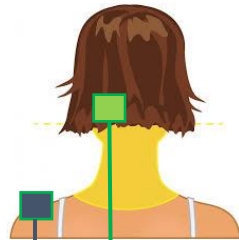
Conclusions

Performance to the food Go/NoGo task was investigated in a sample of 23 normal weight healthy participants was investigated following sham, anodal or cathodal transcranial direct current stimulation (tDCS) applied over the left cerebellar hemisphere



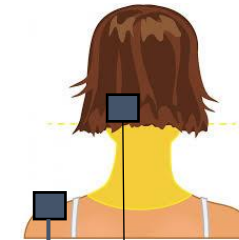
FOOD-RELATED
GO/NoGo TASK

CATHODAL
tDCS



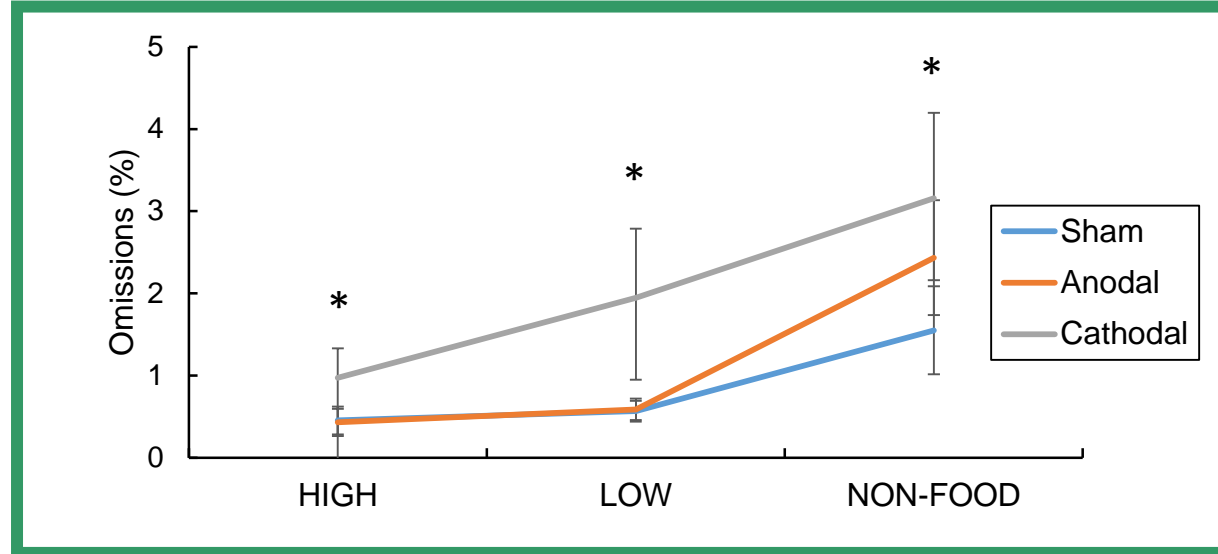
FOOD-RELATED
GO/NoGo TASK

ANODAL
tDCS

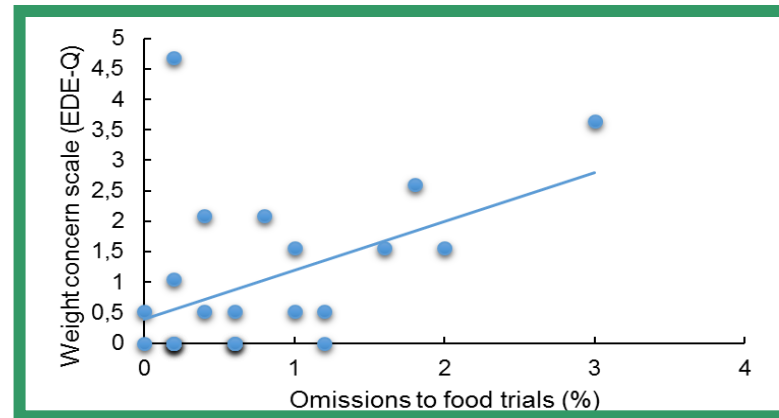


FOOD-RELATED
GO/NoGo TASK

SHAM
tDCS



Cathodal cerebellar tDCS was able to modulate HC performance increasing the number of omissions

