

**High quality weight loss after
spinal cord injury:
Can lean mass be preserved while fighting
obesity?**

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Can diet/nutrition be used as an effective means to manage health complications after spinal cord injury?

Via, its potential effects on inflammation...



RESEARCH

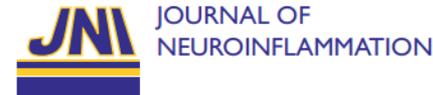
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Targeting inflammation as a treatment modality for neuropathic pain in spinal cord injury: a randomized clinical trial



David J. Allison^{1,2*}, Aysha Thomas¹, Kayleigh Beaudry¹ and David S. Ditor^{1,2}

Allison and Ditor *Journal of Neuroinflammation* (2015) 12:204
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RESEARCH

Open Access

Targeting inflammation to influence mood following spinal cord injury: a randomized clinical trial



David J. Allison^{1,2*} and David S. Ditor^{1,2}



The anti-inflammatory diet:

- The elimination of common food intolerances and inflammation-inducing foods
 - *High glycemic indices*
 - *Cow's milk*
 - *Hydrogenated oils*
 - *Alcohol and coffee*
- *Daily supplements with established anti-inflammatory benefits*
 - *Omega-3, Chlorella, Anti-oxidants, Curcumin, Vegetable-based protein powder*
- *1400kcal/day (~400kcal/day less than usual), Approx. 25% PRO*



Results:

Inflammation:

- 28% decrease in overall pro-inflammatory mediators
- Specific decreases in IL-2, IL-6, IL-1 β , IFN- γ

Neuropathic Pain:

- 40% decrease in sensory component of the NPQ
- Related to decreases in PGE2 and IFN- γ

Depression:

- 55% decrease in CES-D scores
- Related to decreases in IL-1 β and its effects on the Kynurenine pathway



ARTICLE



Maintenance of diet participation in individuals with spinal cord injury: effect on mood and neuropathic pain

David J. Allison^{1,2} · David S. Ditor^{1,2}



Compliance to the diet during the study:

89% (70-100%)

Compliance to the diet at 1-year follow-up:

43% (36-53%)



Report of empirical study

Barriers and facilitators to adhering to an anti-inflammatory diet for individuals with spinal cord injuries

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The MAD DOG diet:

- 5 days per week; 6 weeks
- *Omitted expensive daily supplements and replaced with nutrient dense foods*
- *1375kcal/day (250-500kcal/day below required)
21% PRO (0.9g/kg/day)*
- *Investigated the effects on:*
 - *Inflammation*
 - *Body composition (via DEXA)*



The MAD DOG diet:

Pilot study:

- Six participants (3 male, 3 female)
- SCI (C5-T1; AIS A-D) or MS (RRMS, SPMS)
- 1-33 years post injury/diagnosis

Results:

Compliance to the diet:

- All participants completed the 6-week diet with an average compliance of 92% (89-96%)



Results:

Inflammation:

- **Significant decrease in CRP (34%)**

Body composition:

- **Significant decrease in TOTAL mass (-2.9kg)**
- **Significant decrease in FAT mass (-1.8kg)**
(decreases in subcutaneous fat reached significance, decreases in visceral did not)
- **Significant decrease in LEAN mass (-1.0kg)**



Losses in lean mass typically occur with energy restriction:

- Systematic review by Weinheimer et al., 2010 (Nutr Rev, 68:375-88)
- *Losses in LBM account for 20-30% of losses in body mass during hypoenergetic diets*



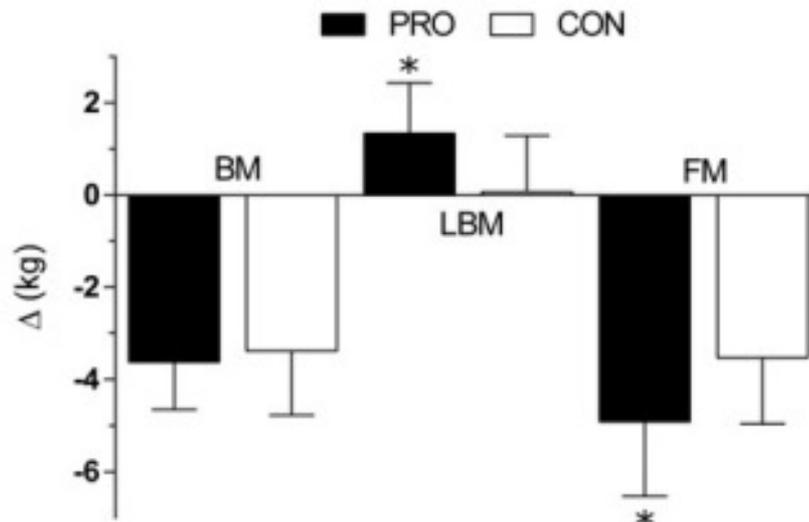
HIGH QUALITY WEIGHT LOSS:

Can it be achieved in the non-disabled?



