OPTIMIZING NUTRITION FOR SPINAL HEALTH

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DISCLOSURE

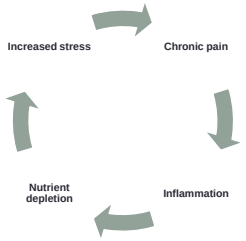
- No conflicts of interest to disclose

OBJECTIVES

- Diet and pain signaling
  - Diet modulates inflammation
  - Inflammation & the nervous system
  - Omega-3 fats
- Nutrient status matters!
  - Vitamin D, Magnesium, B12
  - Surgical outcomes
  - Optimize nutrition vs weight loss
- Anti-inflammatory diet for Pain

WHY?

- Inflammation and poor diet increase pain signals via interference with healing & resolution, and hyper-activation of the CNS
- Chronic pain further increases inflammation & nutrient demand
- VICIOUS CYCLE



How does diet impact neuromusculoskeletal pain?

- INFLAMMATION
  - Acute = tissue healing and repair
  - Chronic = LOSS of ability for healing
- Skeletal, muscle & nerve tissue are all living, active and dependent on nutrient information for maintenance and repair.
- Food and nutrients as building blocks, and chemical messengers/signalers & cofactors for normal maintenance & repair
- Inflammation & deficient nutrients → promotion of degenerative disease
- ROOT CAUSE?

How does diet impact neuromusculoskeletal pain?

THE DIET-INDUCED PROINFLAMMATORY STATE: A CAUSE OF CHRONIC PAIN AND OTHER DEGENERATIVE DISEASES?

David R. Seaman, DC*

Results: The typical American diet is deficient in fruits and vegetables and contains excessive amounts of meat, refined grain products, and dessert foods. Such a diet can have numerous adverse biochemical effects, all of which create a proinflammatory state and predispose the body to degenerative diseases. It appears that an inadequate intake of fruits and vegetables can result in a suboptimal intake of antioxidants and phytochemicals and an imbalanced intake of essential fatty acids. Through different mechanisms, each nutritional alteration can promote inflammation and disease.

Conclusion: We can no longer view different diseases as distinct biochemical entities. Nearly all degenerative diseases have the same underlying biochemical etiology, that is, a diet-induced proinflammatory state. Although specific diseases may require specific treatments, such as adjustments for hypomobile joints, β-blockers for hypertension, and chemotherapy for cancer, the treatment program must also include nutritional protocols to reduce the proinflammatory state. (J Manipulative Physiol Ther 2002; 25:168-79)

- Seaman DR. J Manipulative Physiol Ther. 2002 Mar-Apr;25(3):168-79.

How does diet impact neuromusculoskeletal pain?

"Let food be thy medicine, and medicine be thy food."
~Hippocrates

How does diet impact neuromusculoskeletal pain?

- Hamburger vs Add an avocado slice
  - 11 subjects – 2 separate meals
    - AVOCADO MEAL
      - Reduced activation of the NF-kappa B (NFκB) inflammatory pathway
      - No increase in IL-6 (vs increased IL-6 after burger alone)
  - Avocados contain monounsaturated fatty acids (oleic acid) and antioxidants (carotenoids, tocopherols, polyphenols)
    - Li Z, Wong A. Food Funct. 2013 Feb 26;4(3):384-91.

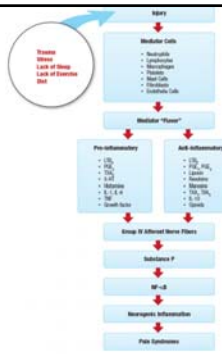
- "substantial amount of evidence to suggest that many foods, nutrients and non-nutrient food components modulate inflammation both acutely and chronically"
  - Minihane AM, Vinoy S, et al. *Br J Nutr*. 2015 Oct 14; 114(7): 999–1012

How does diet impact neuromusculoskeletal pain?

- Proinflammatory diet is activating to the nervous system VIA increased inflammation
  - Inadequate nutrients
  - Linoleic & Arachidonic Acid / Omega-6 fats
  - Acelluar carbohydrates & blood sugar dysregulation

- NF-κB
  - regulates genes involved in inflammation and pain
  - contribution to pain via signaling astrocytes (glial cells)in the CNS

- Hartung JE, Eskew O, et al. Brain Behav Immun. 2015 Nov; 50: 196–202.