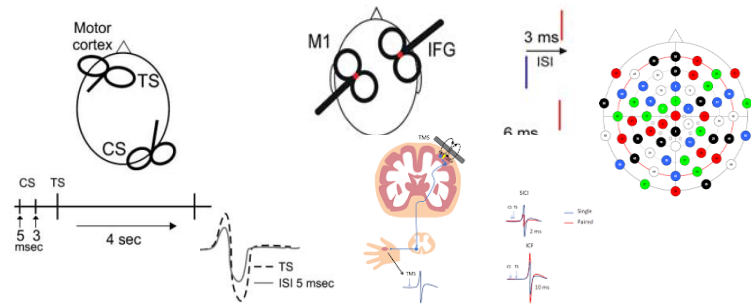


An interesting positive significant correlation between Weight Concern EDE-Q subscale and the percentage of omission to food trials was found ($R = 0.432$; $p = 0.039$). The more the participants were concerned about being overweight, the more they skipped responses to food trials. In other words, weight concerns were paralleled by avoidance of responding to food cues, even in healthy participants



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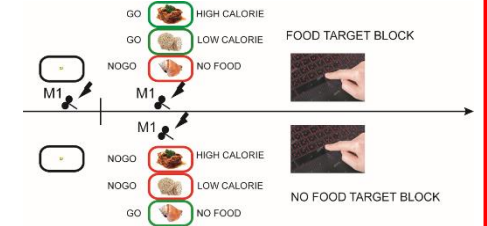
40 patients affected by Anorexia Nervosa (AN)



- Eating Disorder Inventory (EDI-3)
- Eating Attitudes Test (EAT-26)
- Barratt Impulsiveness Scale-11 (BIS-11)
- Raven's Coloured Progressive Matrices