High quality weight loss via high protein and/or resistance training

- 40 overweight (BMI>25) men (23 ± 2 years), low calorie diet (40% reduction)
- All participants did resistance training and HIIT 6 days/week, 4 weeks
- 20 participants were in a low PRO group (1.2g/kg/day)
- 20 participants were in a high PRO group (2.4g/kg/day)

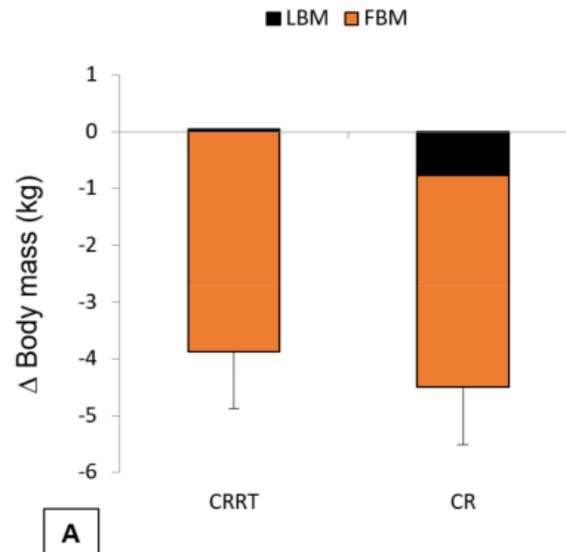


Longland et al., 2016



High quality weight loss via resistance training

- *Sardeli et al., 2018 – Systematic review and meta-analyses of 6 studies in obese older adults*
- *Calorie restriction: 400-800 kcal/day below recommended*
- *Resistance training: 12-24 weeks, 3x/week, 2-3 sets of 8-15 reps*
- *Resistance training reduced the losses in LBM during calorie restriction by 93.5%*



High quality weight loss via high protein?

Stonehouse et al., 2016: Meta-analysis of 15 RCTs

- **Adults aged 18-50; interventions >4weeks**
- **Calorie restriction of approximately 500kcal/day less than required**
- **2-4 servings/day of dairy or whey**
- **Increased dairy during energy-restricted diets results in greater losses in fat mass while attenuating losses in lean mass (75%)**
- **>2g/kg/day protein may maintain LBM during low calorie diets**



HIGH QUALITY WEIGHT LOSS:

Can it be achieved in those with SCI?



Recommended caloric requirements after SCI

- Caloric requirements are variable and resting energy expenditure (REE) should be measured via indirect calorimetry.
- REE for adults with chronic SCI range from:
 - 1500-1700kcal/day for thoracic injuries (TDEE = 1725-1955kcal/day)
 - As low as 900kcal/day for cervical injuries (TDEE = 1035kcal/day)
- Multiply REE by 1.15 to determine total daily energy expenditure (TDEE)

Khalil et al., 2013



High quality weight loss via protein alone after SCI

Case example

- Individual with tetraplegia, 75kg body weight and TDEE of 1400kcal
- Energy restricted diet = 900 kcal/day
- At 2g/kg protein per day = 150g protein/day = 600kcal protein/day
- 67% protein diet!



High Quality weight loss after SCI – The evidence

Combined diet and exercise:

- 16 obese participants (BMI = 34.3kg/m²)
- Time-calorie displacement diet for 12 weeks
- Supervised exercise for 6 weeks (once/week) and encouraged at home

Results:

- Calorie reduction of 219.5kcal/day
- Significant reduction in weight (-3.5kg) and fat mass (-2.9kg)
- No significant change in lean mass (-0.8kg)

Note:

- Protein and resistance exercise not specified
- High quality weight loss?

Chen et al., 2006



High Quality weight loss after SCI – The evidence

Combined diet and testosterone replacement therapy (TRT):

- 31 year old male, T5 SCI; 16-week intervention
- Transdermal TRT; 4mg/day (baseline testosterone: 440ng/dL)
- Reduced calories by 445kcal/day (-25%), increased protein 7.6% (to 28.2%)
- Decreased: Body weight 6.4kg (-8%), Fat mass 8.8kg (-29%), Trunk VAT -12%
- Increased 3.1kg lean mass (+7%)

Gorgey et al., 2019



High Quality weight loss after SCI – The importance

Maintaining/gaining lean mass during weight loss:

- **Strength and function in those with incomplete SCI**
- **Decrease risk of metabolic disease**
- **Increase basal metabolic rate**
- **Source of myokines and cross-talk with adipose tissue**



Myokines are cytokines secreted by muscle during exercise

- Sometimes in an intensity-dependent fashion
- Can communicate with adipose tissue and bone (cross-talk)

Irisin:

- Promotes browning of white adipose tissue (WAT)
- Anti-inflammatory/neuroprotective in rat models of SCI
 - Reduced IL-1 β , IL-6, TNF- α , iNOS, COX-2
 - Improved locomotor function at 28 days post-treatment (*Jiang et al., 2020*)

BAIBA (β -aminoisobutyric acid)

- Promotes browning of white adipose tissue, reduces lipogenesis in WAT
- Anti-inflammatory (*Jung et al., 2018; Roberts et al., 2014*)



HIGH QUALITY WEIGHT LOSS:

Can it be achieved in those with SCI?

Resistance training?

Protein consumption?

Testosterone treatment?

An important topic that warrants further investigation!



Thank You!

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Ontario Neurotrauma Foundation
Fondation ontarienne de neurotraumatologie



Brock
University

High Quality weight loss after SCI – The evidence

Combined diet and exercise:

- 9 individuals with motor complete SCI, 12-week study
- n=5, twice weekly resistance training + diet
- n=4, diet alone

Exercise was associated with leg muscle hypertrophy, but the diet was not hypoenergetic and there was not an overall decrease in weight or fat mass.

- Cannot conclude that resistance training would have attenuated losses in lean mass during weight loss/calorie restriction

Gorgey et al., 2012



REE after SCI should be based on lean mass

- Paraplegia: 28 ± 4 kcal/kg lean mass/day
- Tetraplegia: 31 ± 2 kcal/kg lean mass/day

Recommended protein requirements after SCI

- 0.8-1.0g/kg body weight (in the absence of pressure injuries)
- 1.2-2.0g/kg body weight (in those with pressure injuries)
- Greater than 2.4g/kg body weight during acute SCI

Farkas et al., 2021