- Tennant F. A diet for patients with chronic pain. *Pract Pain Manage.* 2011;11(6):22-30.

How does diet impact neuromusculoskeletal pain?

- Anti-inflammatory diet is resolving to inflammation via:
  - Lower CRP, inflammatory markers
  - Antioxidants
  - Improved blood sugar regulation
  - Reduced adrenal burden
  - Essential fatty acids
    - EPA and DHA

Omega 3's and pain singnaling

- **EPA and DHA from fish oils**
  - increase production of anti-inflammatory **resolvins and protectins (neuroprotectins)**
  - Reduce pro-inflammatory mediators: TNF-a, IL-1b and IL-6
  - Increases anti-inflammatory EPA and DHA containing endocannabinoids
  - Decreased eicosanoids
- **Linoleic & Arachidonic acids (Omega-6)**
  - Essential fatty acids
  - Excess are Pro-inflammatory
    - Increased NF-kB, isoprostanes, prostaglandin E2, leukotrienes

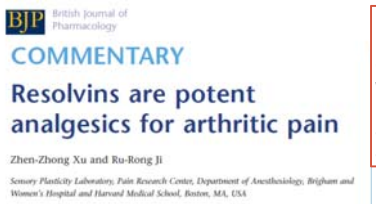
- Calder PC. *Br J Clin Pharmacol.* 2013 Mar;75(3):645-62.
- Vasquez A. *Nutritional Perspectives: Journal of the Council on Nutrition of the American Chiropractic Association* 2005 Jan 28(1).

Omega 3's and pain singnaling

- Safer alternative to NSAIDS
  - 125 patients with discogenic low back pain
  - 1200-2400mg Fish Oils
  - 59% discontinued to take their prescription NSAID medications for pain
  - no significant side effects reported

- Maroon JC, Bost JW. Omega 3 fatty acids (fish oils) as an anti-inflammatory: an alternative to non-steroidal anti-inflammatory drugs for discogenic pain. Surg Neurol. 2006 Apr;65(4):326-31

Omega-3's and Pain Signaling


BJP British Journal of Pharmacology

COMMENTARY

Resolvins are potent analgesics for arthritic pain

Zhen-Zhong Xu and Ru-Rong Ji

Sensory Plasticity Laboratory, Pain Research Center, Department of Anesthesiology, Brigham and Women's Hospital and Harvard Medical School, Boston, MA, USA

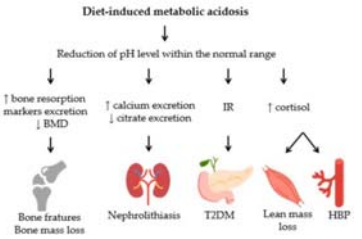
"resolvins may represent a new class of analgesics well suited to treating inflammatory pain associated with arthritis."

- Xu ZZ, Ji RR. *Br J Pharmacol.* 2011 Sep;164(2):274-7.

Diet and bone health

- Pro-inflammatory diet accelerates bone loss
  - Subclinical metabolic acidosis
- Not just Obesity!
- Mineral rich foods:
  - especially magnesium, potassium and boron
- Fruits & vegetables
- Optimize Vitamin D

Diet and Bone Health



- Carnauba RA, Baptistella AB et al. *Nutrients*. 2017 Jun; 9(6): 538.

Vitamin D

- Functions
  - Calcium & Phosphorus homeostasis
  - Bone formation, maintenance, and remodeling
  - Enhances innate immunity and inhibits autoimmunity
- Low Levels
  - Myopathy
  - **Musculoskeletal Pain**
  - Osteomalacia, **bone pain**, osteoporosis
  - Impaired glucose tolerance

- Source: https://lpi.oregonstate.edu/mic/vitamins/vitamin-D

Vitamin D & musculoskeletal pain

- MN Prevalence of deficiency in non-specific musculoskeletal pain
  - 150 patients with persistent, nonspecific musculoskeletal pain to the Community University Health Care Center
  - Of the African American, East African, Hispanic, and American Indian patients, **100% had deficient levels of vitamin D** (< or = 20 ng/mL).
  - Of all patients, 93% had deficient levels of vitamin D
  - 28% of all patients had severely deficient vitamin D levels (< or = 8 ng/mL)
- ***"Vitamin D Deficiency is often misdiagnosed as fibromyalgia"***