Food-related
GO/NoGO TASK

BACKWARD
INHIBITION TASK

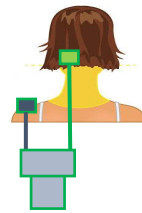


NEUROPHYSIOLOGICAL MEASURES

PSYCHOPATHOLOGICAL MEASURES

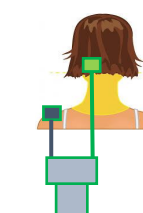
NEUROCOGNITIVE MEASURES

20 AN patients



Real ANODAL
tDCS

18 daily sessions



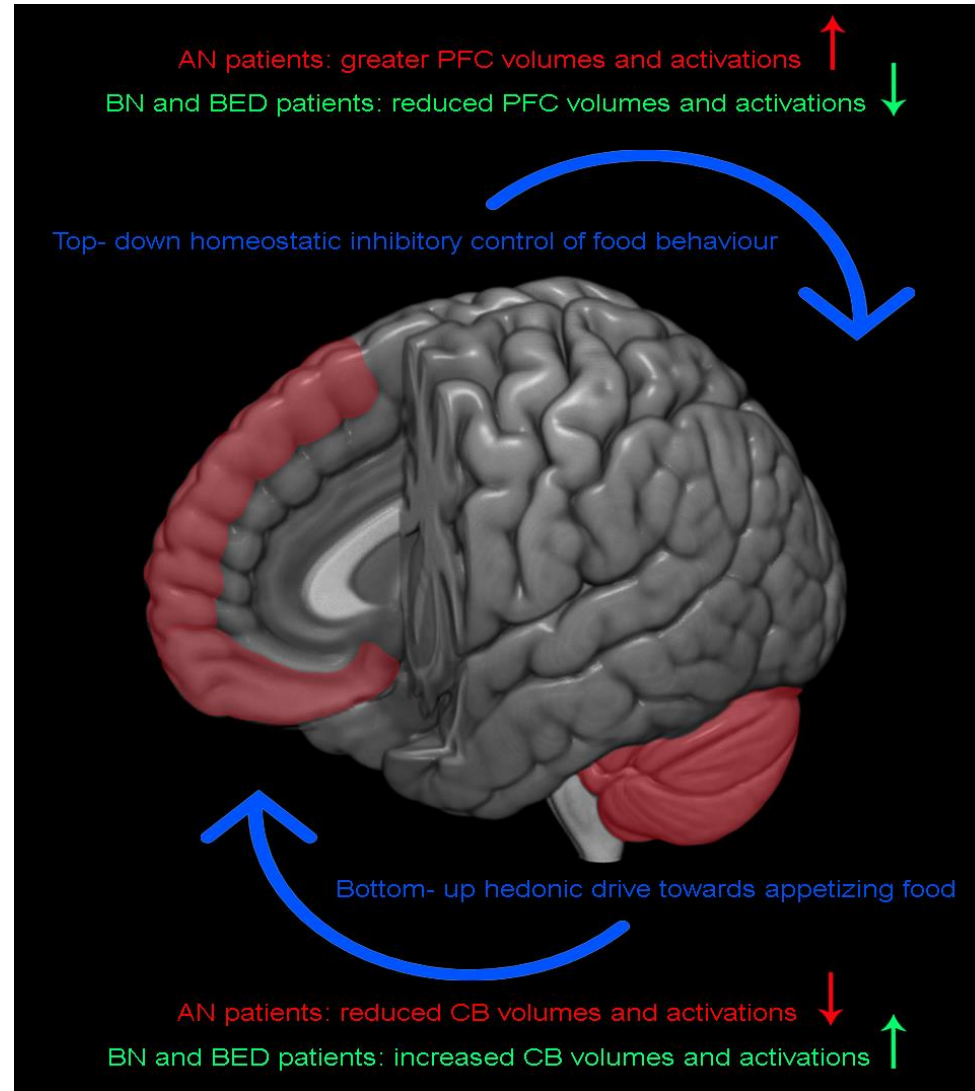
Sham ANODAL
tDCS

20 AN patients



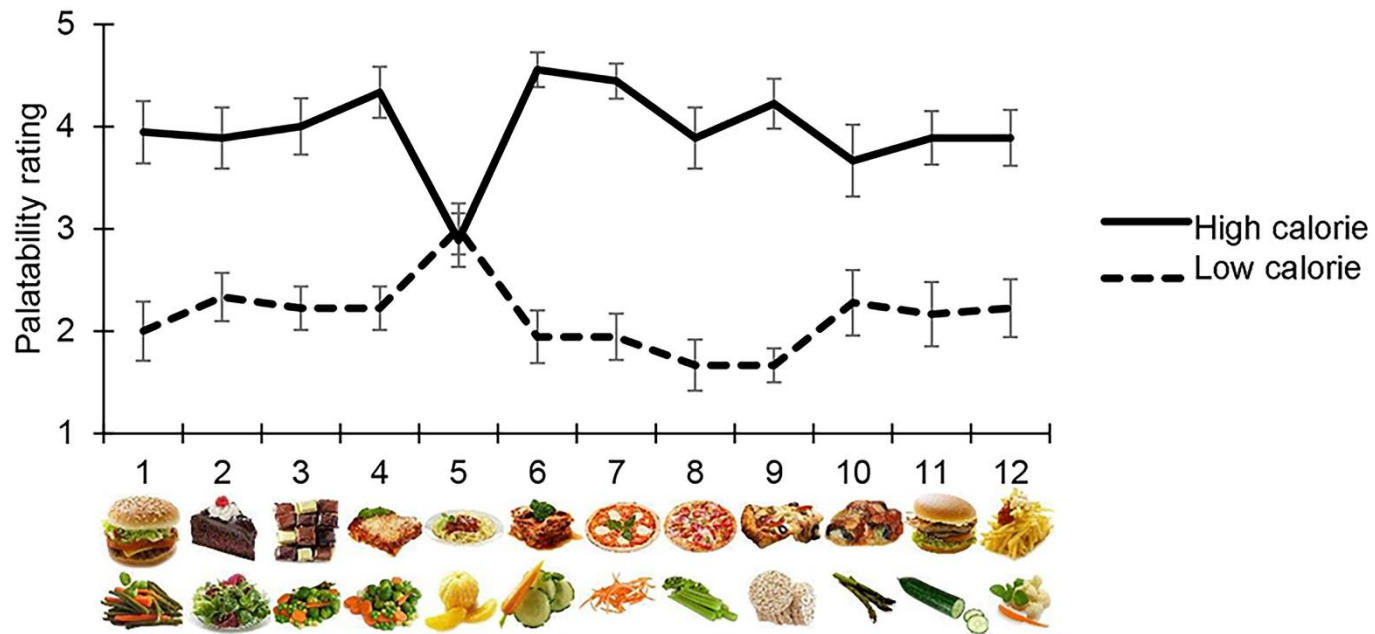
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40 patients affected by Anorexia Nervosa (AN)

