



Weight loss is associated with improvements in cognitive function among overweight and obese people: A systematic review and meta-analysis



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ABSTRACT

Whilst obesity is associated with a higher risk of cognitive impairment, the influence of weight loss on cognitive function in obese/overweight people is equivocal. We conducted a meta-analysis of randomized controlled trials (RCTs) and longitudinal studies evaluating the influence of voluntary weight loss on cognitive function in obese/overweight individuals. Articles were acquired from a systematic search of major databases from inception till 01/2016. A random effect meta-analysis of weight loss interventions (diet, physical activity, bariatric surgery) on different cognitive domains (memory, attention, executive functions, language and motor speed) was conducted. Twenty studies (13 longitudinal studies = 551 participants; 7 RCTs = 328 treated vs. 140 controls) were included. Weight loss was associated with a significant improvement in attention and memory in both longitudinal studies and RCTs, whereas executive function and language improved in longitudinal and RCT studies, respectively. In conclusion, intentional weight loss in obese/overweight people is associated with improvements in performance across various cognitive domains. Future adequately powered RCTs are required to confirm/refute these findings.

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1. Introduction

The prevalence of overweight and obesity is high and increasing in all age groups, including the elderly (Nguyen and El-Serag, 2010; WHO consultation, 2000). Several medical complications are associated with excessive adiposity, including type 2 diabetes (Chan et al., 1994), cardiovascular diseases (Eckel, 1997), cancer (Renehan et al., 2015), cognitive impairment (Xu et al., 2011), and premature mortality (Fontana and Hu, 2014; Ng et al., 2014).

Weight loss remains the cornerstone for the treatment of obesity, and can be achieved through several interventions, such as calorie restriction and/or physical exercise, and in extreme cases bariatric surgery. Weight loss is associated with improvements in multiple metabolic factors (i.e. glucose tolerance, insulin sensitivity, blood pressure, oxidative stress, and inflammation), which have been implicated in the pathogenesis of cognitive impairment and dementia (Ceriello et al., 2014; Bennett et al., 2009; Schmidt et al., 2002).

However, the potential cognitive benefits of weight loss are still unclear and largely limited to those associated with weight loss from physical activity alone. Higher physical activity level seems to be able to increase gray and white matter volume in the prefrontal cortex (Colcombe et al., 2006) and is associated with greater sparing of prefrontal and temporal brain regions (Erickson et al., 2010). Moreover, exercise training increases cerebral blood volume (Burdette et al., 2010) and perfusion of the hippocampus (Pereira et al., 2007), one of the most important organ in the control of food intake. If these anatomical changes correspond to better cognitive function is, however, not fully understood.

A previous systematic review and meta-analysis with a search date of over 5 years ago (Siervo et al., 2011) found that weight loss had a beneficial effect on some cognitive domains, particularly among obese individuals. Whilst this previous study advanced the field, the authors relied on conclusions based on observational studies and did not include data from randomized control trials (RCTs). Whilst inferences from observational data are helpful, the certitude of any relationship between weight loss and cognition from such data is limited. RCTs enable causal inferences to be asserted and therefore, a meta-analysis of interventional data may offer additional information beyond that of observational data. Moreover, these authors did not investigate the influence of different weight loss strategies on cognitive performance outcomes. Understanding the potential impact of different weight loss strategies would offer new and important information.

We therefore aimed to investigate the effect of intentional weight loss on cognitive status assessed through validated scales in overweight and obese people across observational and interventional studies. We hypothesized that weight loss would be beneficial for cognition in obese/overweight individuals.

2. Materials and methods

This systematic review was conducted according to the Strengthening the Reporting of Observational Studies in Epidemiology [STROBE] criteria (von Elm et al., 2008) and the recommendations in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses [PRISMA] statement (Liberati et al., 2009).

2.1. Search strategy

Two investigators (NV, SF) independently conducted an electronic literature search using EMBASE, PubMed and Scopus with no language restrictions, from their inception until 02/01/2016, searching studies providing data on intentional weight loss on cognitive parameters in obese and overweight people. Any inconsistency was resolved by consensus.

In PubMed, the following controlled vocabulary terms and keywords were considered: (obese or overweight) and (weight loss) and (cognit*).

A similar search strategy was performed in the other databases. Reference lists of the articles included in the analysis and of others papers relevant to the topic were hand-searched to identify additional, potentially relevant publications. Conference abstracts were also considered.

2.2. Study selection

We only considered studies that: (1) included overweight and obese people before any weight loss intervention, defined through a body mass index (BMI) between 25 and 29.9 and a BMI \geq 30 kg/m² (WHO consultation, 2000), respectively; (2) reported data on any cognitive domain (e.g. attention, executive function, memory, motor speed, language and global cognition) assessed through validated scales before and after a weight loss intervention program, (3) longitudinal or interventional studies using diet, calorie restriction, increased physical activity or bariatric surgery as interventions; (4) reported at least 2 kg of weight loss (i.e. clinically significant weight loss) (Siervo et al., 2011) in the treated group between follow-up and baseline.

We excluded studies for the following reasons: (1) non validated scales for assessing cognition; (2) unintentional weight loss (i.e. not voluntary weight loss, for example due to an illness); (3) use of pharmacological interventions for losing weight; (4) no human subjects included.

Where data about baseline or follow-up tests were not available, the first and corresponding authors of each paper were contacted at least 4 times in a month period. All of the five authors we contacted

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