- Plotnikoff GA, Quigley JM. Mayo Clin Proc. 2003;78(12):1463-1470.
- Holick MF. Am J Clin Nutr 2004;79:362-71

Vitamin D & musculoskeletal pain

- 60 patients attending spinal and internal medicine clinics over a 6-year period who had experienced low back pain that had no obvious cause for >6 months
- 83% (n = 299) had abnormally low levels of vitamin D before treatment with vitamin D supplements. After treatment, ***clinical improvement in symptoms was seen in all the groups that had a low level of vitamin D, and in 95% of all the patients*** (n = 341)

- Al Faraj S, Al Mutairi K. Spine 2003;28:177-9.

Vitamin D – Balance & muscle strength

- Meta-analysis of seven observational studies on the elderly (840 fallers and 1,330 non-fallers)
- Significantly lower serum 25(OH) D concentrations in fallers than in non-fallers
- ***Vitamin D optimization improves postural balance, muscle strength, and decreases risk of fall and fracture rates***

- Annweiler C, Beauchet O. J Intern Med. 2015;277(1):16-44.
- https://lpi.oregonstate.edu/mic/vitamins/vitamin-D

Vitamin D & surgical outcomes

- "High prevalence of hypovitaminosis D in patients with back pain regardless of whether or not they require surgical intervention".
  - Consequences may include "delayed fusion or pseudarthrosis, impaired osseointegration of implanted spinal hardware, prolonged core, and lower limb muscle weakness, and additional stress on implanted hardware and/or adjacent spinal segments"
- ***"Hypovitaminosis D may be a contributing factor to persistent postoperative pain"***
- ***"All spine surgery patients should be screened as part of their preoperative workup"***

- Rodriguez WJ. Gromelski J. ISRN Orthop. 2013;471695.

Vitamin D & musculoskeletal pain

- Optimal Vitamin D
  - >30 ng/ml – may be higher!
  - Aim for >40ng/mL in symptomatic patients
  - Average 2990 IU/day to achieve >20ng/mL (50nmol/L) most healthy individuals
- Body weight specific recommendations for optimal intake
  - doses of 1885, 2802 and 6235 IU per day are required for normal weight, overweight and obese individuals respectively to achieve natural 25(OH)D concentrations (defined as 23 to 68 ng/mL)

- Nutrients. 2015 Dec; 7(12): 10189–10208.

Magnesium

European Journal of Pharmaceutical Sciences
Volume 99, 1 March 2017, Pages 113-127

Review

Magnesium enhances opioid-induced analgesia – What we have learnt in the past decades?

Magdalena Bujalska-Zadrożny [a] [1], Jan Tatarkiewicz [a], Kamila Kulik [a], Małgorzata Filip [b], Marek Naruszewicz [a]

Show more

https://doi.org/10.1016/j.ejps.2016.11.020

"Magnesium reduces opioid consumption and alleviates postoperative pain scores while not increasing the risk of side effects after opioids"

Magnesium Rich Foods

- Spinach/Chard
- Avocado
- Pumpkin Seeds
- Dark Chocolate
- Almonds
- Black Beans
- Yogurt
- Bananas
- Figs

B12

- "Subacute combined degeneration (SACD) of the spinal cord
  - progressive degeneration of the spinal cord due to vitamin B_{12} deficiency
  - Also with Vitamin E, copper deficiency
  - B12 is necessary for maintenance of myelin sheath
- Spinal changes related to B12 deficiency is difficult to detect with MRI
- Prolonged B12 deficiency → irreversible nervous system damage
- Consider with vegan, vegetarian, or long term metformin or PPI use

- Jain KK, Malhotra HS, et al. *J Neurol Sci.* 2014 Jul 15;342(1-2):162-6.

Metformin and B12

- Metformin-induced vitamin B12 deficiency presenting as a peripheral neuropathy.
  - "Chronic metformin use results in vitamin B12 deficiency in 30% of patients. Exhaustion of vitamin B12 stores usually occurs after twelve to fifteen years of absolute vitamin B12 deficiency. Metformin has been available in the United States for approximately fifteen years. Vitamin B12 deficiency, which may present without anemia and as a peripheral neuropathy, is often misdiagnosed as diabetic neuropathy, although the clinical findings are usually different. Failure to diagnose the cause of the neuropathy will result in progression of central and/or peripheral neuronal damage which can be arrested but not reversed with vitamin B12 replacement. To my knowledge, this is the first report of metformin-induced vitamin B12 deficiency causing neuropathy."