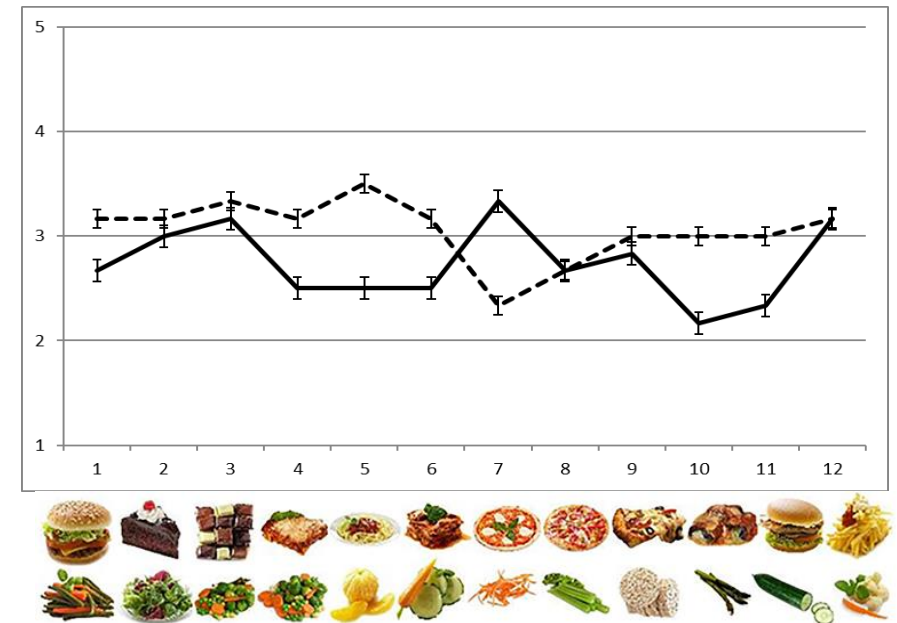


Palatability rates

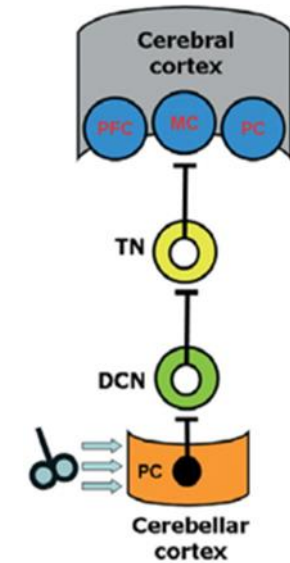
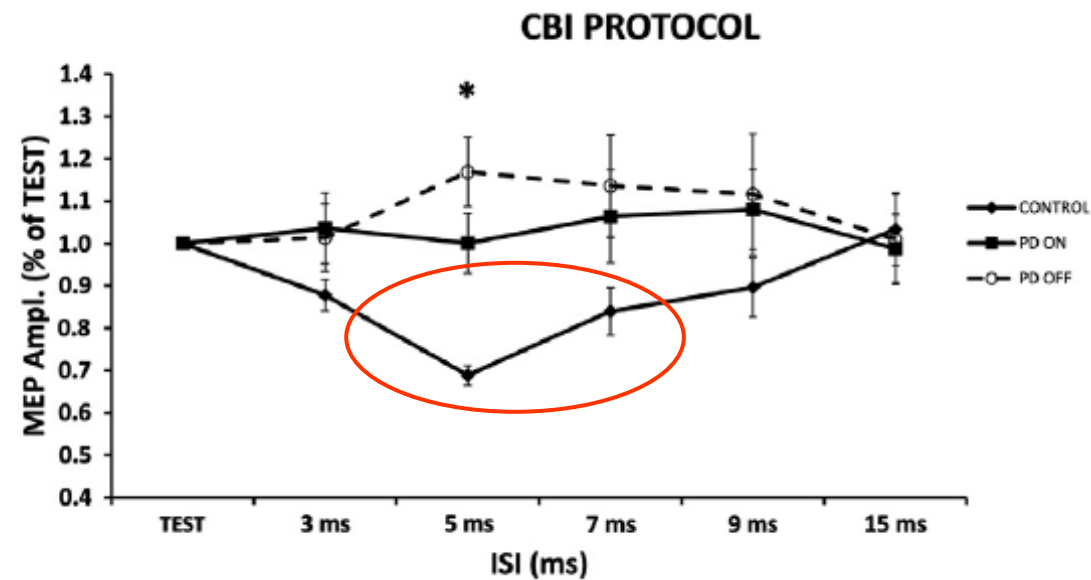
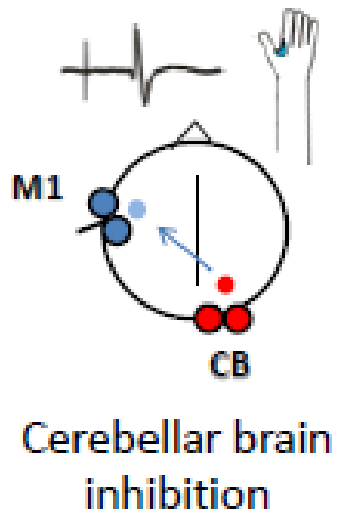
HC