- Bell DS. South Med J. 2010 Mar;103(3):265-7.

B12 testing

- Association of Metformin, Elevated Homocysteine, and Methylmalonic Acid Levels and Clinically Worsened Diabetic Peripheral Neuropathy.
  - Check MMA and Homocysteine
  - "methylmalonic acid (MMA) and homocysteine (Hcy) are more sensitive (MMA and Hcy) and specific (MMA) indicators of early symptomatic Cbl deficiency than serum Cbl itself."
  - Wile DJ, Toth C. *Diabetes Care* 2010 Jan; 33(1): 156-161.
- "total serum B12 levels largely reflect B12 that is not bio-available."
  - Berg RL, Shaw GR. Clin Med Res. 2013 Feb; 11(1): 7–15.
- Serum cobalamin is an insensitive assay for B12 deficiency
  - Olson SR, Deloughery TG, Taylor JA. Blood 2016 128:2447;

Nutrient Optimization vs weight loss

The Effects of Obesity on Spine Surgery: A Systematic Review of the Literature

Keith L. Jackson II[1] John G. Devine[2]

[1]Department of Orthopaedics and Rehabilitation, Womack Army Medical Center, Fort Bragg, North Carolina, United States [2]Department of Orthopaedic Surgery, Georgia Regents University, Augusta, Georgia, United States

Global Spine J 2016;6:394–400.

Abstract

Study Design Literature

Objective The aim of th

postoperative complicatio

Methods A review of the

surgery was conducted us

Results Obesity contribu

increases the risk of develo

surgery have a higher risk of developing postoperative complications, particularly surgical site infection and venous thromboembolism. Though functional outcomes in this population may not mirror the general population, the treatment effect associated with surgery is at least equivalent if not better in obese individuals. This reduction is primarily due to worse outcomes associated with nonoperative treatment in the obese population.

Conclusion: "Obese individuals represent a unique patient population with respect to nonoperative treatment, postoperative complication rates, and functional outcomes. However, **given the equivalent or greater treatment effect of surgery, this comorbidity should not prohibit obese patients from undergoing operative intervention."**

Jackson KL. Devine JG. *Global Spine J.* 2016 Jun; 6(4): 394–400

Weight Stigma

- Poorer health outcomes
- Delayed care, increasing health disparities
- Does NOT increase motivation to eat less & move more

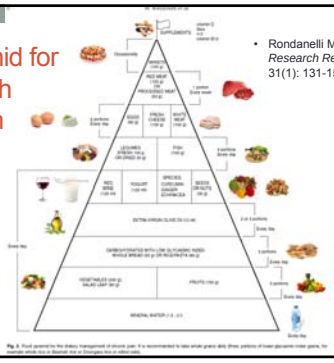
- Avoid prescribing weight loss as an alternative to treating the presenting condition

ANTI-INFLAMMATORY EATING

- Vegetables, Fruits, Nuts, Seeds, Berries, High quality proteins, Legumes, Healthful Fats, Whole grains
- Herbs & Spices
- PUFA, Omega-3 sources
- Hydration
- Limited in additives, acellular carbohydrates

Source: IFM

Food pyramid for subjects with chronic pain



- Rondanelli M, Faliva MA, et al. *Nutr Research Reviews.* 2018 June; 31(1): 131-151.

Conclusion

- Nutrition intervention has the potential to reduce chronic inflammation, chronic pain & accelerate the healing process in many stages of neuromusculoskeletal disorders
- Very low-cost and minimal risk
- Failure to optimize nutrition status will likely result in ongoing decline of bone health, muscular strength, and neurodegeneration

Conclusion

- Anti-inflammatory diet potential to significantly decrease pain and improve QoL
- Dieting alone induces catabolic state.
- Recommending weight loss without nutrient optimization may exacerbate pain & degeneration
- Optimize Vitamin D
- Optimize B12
- Increase antioxidants, essential minerals & plant foods
- Treat symptoms/pt, not lab values or weight

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