AN



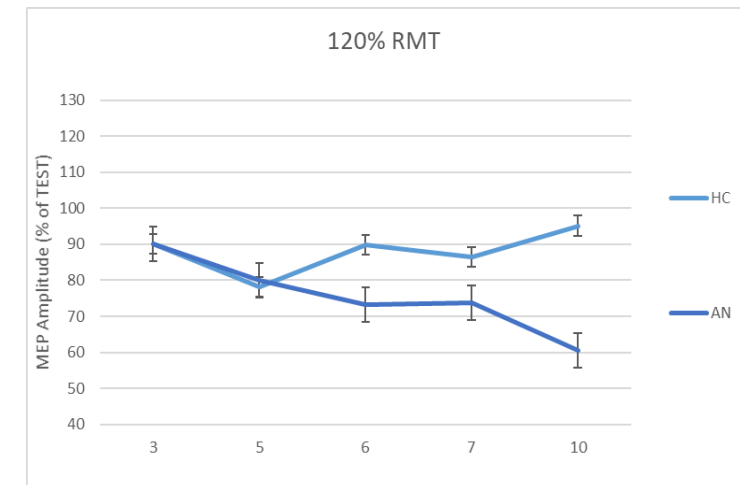
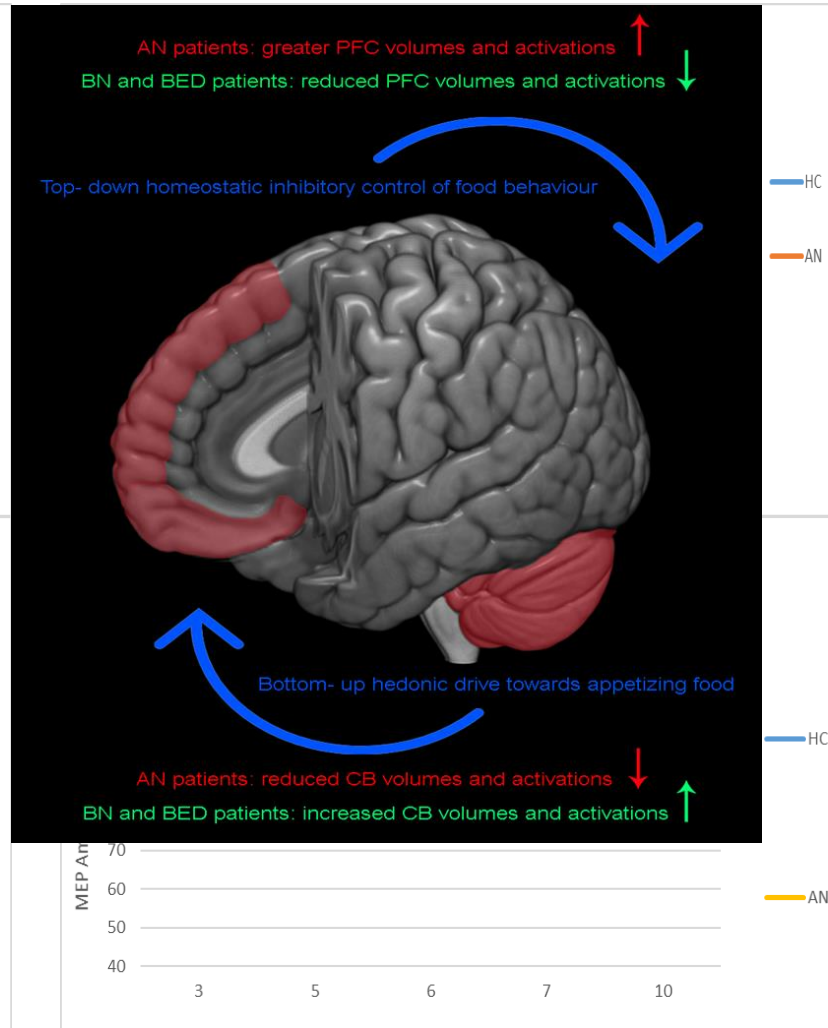
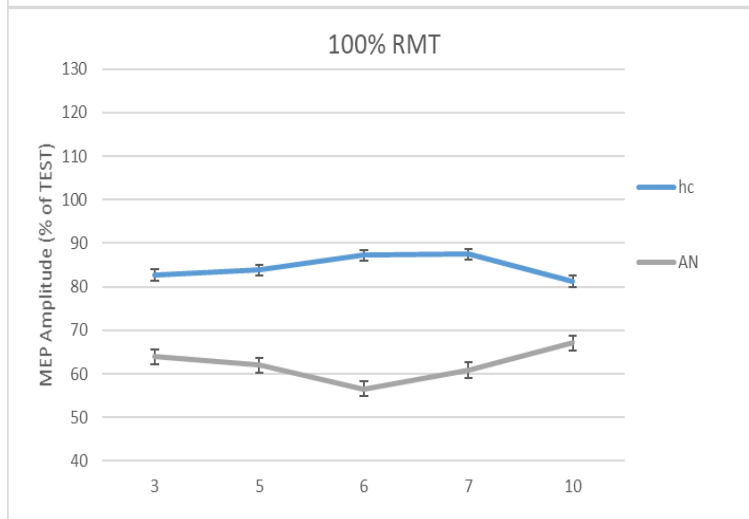
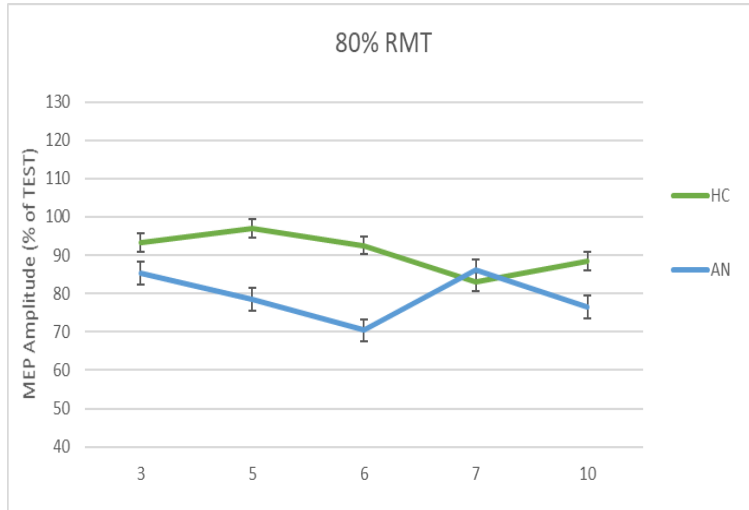
Cerebello-Motor Inhibition (CBI)



7 patients with AN and 9 healthy controls



Cerebello-Motor Inhibition (CBI)

7 patients with AN and 9 healthy controls



- Motor cortex is involved in food related inhibitory control in HC
- Cerebellum is involved in food related inhibitory control in HC
- In accordance with previous neuroimaging findings CBI showed alterations of cerebello-motor connectivity in patients with AN



- Studying the neuropsychophysiology of food choices in healthy participants and in patients with eating disorder is fundamental to understand the nature of these pathological conditions and to develop innovative treatments  TMS-EEG DURING FOOD GONOGO IN AN
- The non-invasive stimulation of the cerebellum could be a promising tool to treat eating disorders  CLINICAL TRIAL ANODAL CEREBELLAR TDCS IN PATIENTS WITH AN



**Experimental
Neurophysiology Lab**



Thanks for the attention



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